Research Journal Publications (2014-15)

Sl. No.	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISBN/ISSN number
1	Experimental and Numerical Study of Flow in Prismatic and Non-prismatic Section of a Converging Compound Channel	Abinash Mohanta, Bandita Naik, K.C. Patra and K.K. Khatua	CE	International Journal of Civil Engineering Research	2014-15	ISSN 2278-3652
2	Empirical Analysis for web based projects - Software Components Reuse Techniques Vol. 5 (3) , 2014-15, P.No.4398-4404	Vuppu Padmakar	CSE	International Journal of Computer Science and Information Technologies® (IJCSIT®)	2014-15	0975-9646
3	Performance of Cryptographic Instructions in RISC Based Architecture	D.VARA PRASADA RAO	ECE	International Journal of Innovative Technology and Research	2014-15	Volume No.2, Issue No. 2, February – March 2014-15, 868 - 871
4	Effect of physical factors on pellet morphology of Aspergillus awamori MTCC 9166 and polygalacturonase production	K. Anuradha · P. Naga Padma · S. Venkateshwar · Gopal Reddy	H&S	Biocatalysis and Agricultural Biotechnology	2014-15	1878-8181
5	Flow analysis for a converging compound channel	B. Naik, K.K.Khatua, Rahul Sahoo and Shiba Shankar Satapathy	CE	International Journal of Applied Engineering Research	2014-15	ISSN 0973-4562
6	An Approach to Automatic Generation of Test Cases from Use-Cases	Vuppu Padmakar	CSE	International Journal of Advanced Research in Computer Science & Technology (IJARCST)	2014-15	2347-8446
7	Selection of nutrients for polygalacturonase production byAspergillus awamori MTCC 9166 using Plackett-Burman design	K. Anuradha · P. Naga Padma · S. Venkateshwar · Gopal Reddy	H&S	Indian Journal of Biotechnology	2014-15	0975-0967 (Online)
8	Software Reuse - Changes in Process and Organizations	Vuppu Padmakar	CSE	INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN COMPUTER SCIENCE & Technology (IJARCST)	2014-15	0976-5697
9	Energy reduction under different cache configurations by using Way Tag Architecture	D.VARA PRASADA RAO	ECE	International Journal of Engineering and Management Research ag Architecture	2014-15	Volume 4 Issue 6, December 2014-15, ISSN No: 2250-0758, Page Number: 151-157 e
10	Significance of IPV6 in real time approach	Vuppu Padmakar	CSE	nternational Journal of Advanced Research in Computer and Communication Engineering (IJARCCE)	2014-15	2278-1021
11	.Combined logic 32-bit Carry Select Adder by using Dominos CMOS Logic	D.VARA PRASADA RAO	ECE	International Journal of Engineering and Management Research	2014-15	Volume 4 Issue 6, December 2014-15, ISSN No: 2250-0758, Page Number: 120-124
12	Comparative Analysis of Software Development Process Models	Vuppu Padmakar	CSE	International Journal of Advanced Research in Computer Science and Software Engineering (IJARCSSE)	2014-15	2277-128X
13	Significances and issues of network security	Vuppu Padmakar	CSE	International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE)	2014-15	2278-1021
14	High Throughput and High Speed Blowfish Algorithm for Secure Integrated Circuits"	Kumara Swamy Varkuti, Dr.Prabhu Benakop	EEE	Annals. Computer Science Series Tome 11, Fasc. 2, "Tibiscus"University of Timişoara, România, Mirton PublishingHouse of Timişoara, România,	2014-15	ISSN: 1583-7165 (printed journal) ISSN: 2065-7471 (e-journal)
15	"Determination of effect of die radius on deep drawing process using FEA technique" pp. 437-443, vol 03, issue 1,	Vishal admane,Dr.A.Raja sekhar	Mech.	International Journal of Mech. Engineering & Advanced Automotive Technology Research	2014-15	ISSN 2348-2370

Research Journal Publications (2014-15)

Sl. No.	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISBN/ISSN number
16	"Optimization of high speed turning parameters of super alloy inconel 718 material using taguchi technique" pp. 431-436, vol 03, issue 1,	R. Sai syam, Dr. A. Raja sekhar	Mech.	International Journal of Mech. Engineering & Advanced Automotive Technology Research	2014-15	ISSN 2348-2371
17	"Comparative analysis of Mech. properties of jute fiber reinforced with e-glass using epoxy and semi-rigid epoxy material" pp. 427-430, vol 03, issue 1,	L.RajaMohan; G.Jagan Naik, Dr.A.Rajasekhar	Mech.	International Journal of Mech. Engineering & Advanced Automotive Technology Research	2014-15	ISSN 2348-2372
18	"Influence of cutting fluids on the carbide tool life in milling operation" pp. 423-426, vol 03, issue 1,	V. Madhusudhan Reddy, K. M. Abraham, Dr. A. Raja sekhar	Mech.	International Journal of Mech. Engineering & Advanced Automotive Technology Research	2014-15	ISSN 2348-2373
19	Structural and Optical Studies of Pure and TICI doped Poly Polymer Electrolyte films	C.Anuradha,G.Akumar, M.V.Ramanareddy, K.Narasimhareddy	H&S	International Journal of Engineering Research &technology (IJERT)	2014-15	2278-0181
20	SSO- A New authentication mechanism for security Analysis for Distributed Computer Network	UNNATI KHANAPURKAR	CSE	International Journal of Technology and Engineering Science [IJTES] VOLUME-2	2014-15	ISSN 2320-8007
21	Determination of the Solidification Time of Al-7%Si Alloy during Centrifugal Casting	P.Shaliesh, B. Praveen Kumar, K Vijaya Kumarc and A NagendraÅ	Mech.	International Journal of Current Engineering and Technology, Inpressco international press corporation	2014-15	P-ISSN 2347-5161
22	A Near Duplicate Detection Algorithm to facilitate Document Clustering	1. Lavanya Pamulaparty 2 Dr. C. V. Guru Rao 3. Dr. M. Sreenivasa Rao	CSE	International Journal of Data Mining and Knowledge Management Process	2014-15	ISSN:2230-9608[Online] ISSN: 2231-007X[Print]
23	An Approach to Identify Dishonest nodes using MAC Protocol in Multihop Cellular Networks	Mr. P.Vijaya Babu Varma ‖ Mrs. Lavanya Pamulaparty ‖ Mr. T. Praveen Kumar	CSE	IOSR Computer Journal of Engineering	2014-15	2278-0661
24	Modelling&Experimental Validation of Combustion Diesel Engine thru CFD	Rv Prasad & Dr SLV Prasad	Mech.	IJTES	2014-15	ISSN2320-8007
25	Micro Genetic Algorithm Based on Pricing of Reactive Power Service in Deregulated Electricity Markets	Ramesh Babu Jarapala, Bhumaiah Jula, Ramesh Jatoth	EEE	International Journal of Ethics in Engineering & Management Education	2014-15	ISSN: 2348-4748
26	Lagrangianmodel for Simulating Turbulent Dispersion &Agglomeration of Droplets in a spray	Rv Prasad & PrakashBabu	Mech.	International Journal of Advanced Technology in Engineering and Science	2014-15	ISSN2324-7550
27	Heat Transfer Analysis Of Automotive Disc Brakes	Y Madhu Maheswara Reddy, Dr P Usha Sri	Mech.	International Journal of Advance Research In Science And Engineering, IJARSE, Vol. No.3, Issue No	2014-15	ISSN-2319-8354(E)
28	Effect of Induced Turbulence in a C.I. Engine by varying compression ratio and injection timing on the performance of the engine	K Srinivasa Raghavan, Dr. V. Pandurangadu	Mech.	International Journal of Engineering Research & Technology (IJERT)	2014-15	ISSN: 2278-0181
29	Energy Based Analysis of a Thermal Power Station for Energy Efficiency Improvement	Dr. Mohammed Yunus1 , Mohammed Asadullah2 , Dr. Hamza A. Ghulman3 , Dr. J. Fazlur Rahman4 , Mohammed Irfan5	Mech.	International journal of modern engineering research	2014-15		ISSN: 2249–6645	www.ijmer.com	Vol. 4	Iss. 2
30	Optimization and Analysis (Failure Mode Effect and Finite Element) of a Common DTH Dish Antenna Bracket Assembly	Dr. Mohammed Yunus1, Dr. Hamza A.Ghulman2, Dr. Shadi M. Munshi3, Sufyan Azam4,Dr. J. Fazlur Rahman5, Mohammed Irfan6, Mohammed Asadulla7	Mech.	International Journal of Mech. Engineering & Technology (IJMET)	2014-15	ISSN 0976 – 6340 (Print)
31	Integration of Web GIS and Remote Sensing for Trees management outside forest	PUPPALA MANGALA TULASI	CSE	International Journal of Advanced Trends in Computer Science and Engineering, Vol. 3 , No.1, Pages : 210 – 215 (2014-15)	2014-15	ISSN 2278-3091
32	Using Checkpoint For Implementing FaultTolerant On Desktop Grids	PUPPALA MANGALA TULASI	CSE	International Journal of Advanced Trends in Computer Science and Engineering, Vol. 3 , No.1, Pages : 235 – 238 (2014-15)	2014-15	ISSN 2278-3091

Research Journal Publications (2014-15)

Sl. No.	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISBN/ISSN number
33	High Throughput and High Speed Blowfish Algorithm for Secure Integrated Circuits"	Kumara Swamy Varkuti, Dr.Prabhu Benakop	EEE	Annals. Computer Science Series Tome 11, Fasc. 2, "Tibiscus"University of Timişoara, România, Mirton PublishingHouse of Timişoara, România,	2014-15	ISSN: 1583-7165 (printed journal) ISSN: 2065-7471 (e-journal)
34	Performance Analysis of Secure Integrated Circuits using Blowfish Algorithm	Kumara Swamy Varkuti, Dr.Prabhu Benakop	EEE	Global Journal of Computer Science and Technology, network, web securityVolume XIII Issue XVII Version I1(D) Year E 2013USA Incorporation No.: 0423089	2014-15	Online-ISSN:0975-4172 PRINT:0975-4350
35	An Enhancement System for Efficient Driving	Dr. M.JOSEPH PRAKASH	CSE	International Journal of Advanced Technology and Innovative Research	2014-15	ISSN 2348–2370
36	Improving The Scalability And Efficiency Of K-Medoids By Map Reduce	V.S. Giridhar Akula	CSE	IJEAS	2014-15	ISSN: 2394-3661
37	A Novel Approach to Encrypt and Decrypt Color Images	V.S. Giridhar Akula	CSE	Asian Journal of Computer Science and Technology	2014-15	ISSN: 2055-530X
38	Characterization of silicate solubilising bacteria isolated from different habitats for plant growth promoting activities	C.Chandrakala,prasad babu, Aparna Kumari, Sunil Kumar, Voleti, Latha	H&S	Journal of Progressive Research, (2014) 9(2): 765-767	2014-15	ISSN2454-1672
39	Biotechnological Production of Polyhydroxyalkonates by Various Isolates: A Review,	Chaitanya Mahmood, rana Kausar, Sunil Kumar	H&S	International Journal of Pharmaceutical Science Invention Volume 3 Issue 9, September 2014, PP.01-11	2014-15	2319-6718
40	Polymer producing bacteria showing siderophore with chrome azurol S (CAS) agar plate assay,	Chaitanya Mahmood, rana Kausar, Sunil Kumar	H&S	International Journal of Scientific and Research Publications, Volume 4, Issue 12, p 1-3, December 2014;	2014-15	2250-3153
41	Extracellular Lignocellulolytic Enzymes by Phanerochaete chrysosporium (MTCC 787) Under Solid-State Fermentation of Agro Wastes	Sai Prashanthi Govumoni1, Jahnavi Gentela1, Sravanthi Koti1, V. Haragopal3, S.Venkateshwar2 and L.Venkateswar Rao1	H&S	Int.J.Curr.Microbiol.App.Sci (2015) 4(10): 700-710	2014-15	2319-7706

Coordinator

Principal

Experimental and Numerical Study of Flow in Prismatic and Non-prismatic Section of a Converging Compound Channel

Abinash Mohanta[1], Bandita Naik[2], K.C. Patra[3] and K.K. Khatua[4]

[1,2,3,4]*Department of CIVIL Engg, National Institute of Technology,
Rourkela, Odisha, India.*

Abstract

Rivers have fascinated engineers and scientists for decades while providing water supply for domestic, irrigation, and industrial consumption or transportation and recreation use. As a result of topography changes along the open channels, designing the converging compound channel is an essential. Water surface prediction is an important task in flood risk management in urban area. In this paper based on the principle of the momentum balance, a one dimensional method is investigated to predict the water surface elevations in non-prismatic compound channels. The numerical method is then applied to calculate water surface elevation in non-prismatic compound channel configurations, the results of calculations show good agreement with the experimental data. In this paper a complete three-dimensional and two phase CFD model for flow distribution in a converging compound channel is investigated. The finite volume method (FVM) with a dynamic Sub grid-scale was carried out for convergence condition. The volume of fluid (VOF) method was used to allow the free-surface to deform freely with the underlying turbulence. The accuracy of the model was analyzed with observed data from experimental studies of a converging compound channel as the qualitative reference and the computed results of the present study were validated. The predicted results for the flow characteristics are in reasonable agreement with the experiment data.

Keywords: Experimental model, Numerical model, FVM method, VOF method, prismatic and non prismatic section, converging compound channel.

1. Introduction

Prediction of conveyance capacity in open channel flows is complex and requires adequate modeling of flow features such as secondary circulation cells and, specifically for over-bank channels, the momentum exchange that occurs at the main channel/floodplain interface. One of the significant characteristic attributes of flow in an open-channel bend is its secondary flow and therefore the helical motion that is the main reason of the winding river morphology and the tendency to create a succession of shoals and deeps along its way. Due to the existence of secondary flow, flow characteristics in channel bends are much more complicated than those in straight channels. In other words, close to the inner wall and also at the channel bed, pressure gradient exceeds centrifugal force and conveys water in a transverse direction towards the inner wall. At the free surface, centrifugal force drives the flow to the outer wall. This kind of flow is known as the secondary flow (Lien et al., 1999). Super-elevation, secondary flows and their tending to redistribute the mean velocity, permuting the boundary shear stress, bank erosion and shifting, flow separation (that its presence coming together with vortex bar formation decreases the channel width and conveyance capacity), and bed migration in mobile boundary channels have made the study of the non-prismatic open channels of a high interest in the field of river engineering.

A step has been taken to do numerical analysis on a non prismatic compound channel flow .The work will help to simulate the different flow variables in such type of complex flow geometry. Booij (2003) and VanBalen et al. (2008) modeled the flow pattern at a mildly-curved 180º bend and assessed the secondary flow structure using large eddy simulation (LES). Lu et al. (2004), Bodnar and Prihoda (2006) and Omid Seyedashraf, AliAkbar &Milad Khatib Shahidi(2012) applied a three-dimensional numerical model to simulate secondary flows, the distribution of bed shear stress, the longitudinal and transversal changes of water depth and the distribution of velocity components at bend using the standard k-ϵ turbulence model. B. K. Gandh, H.K. Verma and Boby Abraham (2010) determined the velocity profiles in both the directions under different real flow conditions and investigated the effects of bed slope, upstream bend and a convergence / divergence of channel width of velocity profile. Ahmed Kassem; Jasim Imran and Jamil A. Khan analyzed from the three-dimensional modeling of negatively buoyant flow in a diverging channel with a sloping bottom and modified the k-e turbulence model for the buoyancy effect. Anthony G. Dixon (2012) simulated CFD software with fluid flow interactions between phases. Other studies have been also conducted by researchers in this area (e.g. Ervine and Jasem (1995), Jasem (1990), James & Brown (1977), Elliott (1990), Bousmar (2002) and Bousmar et al. (2004a) Bahram Rezaei (2006)).

In the present work, an effort has been made to investigate the velocity profiles for prismatic and non-prismatic section of a convergent compound channel by using a commercial computational fluid dynamics(CFD) code, namely FLUENT. The CFD model developed for a real open-channel was first validated by comparing the velocity profile obtained from it with that obtained by actual measurement in the same channel

using preston tube. The CFD model has been the used to analyze the effects of upstream bend, convergence of channel width and bed slope, and to study the variations in velocity profiles along the horizontal and vertical directions.

2. Experimental Setup

Experiments was conducted in non-prismatic compound channels with varying cross section built inside a concrete flume measuring 15m×.9m×0.5m at National Institute of Technology Rourkela Hydraulic laboratory. The width ratio of the channel is α≤1.8and the aspect ratio is δ≥5. The converging angle of the channel is 12.38°.Converging length of the channel is 0.84m.The channel is made up of cement concrete. Water will be supplied through a Centrifugal pumps (15 hp) discharging into a RCC overhead tank. In the downstream end there will be a measuring tank followed by a sump which will feed to over head tank through pumping thus completing recirculation path. Fig.1 shows the schematic diagram of experimental setup and dimensions of channel with test section respectively.Fig.2 shows the plan view of two different experimental sections. Water was supplied to the flume from an underground sump via an overhead tank by centrifugal pump (15 hp) and recirculate to the sump after flowing through the compound channel and a downstream volumetric tank fitted with closure valves for calibration purpose. Water entered the channel bell mouth section via an upstream rectangular notch specifically built to measure discharge in the laboratory channel. An adjustable vertical gate along with flow straighteners was provided in upstream section sufficiently ahead of rectangular notch to reduce turbulence and velocity of approach in the flow near the notch section. At the downstream end another adjustable tail gate was provided to control the flow depth and maintain a uniform flow in the channel. A movable bridge was provided across the flume for both span wise and stream wise movements over the channel area so that each location on the plan of compound converging channel could be accessed for taking measurements. The broad parameters of this channel such as aspect ratio of main channel (δ), width ratio (α).
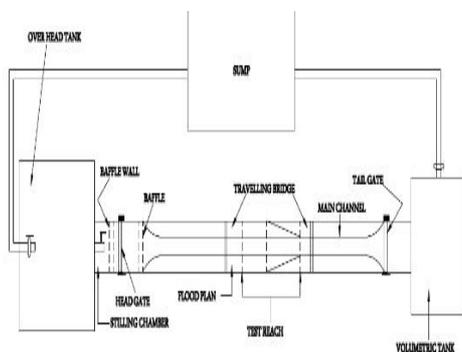

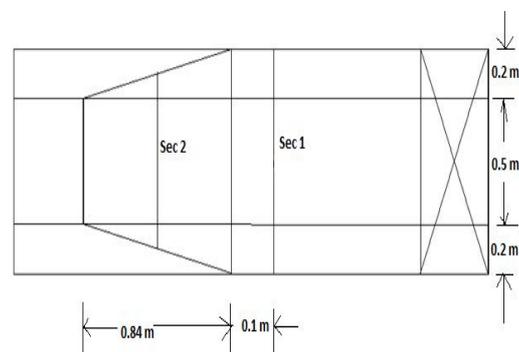**Fig. 1:** Plan view of Experimental Set up

Fig. 2: Plan view of two different experimental section

3. Validation of CFD Model

For validation of CFD simulation, the velocity profile across the width of a channel is measured by a preston tube and compared with the numerical results. A long converging water conveying non prismatic channel has been selected for this purpose. The channel width is divided into cells of 0.05 m size for measurement of velocity at the centre of each cell by Preston tube. For CFD simulation, the flow domain is initially discretized with hexahedral elements of face length equals to 0.01 m for analysis. Flow is assumed to be steady, turbulent and three-dimensional. Experimental velocity profile was measured by preston tube and velocity contour was drawn by SURFER and then validated with CFD prediction.

Discharge evaluated from the two velocity profiles using velocity-area integration method are as under:

Discharge from Preston tube measurement data = 0.051 m3/s
Discharge from CFD simulation data = 0.063 m3/s

4. Results and Discussion

Results have been shown to demonstrate the performance of commercial generic CFD package when applied to open channel flows. In cases where the channel geometry is more complex and varies along the channel, the secondary flow is more as a result of the geometry than the turbulence. Thus the usefulness of CFD and applicability of the models for the problem under consideration depends very much upon the type of geometry and particularly on the nature of dominant forces.
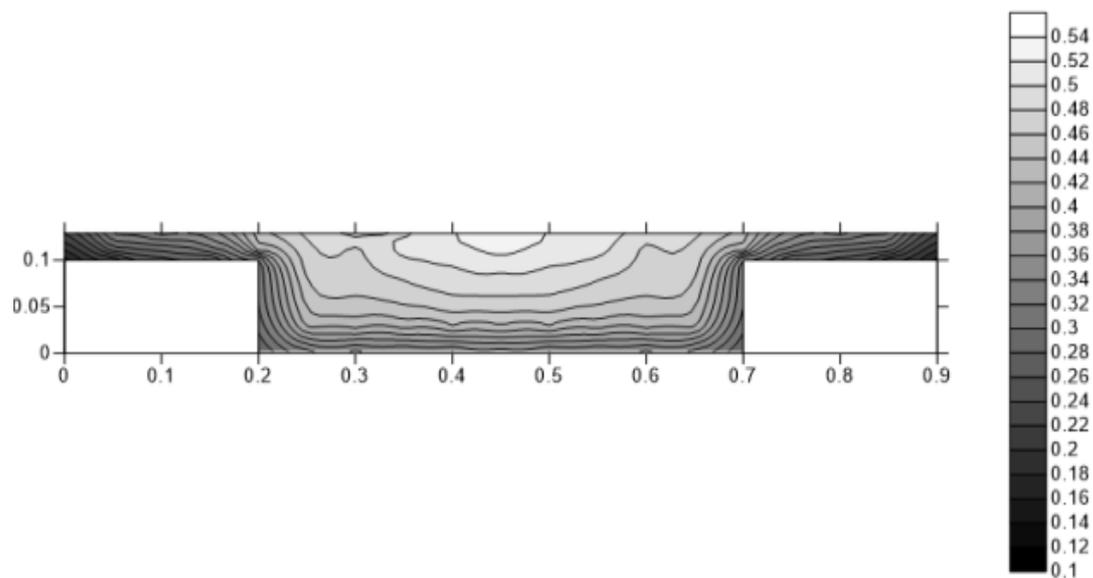

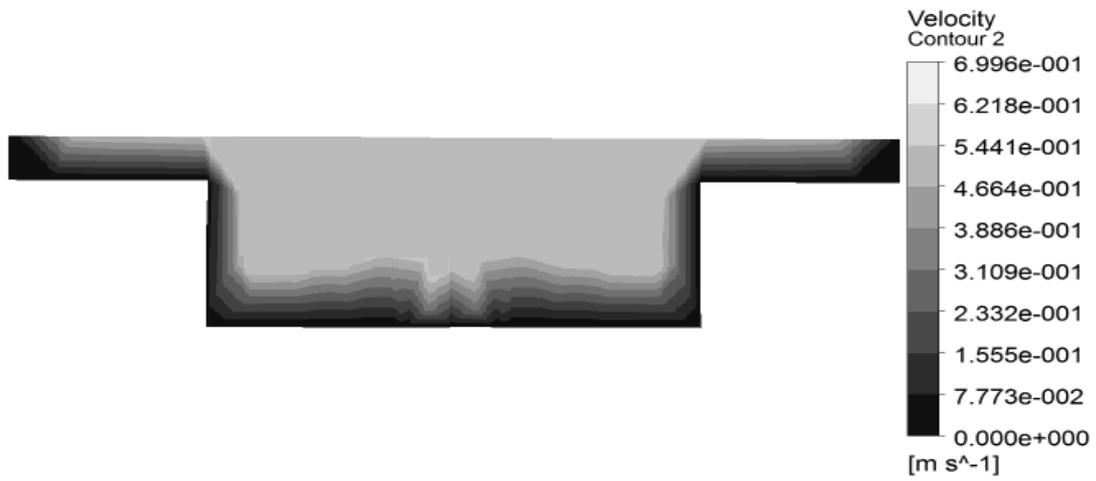**Fig.3 (a)** Contour of Sec 1 of experimental results.

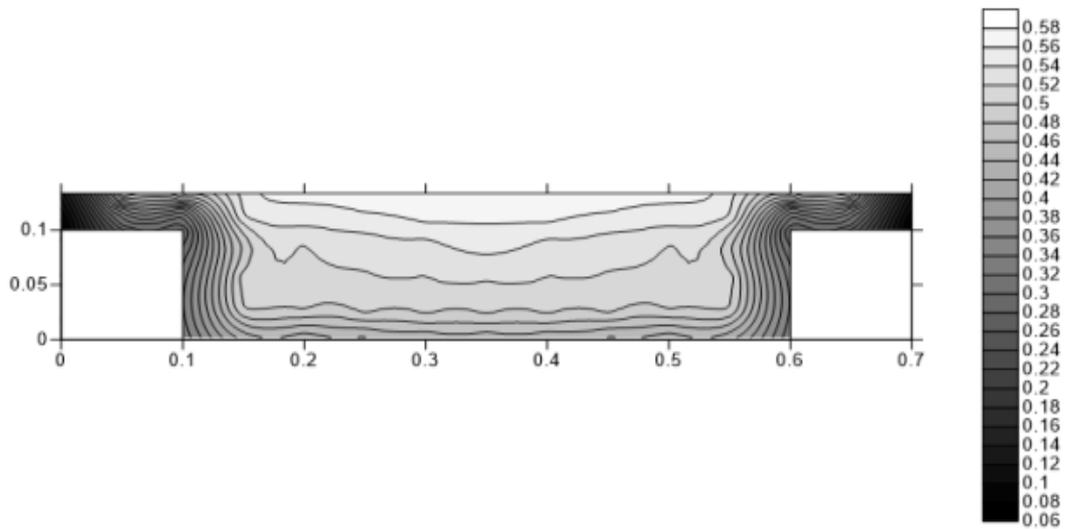**Fig.3 (b)** Contour of Sec 1 by CFD simulation.

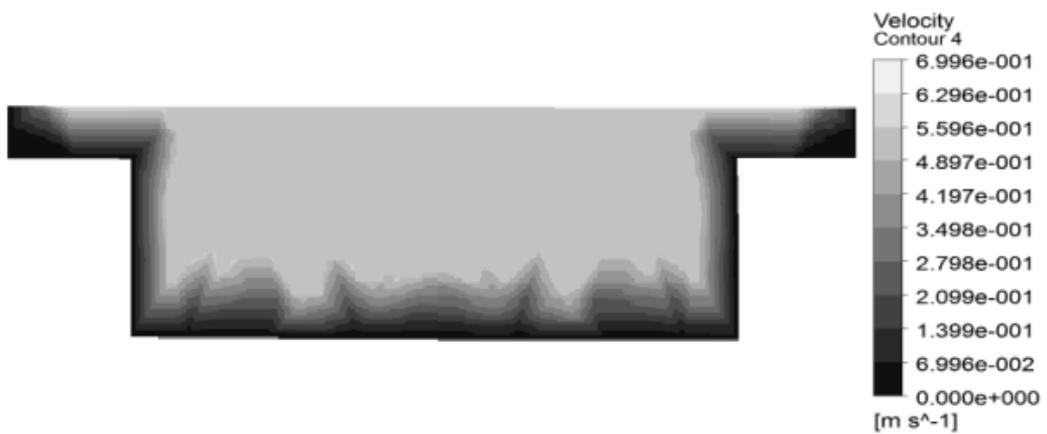**Fig. 4 (a)** Contour of Sec 2 of experimental results.

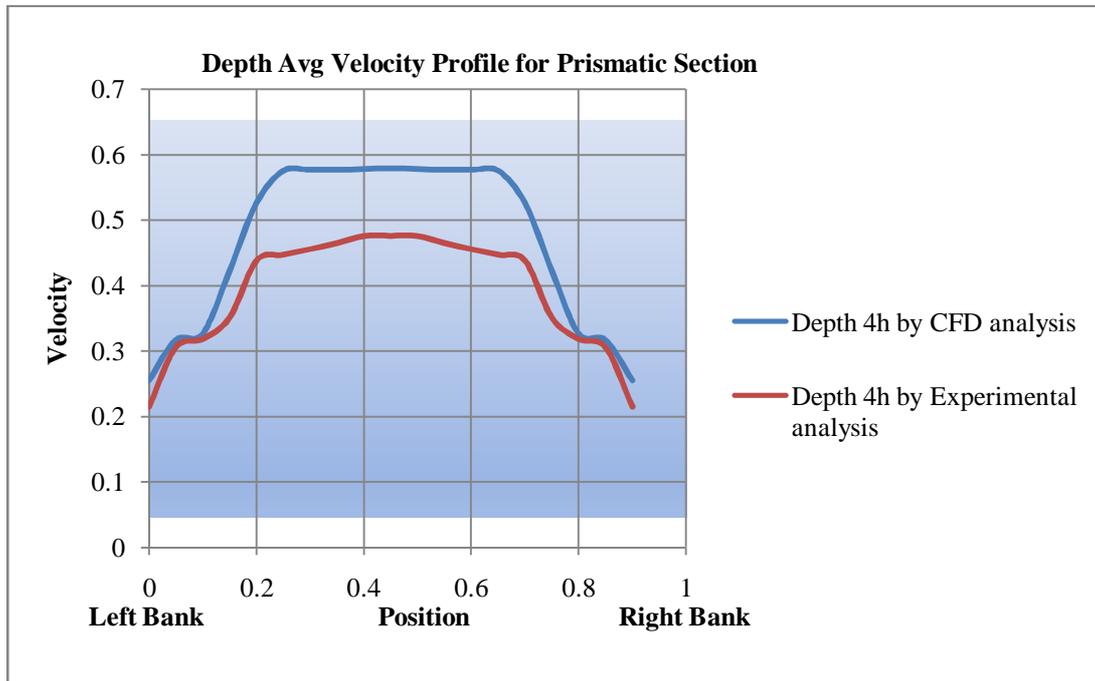**Fig. 4 (b)** Contours of sec 2 by CFD simulation.

Fig. 5: Depth average velocity profile for sec 1(by
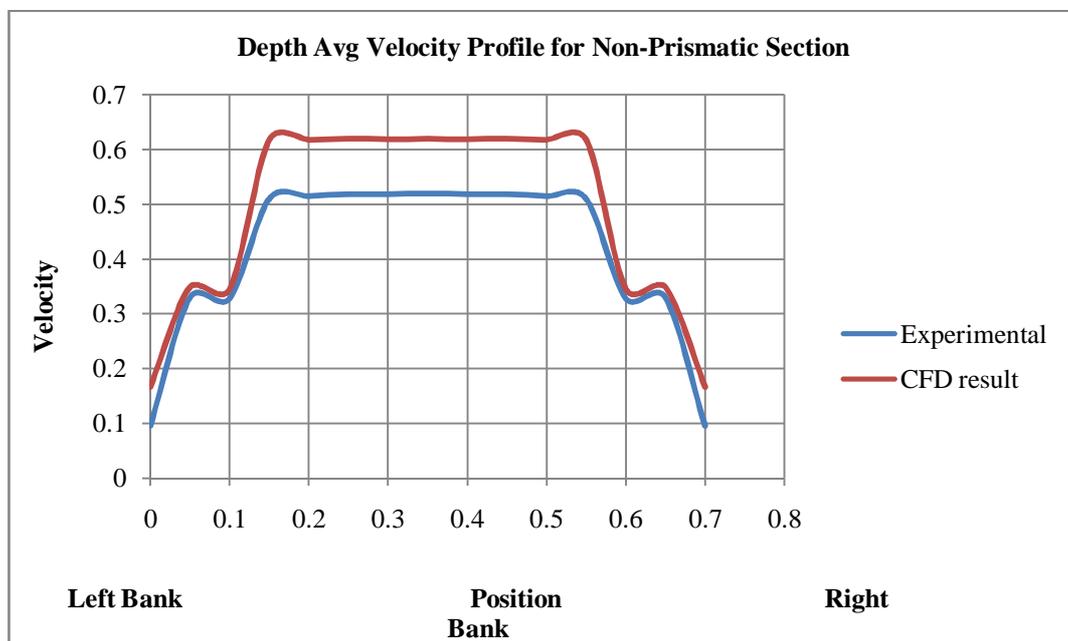both experimental and Computational results)

Fig. 6: Depth average velocity profile for section 2(by both
experimental and Computational results).

5. CONCLUSIONS

1. Fig.3 (a) and Fig.4 (a) shows the velocity contours for sec-1 & sec-2 obtained by experimental results. Fig.3 (b) and Fig.4 (b) shows the velocity contours for sec- 1 &2 by Numerical analysis. Fig.5 and Fig.6 shows the both experimental and Computational depth average velocity profile for sec-1 & sec-2. 2. The results show that the CFD predictions accurately predict the velocity and depth average velocity for LES turbulence model.3. In both the cases velocity was over predicted when smooth walls were applied as expected. In this paper the flow velocity profile in non prismatic compound channel has been numerically modeled. The CFD model has been validated by comparing the results with actual measurement carried out with Preston tube.

References

[1] ANSYS, Inc. (2010, November*), ANSYS Workbench User's Guide,* Canonsburg, Pennsylvania, United States of America.

[2] Ahmed Kassem, Jasim Imran, and Jamil A. Khan (2003), Three-Dimensional Modeling of Negatively Buoyant Flow in Diverging Channel, **10.1061**/*ASCE 0733-9429-2003/129/12936*

[3] Bakker, A. (2008, February 3), Computational Fluid Dynamics Lectures: *Lecture 14*, Multiphase flow, Retrieved from The Colorful Fluid Mixing Gallery: http://**www.bakker.org/dartmouth06/engs150/**

[4] Bodnar, T. and Prihoda (2006), Numerical simulation of turbulent free-surface flow in curved channel. Journal of Flow Turbulent Combust **76**, **429**-**442**

[5] Booij (2003), Measurements and large eddy simulation in some curved flumes, *Journal of turbulence- 4*, **8-16**

[6] Bousmar, D., Wilkin, N., Jacquemart, J.H., Zech, Y., (2004), Overbank flow in symmetrically narrowing floodplains, *J. Hydraul. Eng., ASCE*, **130(4), 305-312**.

[7] Bousmar, D., Denis, B. &Zech, Y. (2004), Coherent flow structures in a converging compound channel, *Proc. River Flow 2004 Conference*, Naples, Italy, 1, **423-430**.

[8] Bousmar, D., and Zech, Y., (2002), Discussion of two-dimensional solution for straight and meandering overbank flows, *J. Hydraul. Eng*., **128(5), 550-551**.

[9] B. K. Gandhi, H.K. Verma and Boby Abraham(2010)Investigation of Flow Profile in Open Channels using *CFDIGHEM-2010*, **21-23**, AHEC, IIT Roorkee, India

[10] Ervine, D.A &Jasem, H.K. (1995), Observations on flows in skewed compound channels, *J. Wat. Marit. En. ICE,* **112, 249-259**.

[11] Fluent Inc. (2006), *FLUENT 6.3 User's Guide*, Lebanon, New Hampshire, United States of America.

[12] Ferziger, J. H., and Peric, M. (2002), Computational methods for fluid dynamics, 3rd Ed., Springer, New York.

[13] *Gambit 2.2* tutorial guide.

[14] Knight, D.W. &Shiono, K. (1990), Turbulence measurements in a shear layer region of a compound channel, *J.Hydr. Res., IAHR*, **28(2), 175-196**.

[15] Khazaee, M. Mohammadiun (2012), Effect of flow field on open channel properties using numerical investigation and experimental comparison, pp.**617-628**.

[16] Lien, H.C., Hsieh, T.Y., Yang, J.C. and Yeh, K.C. (1999), Bend flow simulation using 2D depth–averaged model*, Journal of Hydraulic Engineering-ASCE* **125, 1097-1108.**

[17] Lu, W.Z, Zhang, W.S, Cui, C.Z. and Leung, A.Y.T. (2004), A numerical analysis of free surface flow in curved open channel with velocity–pressure-free-surface correction, *Computational Mechanics***- 33, 215–224.**

[18] Omid Seyedashraf, Ali Akbar Akhtari, Milad Khatib Shahidi (2012), Numerical Study of Channel Convergence Effects on Flow Pattern in 90 Degree Bends, *9th International Congress, IUT*, Isfahan, Iran.

[19] Ramamurthy, A., Han, S., and Biron, P. (2013), Three-Dimensional Simulation Parameters for 90° Open Channel Bend Flows, *Journal of Computing in Civil Engineering-ASCA* **27(3), 282-291**.

[20] Rasool Ghobadian, Kamran Mohammadi (2011), Simulation of subcritical flow pattern in 180° uniform and convergent open-channel bends using SSIIM 3-D model, *Water Science and Engineering***, 4(3) 270-283**

[21] Rezaei, B. (2006), Overbank flow in compound channels with prismatic and non-prismatic floodplains, *PhD Thesis, Univ. of Birmingham*, U.K.

Empirical Analysis for Web Based Projects - Software Components Reuse Techniques

[1] Prof. Vuppu Padmakar   [2] Dr. B V Ramana Murthy,

[1] *Department of Computer Science and Engineering, Chilkur Balaji Institute of Technology,*
Hyderabad, India
[2] *Department of Computer Science and Engineering, Jyotishmathi College of Technology and Science, Shamirpet,*
Hyderabad, India

Abstract-The basic connect of systematic software reuse is simple. Develop systems of components of a reasonable size and reuse them. Then extend the idea of component system beyond code alone to requirements, analysis models, design, and test. All the stages of the software development process are subject to reuse. Developers can save problem- solving effort all along the development chain. They can minimize redundant work. They can enhance the reliability of their work because each reused component system has already been reviewed and inspected in the course of its original development. Code components have passed unit and system test elsewhere and often have stood the test of use in the field. By these means developers can reduce development time from years to months, or to weeks instead of months.

Keywords-Component, web engineering, azail

[1] INTRODUCTION & RELATED WORK.

The experience at companies such as AT & T, Brooklyn Union Gas, Ericsson, GTE, Hewlett-Packard, IBM, Motorola, NEC and Toshiba show that significant cost and time savings result from systematic reuse. Other companies, those that are doing nothing in particular about reuse, provide a base line.

Several organizations have obtained reuse levels around 90% in certain projects or areas:

AT & T: 40 – 92 % in Telecom operation support system software.

Brooklyn Union Gas: 90 – 95 % in a process layer, and 67% in a user interface and business Object layer.

Ericsson AXE: 90 % in hundreds of customer-specific configurations.

Motorola: 85 % reuse and a 10: 1 productivity savings ratio in compiler and compiler-tool test Suites.

Many organizations have achieved through reuse persuades us that management may expect substantial gains:

Time to market: reductions of 2 to 5 times

Defect density: reductions of 5 to 10 times

Maintenance cost: reductions of 5 to 10 times

Overall software development cost: reduction of around 15% to as much as 75% for long-term projects.

Components are sometimes referred to as assets or work products. While the terms refer to the same underlying reality, they carry somewhat different connotations. Components suggests interfaces and packaging Asset brings to mind matters of ownership and management work product highlights the fact that a components is a unit in a cycle of work, the software life cycle.

Revolution in application development: The growing popularity and availability of component-based software technologies is fueling a change in the habits and expectations of millions of programmers. New application development tools and technologies have made components the key to reusing larger grained objects to build application rapidly. These technologies include Micro Soft Visual Basic, ActiveX and OLE, SUN's JAVA and CORBA interface definition language. Internet computing using applets and scripting languages such as VB Scripts and Java Scripts make it easy to develop and quickly deploy novel interactive applications across the enterprise. Component objects models and distributed computing infrastructure in the form of OMGs. CORBA middle ware technologies or Microsoft operating system support for the distributed components object model and OLE technology enable more complex distributed large-grain objects and components to e used. These technologies define and mange component interfaces separately from component implementations.

Practical reuse has also been quite successful with non-object-oriented languages such as COBAL and FORTRAN. These non-object-oriented components-based technologies reinter face the fact the successful reuse is not really about object oriented languages or class libraries. While object oriented languages have many of the qualities sought when developing components, they are not sufficient in themselves. There is a growing commercial market for components providing larger chunks of functionality than typical object classes do called ActiveX components or OLE components OCXs.

As an increasing number of these component-based applications are constructed and deployed by independent developers. Business objects and components will be defined and constructed by separate groups, yet must work together to meet business information system needs.

Systematic Approaches:
1. Engineering
2. Process
3. Organizational
4. Business-oriented

1. **Engineering:** The technology and methods deficiencies include
a) Means to identify clearly elements of the models that describe requirements, architecture, analysis, design, test, and implementation along the development stream. Clear identification underlines that ability either to reuse them or to allow them to be candidates for replacement by reusable component systems.
b) Lack of components to reuse. This category covers a host of obstacles: failure to select and strengthen components for reuse in the first place lack of techniques to package, document, classify, and identify components inadequate design and implementation of library systems poor access to component libraries for potential reuses.
c) Lack of flexibility in potentially reusable components if a component is rigid; it fits few or sometimes no reuse opportunities. In the past our methods for designing a flexible, layered architecture have been immature. Our ability to adapt a component to fit a new need or a new architecture has been limited.
d) Lack of tools to carry out reuse procedures. A number of new tools are needed tools that can be integrated into reuse-oriented support environments.

2. **Process:** In the engineering and technology level, the traditional process of software development is itself deficient in opportunities to encourage reuse. Nowhere in most of the processes that are used to day is there a point where developer sit down and ask themselves. The potential role of the architect in reuse has not been defined. Similarly, the role of a reuse engineer or a reusable component engineer has not been worked out. The places in the process at which developers might consider inserting component systems have not been built in. after analysis, design, or code components have been blocked out, review, inspection and walkthrough procedures fail to contemplate reuse.

3. **Organizational:** very few organizations systematically practice reuse as an established best practice. One reason is that they focus on one project at a time. Reuse requires a border focus. The management group has to look ahead, focusing on a set of projects that cover an application area, that is, that they believe process some characteristics in common. This area is a domain from this domain someone – a domain engineer has to identify that reusable elements and carry on from there.

4. **Business:** Reuse takes capital and funding it takes capital to finance domain engineering. The building of components systems strong enough to justify reuse, and the creation of in house libraries of components. These operations tie up capital until projects that reuse the components pay for them. It takes funding to provide education, training and access to vendor supplied components. It takes money to cope with an unstable domain as when the initial domain is poorly defined or when similar domains in different organizations must be merged. It may take money to penetrate the legal and social reasons for sharing or not sharing software.
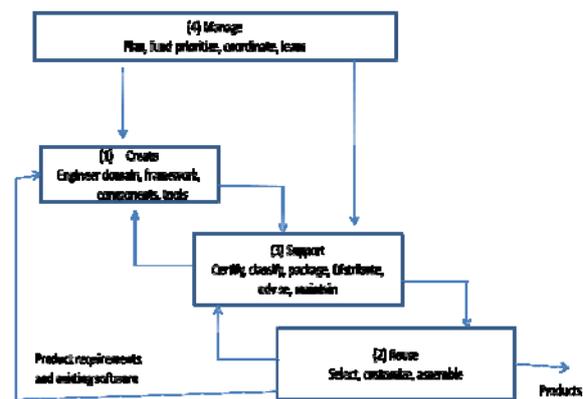
[2] REUSE INVOLVE CONCURRENT PROCESSES

The reuse community has come to understand on the basis of its experience that making systematic reuse effective requires major changes in the way organizations develop software. In the past the software process has focused on developing each application from scratch. At most, individual developers have shared code on an ad hoc basis.

The new way links many application development projects with processes that identify and create reusable assets. To do so, they must overhaul their business and organizational structures. We have come to understand that this significant organizational change can be thought of in terms of business process reengineering. It is rethinking of everything pertaining to software from there stand point of those who ultimately benefit from good software obtained quickly reliably and inexpensively.

Substantial reuse requires, first of all, that reusable assets be identified in terms of a system architecture. Then the assets must be created and appropriately packaged and stocked. Potential users must have confidence in the components integrity, secondly an organization must refashion its systems engineering process so that developer can identify opportunities for reuse and work selected components into the process.

Systematic software reuse is thus the purposeful creation, management, support, and reuse of assets. As illustrated in figure below this can be expressed in terms of four concurrent processes. We call the people in the reusable asset processes, creators, and those in the development projects, reusers.

Create: This process identifies and provides reusable assets appropriate to the needs of the reusers. These assets may be new, reengineered, or purchased of various kinds such as

code, interfaces, architectures, tests, tools and so on. This process may include activities such as inventory and analysis of existing applications and assets, domain analysis, architecture, definition, assessment of reusers needs technology evolution reusable asset testing and packaging.

Reuse This process uses the reusable assets to produce applications or products. Activities include the examination of domain models and reusable assets, the collection and analysis of end-user needs the design and implementation of additional components adaptation of provided assets, and the construction and testing of complete applications.

Support: This process supports the overall set of processes and manages and maintains the reusable asset collection. Activities may include the certification of submitted reusable assets. Classification and indexing in some library, announcing and distributing the asset, providing additional documentation, collecting feedback and defect reports from reusers.

Manage: This process plans, initiates, resources, tracks and coordinates the other processes. Activities include setting priorities and schedules for new asset construction, analyzing the impact and resolving conflict concerning alternative routes when a needed asset is not available, establishing training and setting direction.

Domain engineering:

In most reuse programs to date, a key activity associated with the create process is a fairly systematic way of identifying potentially reusable assets, and an architecture to enable their reuse. This activity is called domain engineering in the systematic reuse community. The development of reuse process is also sometimes called application system engineering. The essence of systematic software reuse is that initial investment by the creator to identify and carefully structure reusable assets will enable reusers to build application rapidly and cost effectively.

Domain engineering reflects the idea that sharing between related applications occurs in one or more application domain or problem domain or solution domains. Reuse of the assets then occurs during a subsequent application system engineering phase.

Sometimes domain engineering has been loosely described as just lke ordinary systems engineering such as structure analysis structured design or object oriented analysis object oriented design except that it applies to a family of systems rather than just one. It is like systems engineering but it is also more that one of kind systems engineering. It seeks the family of similar systems that can inhabit a domain. As a result domain engineering is more complex that established systems engineering. Therefore management should not turn to it without forethought and should establish domain engineering. Therefore management should not turn to it without forethought and should establish domain engineering only when it foresees a business benefit in reuse.

Application System Engineering:

This activity has long existed in the form of building applications from scratch, possibly with the aid of a few back pocket programs. The goal now is to make use of the extensive set of reusable assets that have been provided. The intent is to build the application much more rapidly and cost effectively.

Application system engineering specializes and assembles these components into application. These applications are largely constrained to fit the architecture and the components. Typical applications usually consist of components from several different sets of components.

Starting from the models of the architecture and reusable components, the reusers puts together available reusable assets to meet at least the bulk of the new set of requirements. This is sometimes called a delta implementation because it is an outgrowth of what already exists.

The reusers have to find and specialize components by exploiting a variability mechanisms provided. If it is not possible to meet all the new requirements with the available reusable components additional programming will be needed. This programming may be done by the creator, producing new reusable components or by the reusers.

Finally the components are integrated and the application tested.

Domain engineering	Application system Engineering
Define and scope domain	Do delta analysis and design relative to domain model and architecture
Analysis examples needs trends	Use component systems as starting point
Develop domain model and architecture	Find specialize and integrate components
Structure commonality and variability	Exploit variability mechanism language generators.
Engineer reusable component systems languages and tools	

[3] MOTIVATION AND BACKGROUND

Web-based systems [1] and applications deliver a complex array of content and functionality, to a broad population of end-users. Web engineering is the process that is used to create high-quality web applications. Web engineering is not a perfect clone of a software engineering, but it borrows many of software engineering fundamental concepts and principles. In addition, the web engineering process emphasizes similar technical and management activities are conducted, but the overriding Philosophy dictates a disciplined approach to the development of a computer-based system. Web engineers and non-technical content developers [2] create the web applications. As web becomes increasingly

integrated in business strategies, for small and large companies, the need to build reliable, usable, and adaptable systems grows in importance.

Contrary to popular belief, architecture is an important aspect of agile software development efforts, just like traditional efforts, and is a critical part of scaling agile approaches to meet the real-world needs of modern organizations. But, agile approach architecture a bit differently than traditionalists do architecture provides the foundation from which systems are built and an architectural model defines the vision on which your architecture is based. The scope of architecture can be that of a single application, of a family of applications, for an organization, or for an infrastructure such as the Internet that is shared by many organizations. Regardless of the scope, my experience is that you can take an agile approach to the modeling, development, and evolution of architecture.

An agile approach: Focus on people, not technology or techniques [3]
Keep it simple
Work iteratively and incrementally
Roll up your sleeves
Build it before you talk about it
An Agile Approach
First and foremost, the values, principles, and practices of Agile Modeling (AM) should help to guide your enterprise architecture modeling and documentation efforts. This is just a good start though these issues are:
Focus on people, not technology or techniques
Keep it simple
Work iteratively and incrementally
Roll up your sleeves
Look at the whole picture
Make enterprise architecture attractive to your customers
Potential Problems With The Agile Approach
No approach is perfect, including this one. We would like to address the issues:
It does not include an explicit way to ensure compliancy (although having enterprise architects embedded on the teams goes a long way towards this). It depends on people being responsible.
It requires you to actively strive to keep things simple.
It requires you to accept an agile approach to modeling and documentation[8].

Web Engineering
The World Wide Web and the Internet that empowers it are arguably the most important developments in the history of computing. The technologies have drawn us all into the information age. They have become integral to daily life in the first decade of the twenty-first century. For those who can remember a world without the web, the chaotic growth of the technology hackers backs to another era- the early days of software.

[4] ATTRIBUTES OF WEB-BASED SYSTEMS AND APPLICATIONS:

In the early days of World Wide Web "Web Sites" consisted of little more than a set of linked hypertext files, that presented information, using text and limited graphics. As time passed, HTML was augmented by Development Tools (e.g. XML, Java) that enabled web engineers, to provide computing capability along with information. Thus web-based systems and applications were born. Today, web application has evolved into sophisticated computing tools that not only provide standalone function to the end user, but also have been integrated with corporate databases and business applications[10]. There is little debate that web applications are different from many other categories of computer software. Powell summarizes the primary differences, when he states that web-based systems "involve a mixture between print publishing and software development, between marketing and computing, between internal communications and external relations, and between art and technology." . The following attributes are encountered in the web applications.

Network Intensiveness: A web application resides on a network and must serve the needs of a diverse community of clients.

Concurrency: A large number of users may access the web application at one time. In many cases, the pattern of usage among end-user will vary greatly.

Unpredictable Load: The number of users of the web application may vary by orders of magnitude, from day to day.

Performance: If a web application user must wait too long, he or she may decide to go elsewhere.

Availability: Users of popular web application often demand access on a "24/7/365" basis.

Data Driven: The primary function of many web applications is to use hypermedia to present text, graphics, audio, and video content to the end-user. In addition, web applications are commonly used to access information that exists on databases that were not originally an integrated part of the web-based environment.

Content Sensitive: The quality and aesthetic nature of content remains an important determinant of the quality of a web application.

Continuous Evolution: Unlike conventional application software that evolves over a series of planned, chronologically spaced releases, web application evolves continuously.

Immediacy: The compiling needs to get software to market quickly. It is a characteristic of many application domains.

Security: Because web applications are available via network access, it is difficult, if not impossible, to limit the population of end-users who may access the application. In order to protect the sensitive content and provide secure modes of data transmission, strong security measures must be implemented throughout the infrastructure, that supports a web application and within the application itself.

Web Application Engineering Layers: The development of web-based systems and applications incorporates Specialized Process Models, Software Engineering Methods adapted to the characteristics of web application development and a set of important enabling technologies. Process, methods and technologies provide a layered approach to web engineering that is conceptually identical to the software engineering layer.

Process: Web engineering process embraces the agile development philosophy [9].

Agile development emphasizes a lean development approach that incorporates rapid development cycles. Aoyama [64] describes the motivation for the agile approach in the following manner: The Internet changed software development's [65] top priority from what to when. Reduced time-to-market has become the competitive edge that leading companies strive for. Thus, reducing the development cycle is, now, one of the software engineering's most important missions. Even when rapid cycle times dominate development thinking, it is important to recognize that the problem must still be analyzed, a design should be developed, implementation should proceed in an incremental fashion, and an organized testing approach must be initiated. However, these framework activities must be defined within a process that (1) embraces change (2) encourages the creativity and independence of development staff and strong interaction with web application stakeholders, (3) builds systems using small development teams, and (4) emphasizes evolutionary or incremental development, using short development cycles.

Web Methods: The web engineering methods landscape encompasses a set of technical tasks that enable a web engineer to understand, characterize, and then build a high-quality web application. Web methods can be categorized in the following manner:

Communication Methods: Communication Methods define the approach used to facilitate communication between web engineers and all other web application stakeholders. Communication techniques are particularly important during requirements gathering and whenever a web application increment is to be evaluated.

Requirements Analysis: They provide a basis for understanding the content to be delivered by a web application, the function to be provided for the end-user and the modes of interaction that each class of user will require for navigation through the web application.

Design Methods: They encompass a series of design techniques that address web application content, application and information architecture, and interface design and navigation structure.

Testing Methods: They incorporate formal technical reviews of both the content and design model and a wide array of testing techniques that address component level and architectural issues, navigation testing, usability testing and configuration testing.

Tools and Technology: They encompass a wide array of content description and modeling languages.

Web Engineering Framework: To be effective, any engineering process must be adaptable[5]. That is, the organization of the project team, the modes of communication among team members, the engineering activities and tasks to be performed, the information that is collected and created and themethods used to produce a high-quality product must all be adapted to the people doing the work.

Web Application is often delivered incrementally: That is, framework activities will occur repeatedly as each increment is engineered and delivered.

Changes will occur frequently: These changes may occur as a result of the evaluation of a delivered increment or as a consequence of changing business condition.

Business Analysis: Business analysis defines the business/organizational context for the web application. In addition, stakeholders are identified, potential changes in business environment or requirements are predicted and integration between the web application and other business applications, databases and functions are also designed.

Formulation: Formulation is a requirements gathering activity, involving all stakeholders. The intent is to describe the problem that the web application is to solve using the best information available. In addition an attempt is made to identify areas of uncertainty and where potential changes will occur.

Planning: The project plan for the web application increment is created. The plan consists of a task definition and a timeline schedule for the time period, projected for the development of the web application increment.

Modeling: Conventional Software Engineering Analysis and Design tasks are adapted to web application development, merged and then into the web engineering modeling activity. The intent is to develop "rapid" analysis and design models that define requirements and at the same time, represent a web application that will satisfy them.

Construction: Web engineering tools and technology are applied to construct the web application that has been modeled. Once the web application increment has been constructed, a series of rapid tests are conducted to ensure that errors in designs are uncovered.

Homepage: Web application should contain useful information or a simple listing of links that lead a user to more detail at lower level.

Page Layout: It varies depending upon the type of web application being developed.

Multimedia: Multimedia options are effective options for web application.

Engineering Best Practices: Web engineering teams are, sometimes, under enormous time pressure and will try to take short-cuts, but a set of fundamental best practices adopted from the software engineering practices should be applied, if industry quality web applications are to be built[7].

Product Objectives: It is essential to understand the business needs and product objectives, even if the details of the web applications are vague: Many web application developers, erroneously, believe that vague requirements relieve them from the need to be sure that the system, they are about to engineer, has a legitimate business purpose. The end result is good technical work that results in the wrong system, built for the wrong reasons, for the wrong audience.

If stakeholders cannot enunciate a business need for the web application, proceed with extreme caution. If stakeholders struggle to identify a set of clear objectives for the product, do not proceed until they can.

User Interaction: The user interaction with the web application should be described using a scenario-based approach: stakeholders must be convinced to develop use-cases to request how various actors will interact with the web application. These scenarios can then be used for project planning and tracking to guide analysis and design modeling, and as important input for the design of tests.

Project Plan: Project Plan, should be developed even if it is very brief. Then the plan has to be based on a predefined process framework that is acceptable to all stakeholders. Because project timeliness is short, schedule granularity should be fine.

Modeling: Modeling demands time spending to ascertain what it is being done to build: Generally, comprehensive analysis and design models are not developed during web engineering. However, UML class and sequence diagrams along with other selected UML notation may provide invaluable insight.

Review the models for consistency and quality: Formal technical reviews should be conducted throughout a web-engineering project. The time spent on reviews pays important dividends because; it often eliminates rework and results in a web application that exhibits high quality, thereby increasing customer satisfaction.

Tools and Technology: Tools and Technology that enable to construct the system with as many reusable components as possible: A wide array of web application tools is available for virtually every aspect of web application construction. Many of these tools enable a web engineer to build significant portions of the application using reusable components.

Testing: Don't rely on early users to debug the web application design comprehensive test and execute them before releasing the system. Users of a web application will often give it one chance. If it fails to

Perform, they move elsewhere-never to return. It is for this reason that "test first, then deploy" should be an overriding philosophy, even if deadlines must be stretched.

Other Software: Web application software is different from other categories of computer software.

Objectives: If stakeholders struggle to identify a set of clear objectives for the product, it is not advisable proceed, until they can.

Generic Process: The generic process framework-communication, planning, modeling, and deployment are applicable to web engineering[6].

Implementation: Having understood the significance of web engineering for successful development of web applications, the fundamental question that arises, for any web developer is, the concepts relevant for agile, various attributes that are vital for designing web applications, their relative significance and the emphasis required for each attribute, for the successful implementation of the web application using agile methodology. The present study is a humble beginning, to explore the concepts of web attributes and the agile & component technology methodology.

Keeping in view of the elements of web engineering and the process of developing web based projects based on different approaches like

1. Traditional T: Uses traditional approach –Waterfall model
2. Application A: Uses Programming Languages from scratch
3. Component C:Uses component for reuse
4. Agile and Component based AC: Reuse & Incremental along with client interaction

Analytic Hierarchy Process: The Pair wise Comparison Method was developed by Saaty (1980) in the context of the Analytic Hierarchy Process (AHP). This method involves pairwise comparisons to create a ratio matrix. It takes, as input, the pair wise comparisons and produces the relative weights as output

[5] DEVELOPMENT OF THE PAIR WISE COMPARISON

MATRIX: The method employs an Underlying scale with values ranging from 1 to 9 to rate the relative preferences for two criteria (see table).

Intensity of Importance	Definition
1	Equal importance
2	Equal to moderate importance
3	Moderate Importance
4	Moderate to strong importance
5	Strong importance
6	Strong to very strong importance
7	Very strong importance
8	Very to extremely strong importance
9	Extreme importance

Source: Saaty Scale for pair wise comparison

[6] DEVELOPMENT OF THE PAIR WISE COMPARISON MATRIX

This step involves the following operations:
(a) Sum the values in each column of the pair wise comparison matrix;

	T	A	C	A&C
T	1	1/3	1/7	1/9
A	3	1	1/7	1/8
C	7	7	1	1/9
A & C	9	8	9	1

(b) Divide each element in the matrix by its column total (the resulting matrix is referred to as the normalized pair wise comparison matrix);

	T	A	C	A&C
T	0.05	0.02	0.01	0.08
A	0.15	0.06	0.01	0.09
C	0.35	0.44	0.10	0.08
A C	0.45	0.50	0.88	0.75

Compute the average of the elements in each row of the normalized matrix, that is, divide the sum of normalized scores for each row .

	T	A	C	A&C	w
T	0.05	0.02	0.01	0.08	0.04
A	0.15	0.06	0.01	0.09	0.08
C	0.35	0.44	0.10	0.08	0.24
A C	0.45	0.50	0.88	0.75	0.65

These averages provide an estimate of the relative weights of the criteria being compared. AHP technique is used to find the weights of web based development approaches and the results were as follows

1.Traditional T: Uses traditional approach –Waterfall model

2. Application A:Uses Programming Languages from scratch

3. Component C:Uses component for reuse

4. Agile and Component based   AC: Reuse   & Incremental along with client interaction

Approach	Weights in %
Traditional T	0.04
Application A	0.08
Component C	0.24
Agile and Component AC	0.65

And the graph has been depicted for the above table which is as follows
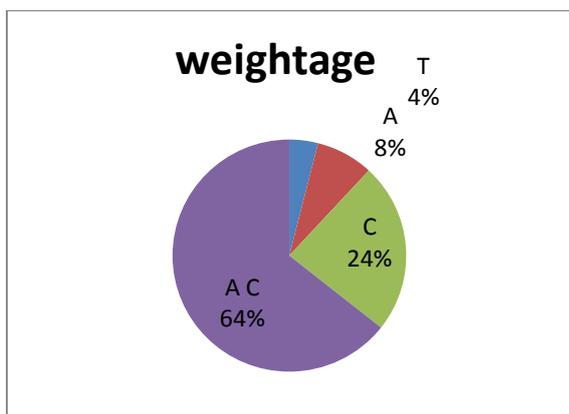
The graph shows that the approach for web based projects is more significant for Agile and Component base which takes 65% of the weight age when compared to other approaches

[7] CONCLUSION

There are many SDLC models such as Agile, RAD and Waterfall etc. used in various organizations depending upon the conditions prevailing in it like v-model gives the verification and validation for organization and it is very useful for organization. All these different software development models have their own advantages and disadvantages. Nevertheless, in the contemporary commercial software development world, the fusion of all these methodologies is incorporated. Timing is very crucial in software development. If a delay happens in The development phase, the market could be taken over by the competitor. Also if a bug' filled product is launched in a short period of time (quicker than the competitors), it may affect the reputation of the company. So, there should be a tradeoff between the development time and the quality of the product. Customers don't expect a bug free product but they expect a User-friendly product that results in Customer Ecstasy!

REFERENCE

[1]   Powell,T.A., Website Engineering Prentice Hall,1999.
[2]   Pressman, R. S.,"Can Internet Based Applications be Engineered?" IEEE Software, September 1998, pp. 104-110.
[3]   The Agile Alliiance Home Page ,hhtp//www.agilealliance.org/home
[4]   Ambler   ,S,   "what   is   Agile   Modelling http://www.agilemodeling.com/index.htm.
[5]   Cockburn A.,Agile Software Development: Addison Weley
[6]   Cockburn and J HighSmith ., What is Agile Software Development The People Factor "IEEE computing Vol 34 pp 131-133
[7]   DeMarco ,.T,and T Listener .Peopleware second edition
[8]   DeMarco ,.T and Boehm,"The Agile Method s Fray "IEEE Computer Vol 35 pp 90-92.
[9]   HighSmith ., J. Agile Software Ecosystem Addision–Wesley.
[10] Highsmith J., "The Methodology Debate" Part -1 Vol 14.

Performance of Cryptographic Instructions in RISC Based Architecture

D. VARA PRASADA RAO
HOD-ECE
Turbomachinery Institute of Tech. & Sci., A. P. , India.,

RAJESH VEERANKI
Assoc. Prof, ECE Dept
Turbomachinery Institute of Tech. & Sci., A. P. , India.,

E.V.KRISHNA KISHOR GOWD
Asst. Prof, ECE Dept
Turbomachinery Institute of Tech. & Sci., A. P. , India.,

Abstract: **On a general purpose processor it results lower throughput and larger power consumption. In**: **security is one of the most important features in data communication. Cryptographic algorithms are mainly used for this purpose to obtain confidentiality and integrity of data in communication. Implementing a cryptographic algorithm this work we propose processor architecture to perform the cryptographic algorithms and also it speed up the encryption and decryption process of data. This processor will perform the cryptographic operations as like general instructions in GPP. The data size of this processor is 32-bit. The processor architecture is designed using Verilog HDL.**

Keywords: **Cryptographic Algorithms, GPP, Verilog.**

I.   INTRODUCTION

There are two basic types of processors design philosophies: reduced instruction set computer (RISC) and complex instruction set computer (CISC). As the name suggests CISC systems use complex instructions. For example adding two integers is considered a simple instruction. But an instruction that copies an element from one array to another and automatically updates both array subscripts is considered a complex instruction. RISC systems use only simple instructions. RISC systems assume that the required operands are in the processors internal registers not in the main memory. A CISC design does not impose such restrictions. RISC designs use hardware to directly execute instructions.

Cryptography plays a significantly important role in the security of data transmission. On one hand with developing computing technology implementation of sophisticated cryptographic algorithms has become feasible. The cryptographic algorithms are classified into public key cryptography and private key cryptography. The private key cryptography which usually has a relatively compact architecture and smaller key size than public key cryptography is often used to encrypt/decrypt sensitive information or documents. Some well known examples of public key cryptographic algorithms are RSA (Rivest-Shamir-Adleman) and elliptic curve crypto systems and private key cryptographic algorithms are AES (Advance Encryption Standard), DES (Data Encryption Standard) and TEA (Tinny Encryption Algorithm). Implementation of these cryptographic algorithms on a general purpose processor is complex and also it has the drawback of lower throughput and higher power consumption.

In the present work the design of a 32-bit data width RISC processor is presented based on cryptographic algorithms. It was designed with simplicity and efficiency in mind. It has a complete instruction set, Hayward architecture memory, general purpose registers and simple Arithmetical Logic Unit (ALU). Here the ALU design performs the cryptographic operations like operations in AES, Blowfish, IDEA algorithms. To design of RISC architecture we used Verilog HDL.

Present work is divided as follows: Section II presents the Processor architecture with cryptographic operations; section III presents the Cryptographic operations are presented; section IV is dedicated functional blocks and results discussions.

II.   PROCESSOR ARCHITECTURE

The proposed processor has 32-bit data size, that its architecture has been designed in a way to be modular.

The ALU unit that uses a minimal instruction set, emphasizing the instructions used most often and optimizing them for the fastest possible execution. In this architecture the execution time of all instructions with the CPU clock cycle. The proposed architecture will perform both basic arithmetic and logical operations and cryptographic operations like rotate word, Swapping, Fixed coefficient multiplication, matrix multiplication.
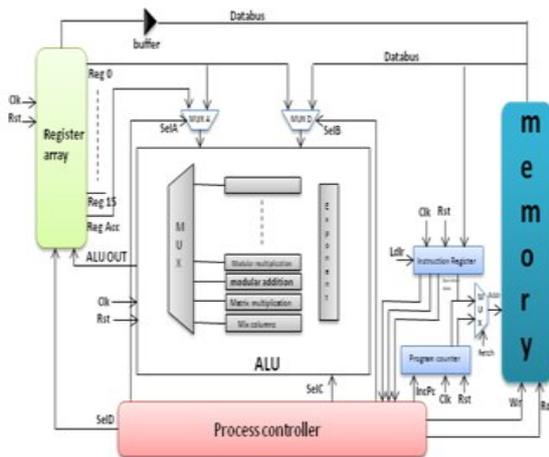
Figure no.1

III.   CRYPTOGRAPHIC OPERATIONS

AES (Advance Encryption Standard) is a block cipher developed in effort to address threatened key size of Data Encryption Standard (DES). It allows the data length of 128 bits and different key lengths 128, 192, 256 bits. The main operations in AES are Shift Rows, Rotate Word, Matrix Multiplication, Mix column.

Blowfish is a symmetric block cipher that encrypts data in 8-byte blocks. The algorithm has two parts;

key expansion and data encryption. Key expansion consists of generating the initial contents of one array namely, eighteen 32-bit sub-keys and four arrays (S-Boxes), each of size 256 by 32 bits from a key of at most 448 bits. The main operations of this algorithm are addition modulo two (XoR) and addition modulo 2^32.

IDEA algorithm of the encryption process we provide the original (128 bits) cipher key to the mentioned unit. When the necessary the key generator unit produces different sub-keys by performing circular left shift operation by 25 bits on the current key and provides the sub-keys to other units. The unit named as multiplication modulo 216+1 is used to perform all the multiplication modulo 2^16+1 operation, when required the same unit is for bit wise Xor.

Instruction Set: for a complete design it was necessary to create a specific instruction set and its own instruction format. The instructions are classified in to Data manipulation and arithmetic logical operations.

The below table describes the complete instruction set. Each instruction having its own opcode.

Table no.1

| Syntax	Operation	Description
NoP	**Nop**	**No operation**
Ld Sr[A]	**Sr= Memm[Address]**	**Move data from memory to register**
Addition [A,B]	**C=A xor B**	**GF(2m) addition**
ModularMultiplication[A,B]	**C=A+Bmod P**	**GF(2m) modular addition**
Modular Multiplication[A,B]	**C=A*Bmod P**	**GF(2m) modular multiplication**
MatrixMultiplication[A,B]	**Matrix multiplication**	**Polynomial matrix multiplication**
Mix column[A,B]	**C=Y*A mod X 4%1**	**Polynomial mix column transformation**
Fixedmultiplier[A,B]	**C=(03)*A**	**Reduction multiplication**
AMXModulo [A]	**C=A*(2A+1) mod P**	**Reduction modulo multiplication**
Length rotation[A,B]	**C=A<<B**	**Variable length rotation**
Rotate word [A]	**C=shiftrow(A)**	**Rotate word**
LRShift[A,B]	**C=A>>B,C=A<<B**	**Left, rotate shift operation**

The logical operations like shift left shift right and rotate word which requires only one source register shown in below type.
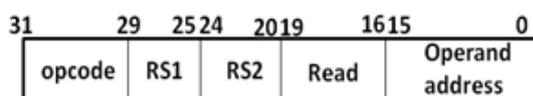
The operations like addition, modular functions require two source registers and to store result in destination result as shown in below type.
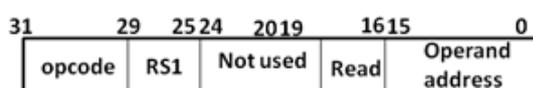
The load instructions and store instructions requires address from different data sources shown in below.
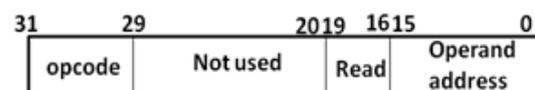
IV.   RESULT DISCUSSION

Instruction Register: Instruction registers store the instruction which read from the memory and keep it as an output for the control circuit like operation code, source registers, operand address

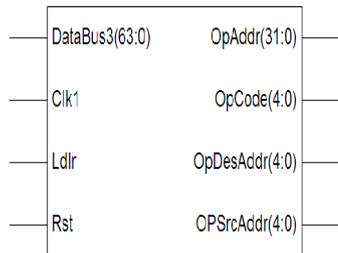and operands these values set to general purpose registers.
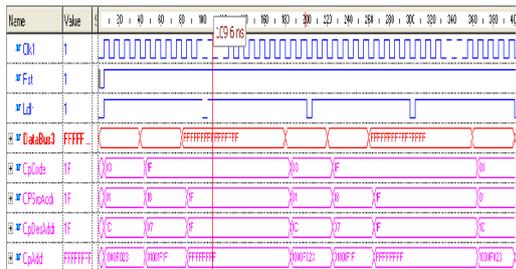

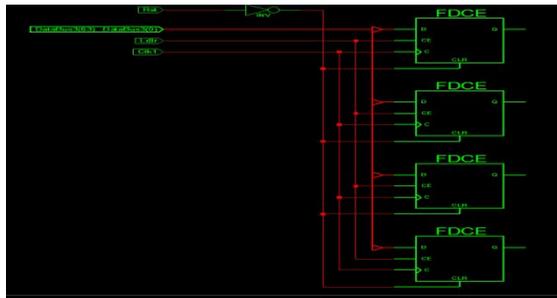*Figure no.2 Block diagram*

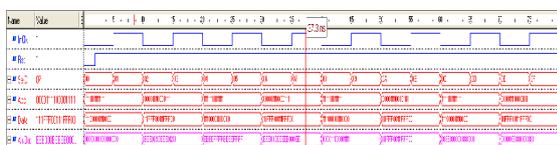*Figure no.3 simulation results*

Figure no.4 Technology schematic

Table no.2 implementation results

Logic Utilization	Usage	Availability
Slices	1	768
Flip Flops	47	1536
LUTs	1	1536
IOBs	93	124

Arithmetic Logical Unit: The arithmetic logical unit has 16 operations each one of them was created and converted in to a symbol, and then a multiplexer was placed in order to obtain a 4-bit selector.

Figure no.6 block diagram

Figure no.7 simulation results
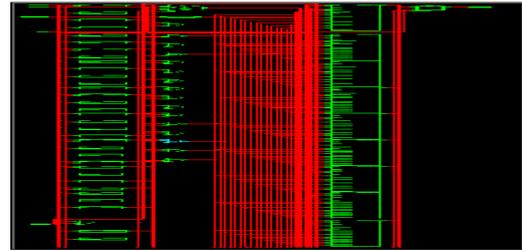
Figure no.8 Technology schematic

Table no.3 implementation results

Logic Utilization	Usage	Availability
Slices	360	768
Flip Flops	64	1536
LUTs	652	1536
IOBs	199	124

General Purpose Registers: General purpose registers store and save operands and results during program execution. ALU and memory must be able to write/read those registers so a set of sixteen 32-bit registers were used along with multiplexers and control circuit which are the operands to ALU which perform the operation.
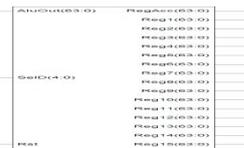

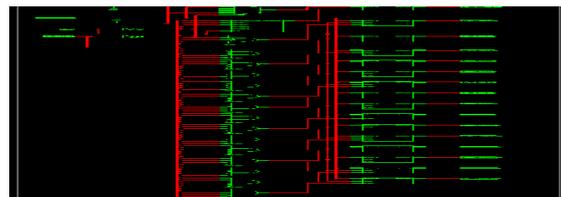*Figure no.10 block diagram*

Figure no.11 simulation results

Figure no.12 Technology schematic

Table no.4 implementation results

Logic Utilization	Usage	Availability
Slices	48	768
Flip Flops	87	1536
LUTs	1024	1536
IOBs	8	124

Control Unit: The control unit is based on using FSM and we designed it in a way that allows each state to run at one clock cycle, the first state is the reset which is initializes the CPU internal registers and variables. The machine goes to the reset state by enabling the reset signal for certain number of clocks. Following the reset state would be the

instruction fetching and decoding states which will enable the appropriate signals for reading instruction data from the memory and decoding the parts of the instruction. The decoding state will also select the next state depending on the instruction since every instruction has its own set of states, the control unit will jump to the correct state based on the instruction given.
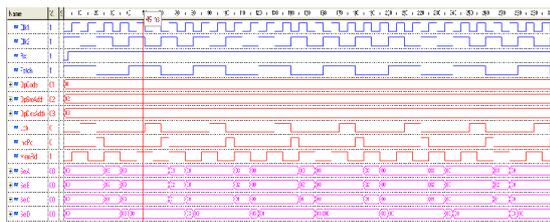

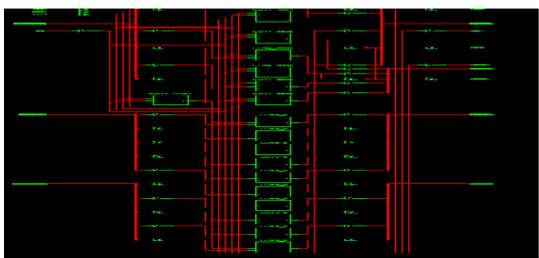*Figure no.13 block diagram*

Figure no.14 simulation results

Figure no.15 Technology schematic

Table no.5 implementation results

Logic Utilization	Usage	Availability
Slices	12	768
Flip Flops	44	1536
LUTs	20	1536
IOBs	44	124

V. CONCLUSION

32-bit cryptographic processor perform mathematical computations used in symmetric key algorithms has been designed using Verilog HDL the simulations are performed using Active HDL and implementation performed using Xilinx tool.

REFERENCES

[1.] Jun-hong chen "A High-Performance Unified Field Reconfigurable Cryptographic Processor". IEEE-2010

[2.] Nima Karimpour Darav "CIARP: Crypto Instruction-aware RISC Processor.IEEE-2012"

[3.] Antonio H. Zavala "RISC-Based Architecture for Computer Hardware Instruction" IEEE-2011
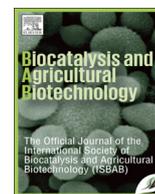
[4.] "Data Encryption Standard" 1999 october 25.

[5.] "Advance Encryption Standard" November 26 2001

Contents lists available at ScienceDirect

Biocatalysis and Agricultural Biotechnology

journal homepage: www.elsevier.com/locate/bab

Original Research Paper

Effect of physical factors on pellet morphology of *Aspergillus awamori* MTCC 9166 and polygalacturonase production

K. Anuradha [c], P. Naga Padma [c], S. Venkateshwar [b], Gopal Reddy [a,*]

[a] Department of Microbiology, Osmania University, Hyderabad 500007, India
[b] College of Technology, Osmania University, Hyderabad, India
[c] Department of Microbiology, BVB Vivekananda College, Secunderabad 500094, India

ARTICLE INFO

ABSTRACT

Polygalacturonase enzyme has its industrial application in extraction and clarification of fruit juices. Growth as pellet is an important character for any industrial fungal strain as product recovery becomes easy and simple. The simultaneous effect of fermentation conditions like pH, temperature, agitation and inoculum size were studied on pellet morphology and polygalacturonase production by *Aspergillus awamori* MTCC 9166 in submerged fermentation using crude pectin. The studies were done by unidimensional approach in which conventionally one parameter was selected and studied at a time. Optimum fermentation conditions for maximum polygalacturonase production were at pH 5.5, temperature 28 °C, agitation speed 200 rpm and inoculum size 1×10^6 spores/ml. The highest enzyme production at these conditions was 17.8 U/ml. The study revealed a significant fact that the same optimum fermentation conditions promoted both pellet formation and maximum enzyme production.

© 2014 Published by Elsevier Ltd.

1. Introduction

Pectin is a hetero polysacharide polymer found in the middle lamella of cell wall of plants. Pectin is degraded by the action of several enzymes included under the generic term pectinases. Pectinases produced by different microorganisms are classified into depolymerizing enzymes and saponifying enzymes. Depolymerizing enzymes are those that catalyze the hydrolytic cleavage of the α-(1–4)-glycosidic bonds in the D-galacturonic acid moieties of the pectic substances. They are polymethylgalacturonases, pectin lyases, polygalacturonases and pectate lyases. Saponifying enzymes are esterases that catalyze the de-esterification of pectins by the removal of methoxy esters and are called pectinesterases (Whitaker, 1990).

About 75% of the estimated sale of industrial enzyme is contributed by pectinases (Sathyanarayana and Panda, 2003). These have wide applications in food industry for clarification of fruit juices, wines (Alkorta et al., 1998; Whitaker, 1984) coffee and tea fermentations (Jayani et al., 2005) and extraction of essential oils etc. The production of pectinolytic enzymes has been widely reported in bacteria and filamentous fungi (Naidu and Panda, 1998). Fungal polygalacturonases are very significant for clarification of fruit juices, wines and for extraction of vegetable oils (Castilho et al., 2000). Their significance in clarification of fruit

juices is due to the fact that their optimal pH closer to that of many fruit juices. Pellet morphology in fungi results in formation of spherical agglomerates of hyphae that not only increase the efficiency of nutrient transfer but also make recovery of product easy and simple (Cui et al., 1997; Ryoo, 1999; Zhaou et al., 2000).

In the present study the effect of fermentation conditions on both pellet morphology and production of polygalacturonase (PG) by *Aspergillus awamori* MTCC 9166 was studied. There was variation in size and number of pellets with variation in fermentation conditions like pH, temperature, agitation speed and inoculum size. Optimum fermentation conditions for polygalacturonase production were also identified in the study.

2. Materials and methods

2.1. Microorganism

A. awamori MTCC 9166 was isolated from vegetable dumpyard soil and maintained on PDA slants in refrigerator (Anuradha et al., 2010).

2.2. Inoculum preparation

Fungal spores were scrapped from PDA slants to water suspension and added at a concentration 10^6 spores/ml to fermentation broth.

2.3. Fermentation conditions

Experiments were carried out in 250 ml flasks with 50 ml Czapek's broth containing (g/l) – K_2HPO_4 0.2, KCl 0.5, $NaNO_3$ 0.2, $FeSO_4$ 0.03, and 1% crude pectin as sole carbon source. Fermentation parameters like pH, temperature agitation and inoculum size were tested for optimization. The ranges were pH 2–7, temperature 20–40 °C, agitation speed 140–220 rpm and inoculum size 10^4–10^8 spores/ml.

2.4. Study of pellets

The size of different types of pellets formed under different physical conditions was determined. Experiments for pellet studies were carried out in 250 ml flasks with 100 ml Czapek's broth. The number of pellets and their total dry weight were simultaneously determined.

2.5. Recovery and enzyme assay

Polygalacturonase (PG) enzyme was extracted using acetate buffer at pH of 5.2 and assayed by measuring the D-galacturonic acid realeased from polygalacturonic acid as substrate by Miller's method (Miller, 1959). One unit of enzyme activity is defined as the amount of enzyme required to produce 1 μ mole of galacturonic acid per minute at 37 °C.

3. Results

The simultaneous effect of fermentation conditions like pH, temperature and agitation on pellet morphology and polygalacturonase production was studied. Pellet formation is a character of some fungi and fermentation conditions influence both the size and number of pellets formed. The size of *A. awamori* MTCC 9166 pellets formed ranged 0.5–1.8 mm and the number varied from 70–145/100 ml for pH range 4–6. The optimum pH was 5.5 as a maximum of 145 pellets/100 ml of 0.9 mm size weighing 1.05 g/100 ml were formed (Table 1). Effect of temperature on pellet morphology was also significant as pellets ranging in size 0.5–1.8 mm, with dry weight 0.9 g/100 ml and number variation of 90–145 were formed. The optimum temperature was 28 °C as a maximum of 145 pellets/100 ml of 0.9 mm size weighing 0.9 g/100 ml were formed (Table 2). The ranges of pellet size, number and dry weight formed in response to variation of agitation speed was almost similar to that of temperature (Table 3). The optimum agitation speed was 200 rpm as a maximum of 145 pellets/100 ml of 0.9 mm size weighing 1 gm/100 ml were formed (Table 3).

The studies for optimization of fermentation conditions like pH, incubation temperature, agitation and inoculum size were done by uni-dimensional approach in which conventionally one parameter was selected and studied at a time. As pH of the medium is one of the important factors effecting enzyme production its effect on PG production when studied at various pH ranging 2–7, it was observed that the PG production was maximum at pH 5.5 (17.6 units). Enzyme yields were low at pH 2–3.5 pH and also beyond pH 6 (Fig. 1). Effect of temperature was studied at various

Table 1
Effect of pH on pellet morphology and polygalacturonase production by *Aspergillus awamori* MTCC 9166.

Parameter	pH				
	4	4.5	5	5.5	6
Pellet number/100 ml medium	90	95	100	145	70
Pellet morphology (size in mm)	Very small 0.5	Very small 0.5	small 0.7	medium 0.9	large 1.8
Biomass dry weight (g/l) at 72 h	5	5	6	10.5	7.5
Maximum enzyme activity/ml	11.5	12.5	14	17.6	11.5

Table 2
Effect of temperature on pellet morphology and polygalacturonase production by *Aspergillus awamori* MTCC9166.

Parameter	Temperature (°C)				
	20	25	28	30	37
Pellet number/100 ml medium	90	100	145	120	100
Pellet morphology (size in mm)	Very small 0.5	small 0.7	medium 0.9	large 1.8	large 1.8
Biomass dry weight (g/l) at 72 h	6	8	9	8	7
Maximum enzyme activity/ml	14.5	16	17.8	16.3	15

Table 3
Effect of agitation on pellet morphology and polygalacturonase production by *Aspergillus awamori* MTCC 9166.

Parameter	Agitation speed (rpm)				
	140	160	180	200	220
Pellet number/ 100 ml medium	100	125	130	145	80
Pellet morphology (size in mm)	Very small 0.5	small 0.7	small 0.7	medium 0.9	large 1.8
Biomass dry weight (g/l) at 72 h	6	8	9	10	6.5
Maximum enzyme activity/ml	12.5	15	16	17.8	11.5

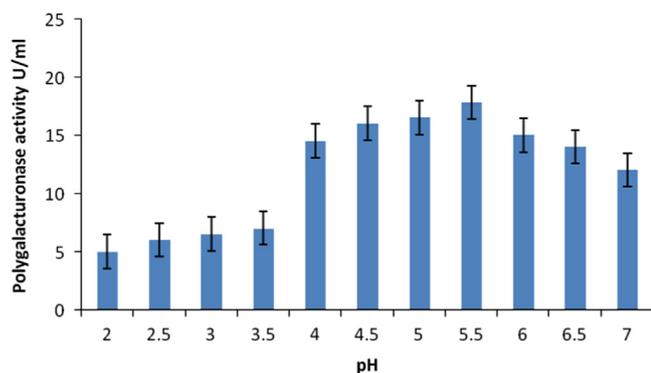**Fig. 1.** Effect of pH on polygalacturonase production by *Aspergillus awamori* MTCC 9166. The *p*-value is 0.000213 and it is less than α.

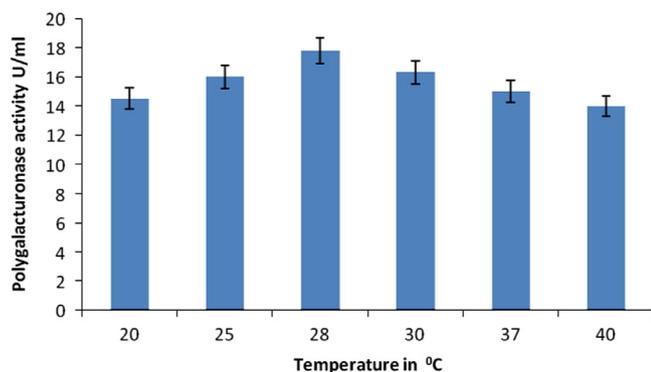**Fig. 2.** Effect of temperature on polygalacturonase production by *Aspergillus awamori* MTCC 9166. The *p*-value is 0.005579 and it is less than α.
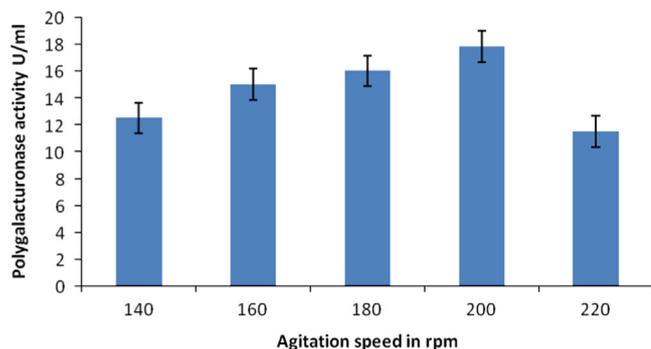

Fig. 3. Effect of agitation speed on polygalacturonase production by *Aspergillus awamori* MTCC 9166. The *p*-value is 0.000309 and it is less than α.

temperatures ranging from 20 to 40 °C. *A. awamori* MTCC 9166 was found to produce maximum PG (17.8 U/ml) at 28 °C (Fig. 2). Agitation speed in the range of 140–220 rpm was maintained and its effect studied for PG production by *A. awamori* MTCC 9166. Increased agitation was found to improve enzyme production with 17.8 U/ml, at 200 rpm and beyond that speed there was decrease in enzyme production (Fig. 3). When the inoculum size ranging in a spore count (10^4–10^8 spores/ml) was studied for its effect on PG production, it was observed that inoculum size of 10^6 spores/ml showed maximum PG production (Fig. 4).

4. Discussion

The *A. awamori* MTCC 9166 under present study exhibited pellet morphology which is an important character as it makes
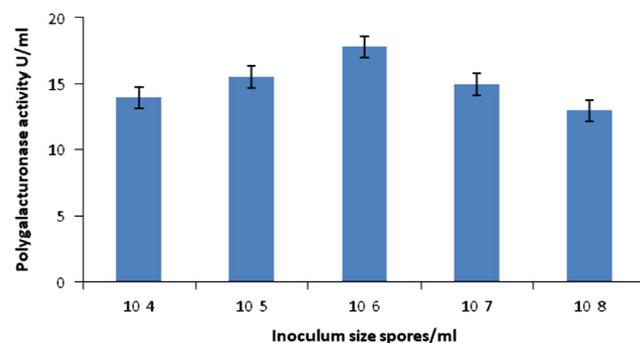

Fig. 4. Effect of Inoculum size on polygalacturonase production by *Aspergillus awamori* MTCC 9166. The *p*-value is 0.0053 and it is less than α.

both fermentation and downstream processing easy. Many studies on growth morphology in terms of different products have concluded that pellet morphology is more favorable for industrial strains as it not only improves culture rheology but also promotes better microbe nutrient interaction for efficient product yield (Lopez et al., 2005; Zhaou et al., 2000). Fermentation conditions are known to affect the growth morphology and enzyme production by *Aspergillus sojae* and *Rhizopus oryzae* (Oncü et al., 2007; Tari, et al., 2011). The physical factors influenced the size, number and dry weight of pellets and also the primary metabolite production like PG enzyme. In the present study it was found that a pH 5.5, temperature 28 °C and agitation 200 rpm were the optimum as they increased both the pellet formation (size and number) and PG enzyme production (17.8 U/ml) by *A. awamori* MTCC 9166. There was better enzyme production with medium sized pellets (0.9 mm) as these could promote more microbe-nutrient interaction and better oxygen transfer which is necessary for an aerobic organism like *Aspergillus*. Studies on optimization of inoculum size for both pellet formation and PG production revealed that 10^6 spores/ml was optimum and this is important to form both biomass (pellets) and enzyme as a primary metabolite. Similar results were obtained in earlier studies where the authors described the effects of the inoculum concentration for better production of enzymes (Kiro, 2010; Shah and Madamwar, 2005; Qinnghe et al., 2004). This study on pellet morphology provides significant information for PG production as there are no such reports on *A. awamori*. Therefore the present findings serve as a base line study on pellet morphology and PG production or any other enzymes by fungal organisms.

5. Conclusion

A pellet forming fungal isolate *A. awamori* MTCC 9166 showed good polygalacturonase production. Optimum fermentation conditions for pellet formation and maximum polygalacturonase production were pH of 5.5, temperature 28 °C, agitation speed of 200 rpm and inoculum size of 1×10^6 spores/ml. The present study is significant for fungal polygalacturonase producer with pellet morphology, which is an important character in industrial product recovery.

References

Alkorta, I., Garbisu, C., Llama, M.J., Serra, J.L., 1998. Industrial applications of pectic enzymes: a review. Process Biochem. 33, 21–28.

Anuradha, K., Naga Padma, P., Venkateshwar, S., Reddy, Gopal, 2010. Fungal isolates from natural pectic substrates for polygalaturonase and multienzyme production. Indian J. Microbiol. 50, 339–344.

Castilho, L.R., Medronho, R.A., Alves, L., 2000. Production and extraction of pectinases obtained by solid state fermentation of agroindustrial residues with *Aspergillus niger*. Bioresour. Technol. 71, 45–50.

Cui, Y.Q., Van der Lans, R.G. J.M., Luyben, K.C. A.M., 1997. Effects of agitation intensities on fungal morphology in submerged fermentation. Biotechnol. Eng. 55, 715–726.

Jayani, R.S., Saxena, S., Gupta, R., 2005. Microbial pectinolytic enzymes: a review. Process Biochem. 40, 2931–2944.

Kiro, M., 2010. The effects of different carbon sources on biosynthesis of pectinolytic enzymes by *Aspergillus niger*. Appl. Technol. Innov. 3, 23–29.

Lopez, L.C., Perez, J.A. S., Sevilla, J.M.F., Porcel, E.M.J., Chisti, Y., 2005. Pellet morphology, culture rheology and lovastatin production in cultures of *Aspergillus terreus*. J. Biotechnol. 116, 61–77.

Miller, G.L., 1959. Use of dinitrosalicylic acid reagent for determination of reducing sugar. Anal. Chem. 31, 426–428.

Naidu, G.S.N., Panda, T., 1998. Production of pectolytic enzymes: a review. Bioprocess Eng. 19, 355–361.

Oncü, S., Tari, C., Unluturk, S., 2007. Effect of various process parameters on morphology, rheology and polygalacturonase production by *Aspergillus sojae* in a batch bioreactor. Biotechnol. Prog. 23, 836–845.

Qinnghe, C., Xiaoyu, Y., Tiangui, N., Cheng, J., Qiugang, M., 2004. The screening of culture condition and properties of xylanase by white-rot fungus *Pleurotus ostreatus*. Process Biochem. 39, 561–566.

Ryoo, D., 1999. Fungal fractal morphology of pellet formation in *Aspergillus niger*. Biotechonol. Tech. 13, 33–36.

Sathyanarayana, N.G., Panda, T., 2003. Purification and biochemical properties of microbial pectinases: a review. Process Biochem. 38, 987–996.

Shah, A.R., Madamwar, D., 2005. Xylanase production by a newly isolated Aspergillus foetidus strain and its characterization. Process Biochem. 40, 1763–1771.

Tari, C., Ozkan, K., Oncu, S., Avci, T., 2011. The relationship of pellet morphology to polygalacturonase production of *Rhizopus oryzae* in various media compositions. GIDA 36, 25–31.

Whitaker, J.R., 1984. Pectic substances, pectic enzymes and haze formation in fruit juices. *Enzyme*. Microb. Technol. 6, 341–349.

Whitaker, J.R., 1990. Microbial Pectinolytic enzymes. In: Fogarty, W.M., Kelly, C.T. (Eds.), Microbial Enzymes and Biotechnology, 2nd ed. Elsiever Science Ltd, London, pp. 133–176.

Zhaou, Y., Du, J., Tsao, G.T., 2000. Mycelial pellet formation by *Rhizopus oryzae* ATCC 20344. Appl. Biochem. Biotechnol. 84, 779–789.

Flow Analysis for a Converging Compound Channel

4 authors, including:

Bandita Naik
Biju Patnaik University of Technology
16 PUBLICATIONS   **35** CITATIONS

Shiba Shankar
National Institute of Technology Rourkela
1 PUBLICATION   **2** CITATIONS

Some of the authors of this publication are also working on these related projects:

UKIERI View project

A STUDY OF RATING CURVE & FLOOD ROUTING USING NUMERICAL METHODS View project

Flow Analysis for a Converging Compound Channel

B. Naik, K.K. Khatua, Rahul Sahoo and Shiba Shankar Satapathy

Department of Civil Engineering, N.I.T. Rourkela, INDIA.

Abstract

In overbank flow, due to interaction mechanism between the main channel and floodplain, the flow properties of the compound sections are greatly affected. The complexity raises more when dealing with a compound channel with converging floodplains. In converging compound channels, due to change in floodplain geometry, there is either severe change of momentum exchanges if the geometry of transition is contraction or expansion. Many investigators have studied and explained the complexity of such compound geometry in predicting the flow variable. In this paper, some experimental results in compound channels with converging floodplains are described and compared. The variations of flow properties for both prismatic and non-prismatic floodplains of different convergence angles are studied and analysed.

Keywords: compound channel, converging angle, water surface profile, flow depth, velocity.

1. Introduction

Open Channels are classified either Prismatic open channels or non-prismatic channels. The open channels in which shape, size of cross section and slope of the bed remain constant are said to be as the prismatic channels otherwise said to be non-prismatic channels. In non-prismatic compound channels with converging/diverging floodplains, due to continuous change in floodplain geometry along the flow path, the resulting interactions and momentum exchanges is increased. This extra momentum exchange is very important parameter and should be taken into account in the overall flow modelling of a river.As natural river data during flood are very difficult to obtain, research on such a topic is generally done in laboratory flumes. The present study focuses on converging compound channels. In a converging compound channel if the

flood plain is contracted, the flow is forced to leave the flood plains and enter to the main channel because of change in cross section area. New experiments have been conducted at the Hydraulics and Fluid mechanics Laboratory of Civil Engineering Department of NIT, Rourkela to analyse the behaviour of flow effect due to change in flood plain geometry in terms of converging angle.

2. Experimental Work

2.1 Experimental Setup

Experiments have been conducted in non-prismatic compound channels with varying cross section built inside a concrete flume measuring 15m long ×.95m width × 0.55m depth. The width ratio of the channel is α>1.72 and the aspect ratio is δ>5.78.The converging angle of the channel is taken as 12.38°.Converging length of the channel is found to be 0.84m. The channel is made up of cement concrete. Water was supplied through a Centrifugal pumps (a 15 hp) discharging into a RCC overhead tank. In the downstream end there lies a measuring tank followed by a sump which feed the water to the overhead tank through pumping.. Water was supplied to the flume from an underground sump via an overhead tank by centrifugal pump (15 hp) and recirculated to the sump after flowing through the compound channel and a downstream volumetric tank fitted with closure valves for calibration purpose. An adjustable vertical gate along with flow straighteners was provided in upstream section sufficiently ahead of rectangular notch to reduce turbulence and velocity of approach in the flow near the notch section. At the downstream end another adjustable tail gate was provided to control the flow depth and maintain a uniform flow in the channel. A movable bridge was provided across the flume for both span wise and stream wise movements over the channel area so that each location on the plan of compound converging channel could be accessed for taking measurements.

Water surface measurements were measured directly with point. The measurements were made each 5mm and 10mm in converging flume of 840 mm length. Point velocities were measured along verticals spread across the main channel and flood plain so as to cover the width of entire cross section. Also at a no. of horizontal layers in each vertical, point velocities were measured. Measurements were thus taken from mid-point of main channel to the left edge of floodplain. The lateral spacing of grid points over which measurements were taken was kept5cm inside the main channel and the flood plain. Velocity measurements were taken by pitot static tube (outside diameter 4.77mm) and two piezometers fitted inside a transparent fibre block fixed to a wooden board and hung vertically at the edge of flume the ends of which were open to atmosphere at one end and connected to total pressure hole and static hole of pitot tube by long transparent PVC tubes at other ends.. Steady uniform discharge was maintained the run of the experiment and several runs were conducted for overbank flow with relative depth varying between 0.05-0.51. The discharge varied between 39259.768cm^3/s to 146672.3cm^3/s. Point depth average velocity were made at a depth of 0.4H from the bed in the main channel and 0.4(H-h) on the flood plains.

Table 1: Hydraulic parameters for the experimental runs.

Sl. No. of Runs	Discharge Q in cm3/s	Overbank depth H in cm	Relative depth $D_{r=(H-h)/H}$	Froude no.(Fr)	Reynolds no.(R)
1	39259.36	10	0.05	0.677465	34138.57
2	51338.78	11.7	0.19	0.537911	43360.45
3	62014.92	14.02	0.32	0.353251	50402.24
4	92108.59	15.83	0.4	0.259969	72721.13
5	146672.3	19.4	0.51	0.205241	109620.5

After obtaining the point velocities at various grid points representing the whole compound channel flow cross section, velocity contours were drawn. The velocity contours were drawn by normalizing the point velocities with the cross sectional means velocities for the respective overbank depth of flow

3. Result and Discussion

The new experimental results from non-prismatic compound channels are presented in this section. Velocity contour of prismatic non prismatic section are shown in **Fig1(a,b)**The stage discharge curve at experimental section-1&2 was plotted and shown in **Fig 2(a&b) .** The water surface profile of different relative depth are shown in **Fig 3(a)**.The depth average velocity of different converging part of relative depth of 0.5 are shown in the **Fig 4(a,b,c)..** The boundary shear stress of different converging part of relative depth of 0.5 are shown in the **Fig 5(a,b,c)**.
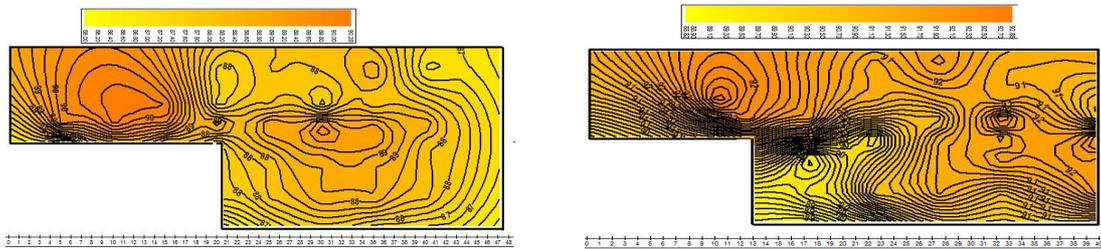

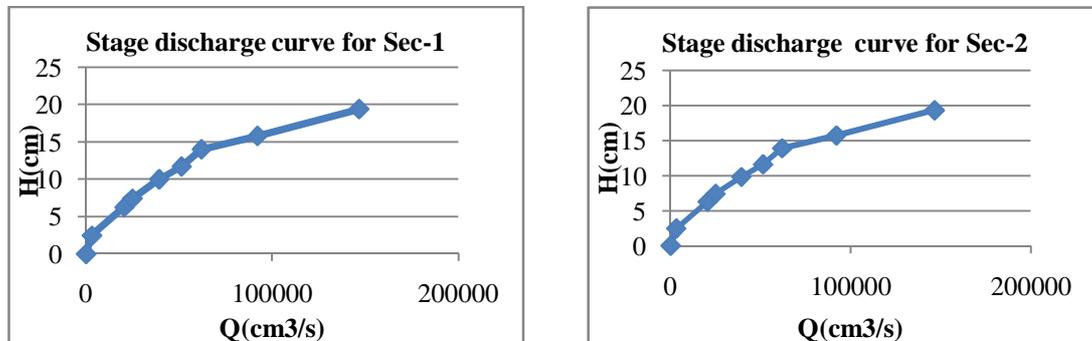**Fig. 1:** (a)Velocity contour of sec-1 (b)Velocity contour of sec-2

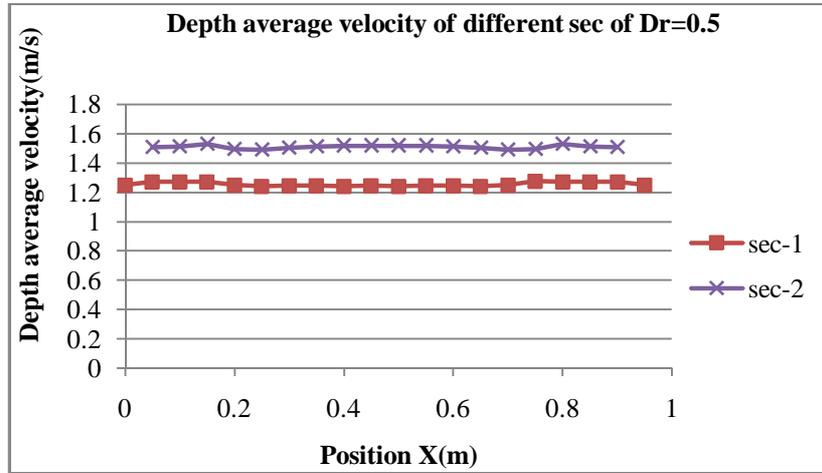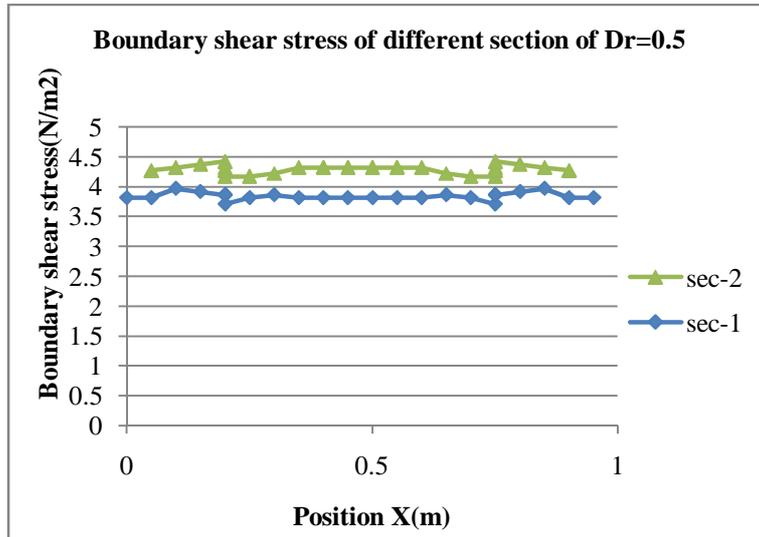**Fig. 2**: (a,b)Stage discharge curve for Prismatic and Non prismatic section.

Fig. 3: (a) shows the Depth average velocity.

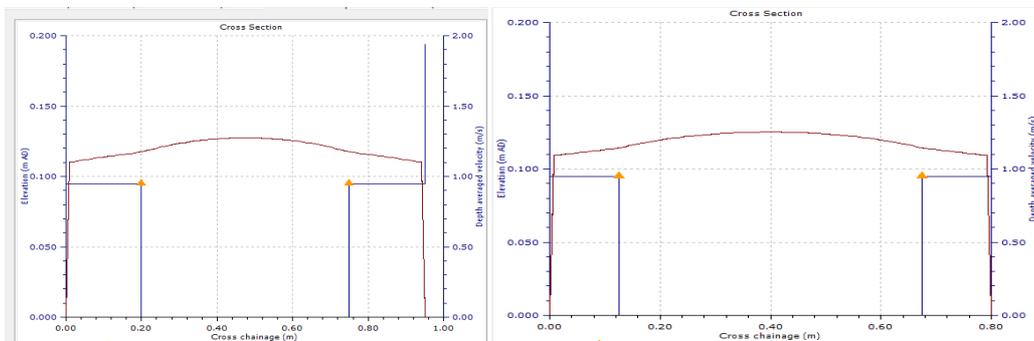(b) shows the boundary shear of Prismatic and Non prismatic section

Fig. 4: (a) Depth average velocity of sec-1 (b) Depth average velocity of sec-2 by CES
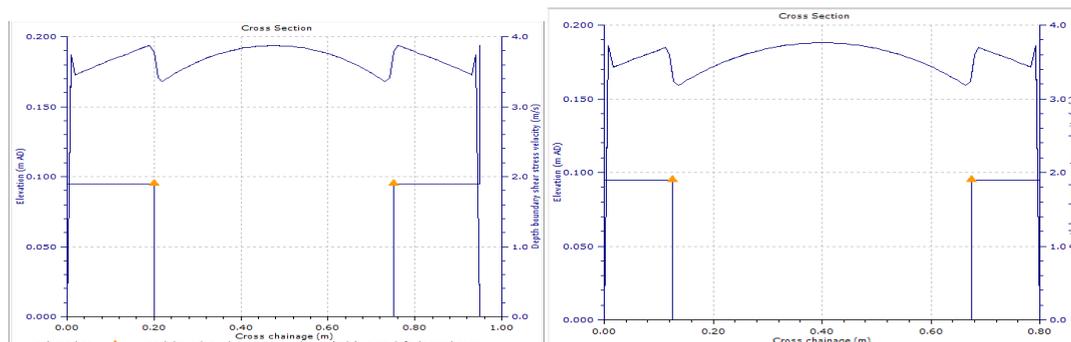
Fig. 5: (a) Boundary shear stress of sec-1 (b) Boundary shear stress of sec-2 by CES

4. Conclusions

1. Experiments are conducted to study the effect of flow variables for converging and non-converging compound channels.
2. From the Velocity contours of the expetrimental channels, it is seen that at section 1 the higher velocity contours occur both at the middle of flood plain and interface of main channel. At section 2 the occurrence of higher magnitude velocity contours happens same for floodplain however in the main channel region it is again at central region.
3. From the stage discharge curve it is seen that non of the methods is good agreement with the actual stage discharge.
4. From the water surface profile curve it is seen that the depth of flow start decreases from mid section of the converging part. It is clearly distinguish at higher relative depth
5. From the depth average velocity curve and boundary shear stress curve it is seen that both increses along the narrowing part of the flume.
6. In CES also the depth average velocity and boundary shear stress increase along the narrow part of the flume.

References

[1] Ackers P. (1993). "Stage–discharge functions for two-stage channels'' the impact of new researches. Inst Water Environ Manage, 7, pp.52–61
[2] Bousmar, D., and Zech, Y., (1999). "Momentum transfer for practical flow computation in compound channel" J. Hydraul. Eng., 125(7), 696-706.
[3] Bousmar, D., and Zech, Y., (2002). "Discussion of two-dimensional solution for straight and meandering overbank flows."J. Hydraul. Eng., 128(5), 550-551.
[4] Bousmar, D., Wilkin, N., Jacquemart, J.H., Zech, Y., (2004). "Overbank flow in symmetrically narrowing floodplains." J. Hydraul. Eng., ASCE, 130(4), 305-312.

[5]   Chow VT. (1959). "Open- channel hydraulics''. New York: Mc. Graw-Hill Book Co, .Hydraul. Eng., 137(8), 815-824

[6]   Elliott, S.C.A &Sellin, R.H.J. 1990. "SERC floo channel facility: skewed flow experiments",J. Hydr. Res., IAHR, 28(2), 197-214

[7]   James, M. & Brown,B.J. 1977. Geometric parameters that influence floodplain flow,Report WES-RR-H-77-1, USACE, Vicksburg, USA.

[8]   Knight, D.W.,and Hamed, M.E., (1984), "Boundary Shear in Symmetrical Compound Channels", Journal of the Hydr. Eng., ASCE, Vol.110, No.HY10, Paper 19217, pp.1412-1430.

[9]   Khatua K.K, Patra K.C,and Mohanty P.K. (2012). "Stage-Discharge Prediction for Straight and Smooth Compound Channels with Wide Floodplains'' J. Hydr. Engg, ASCE

[10] Rezaei, B. (2006). "Overbank flow in compound channels with prismatic and non-prismatic floodplains." PhD Thesis, Univ. of Birmingham, U.K.

[11] Rezaei, B., and Knight, D.W., (2009). "Application of the Shiono and Knight Method in compound channel with non-prismatic floodplains" J. Hydraul. Research.47 (6), 716-726.

[12] Rezaei, B., and Knight, D.W., (2011). "Overbank flow in compound channels with non-prismatic floodplains" J. Hydraul. Research

[13] Sellin, R.H.J., (1964),"A Laboratory Investigation into the Interaction between Flow in the Channel of a River and that of its Flood Plain", La Houille Blanche, No.7, pp.793-801.

[14] Wormleaton, and Hadjipanos, P., (1985), "Flow Distribution in Compound Channels", Journal of the Hydr. Engg., ASCE, Vol.111, No.7, pp. 1099-1104.

An Approach to Automatic Generation of Test Cases from Use-Cases

[I]Dr. B V Ramana Murthy, [II]Prof. Vuppu Padmakar, [III]A. Vasavi

[I,III]Dept. of CSE, Jyotishmathi College of Technology, and Science, Shamirpet, Hyderabad India
[II]Dept. of CSE, Guru Nanak Institutions Technical, Campus, Hyderabad, India

Abstract

A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal. It consists of a group of elements (for example, classes and interfaces) that can be used together in a way that will have an effect larger than the sum of the separate elements combined. The use case should contain all system activities that have significance to the users. A use case can be thought of as a collection of possible scenarios related to a particular goal, indeed, the use case and goal are sometimes considered to be synonymous

Keywords

Use cases, Gent Case, Tools, Test Case

I. Introduction

A use case (or set of use cases) has these characteristics:
- Organizes functional requirements
- Models the goals of system/actor (user) interactions
- Records paths (called scenarios) from trigger events to goals

Describes one main flow of events (also called a basic course of action), and possibly other ones, called exceptional flows of events (also called alternate courses of action)[3] Is multi-level, so that one use case can use the functionality of another one.

Use case analysis is a technique used to identify the requirements of a system (normally associated with software/process design) and the information used to both define processes used and classes (which are a collection of actors and processes) which will be used both in the use case diagram and the overall use case in the development or redesign of a software system or program. The use case analysis is the foundation upon which the system will be built.

A use case analysis is the primary form for gathering usage requirements for a new software program or task to be completed. The primary goals of a use case analysis are: designing a system from the user's perspective, communicating system behavior in the user's terms, and Specifying all externally visible behaviors. Another set of goals for a use case analysis is to clearly communicate: system requirements, how the system is to be used, the roles the user plays in the system, what the system does in response to the user stimulus, what the user receives from the system, and what value the customer or user will receive from the system. [5]

II. Reasons why use cases are indispensable to your software development project

Use cases help the analysis team, Improve communication among team members. Collaborative effort enhances the success of any team. As the team members work to describe business processes, use cases provide a repository of team members' business knowledge. As a written document, each use case spawns meaningful discussion within the group. The axiom, "the whole is greater than the sum of the parts", applies here. Group discussion exposes in-depth viewpoints that would otherwise remain hidden. With use cases, the team captures these perspectives while identifying the related business goals, conditions, and issues.

III. Encourage common agreement about system requirements

The process of writing and revising use cases produces three important outcomes in the analysis team clarity, consensus, and commitment. Remarkably, it is common for stakeholders to be uncertain about how a process they own actually works! Writing a use case helps stakeholders align the narrative with the details of an existing process.

In a recent project, it became clear that stakeholders could not agree about the specifics of several core processes. However, consensus came quickly as the team wrote and revised use cases.[6] For many stakeholders, these written documents offer a foothold on a sometimes bewildering mountain of complex business processes. Remarkably, use cases often help stakeholders reach common agreement on "best practice" processes as well. In a facilitated group setting, divergent perspectives are welcomed, understood, and appreciated. As a by-product of this agreement, team members inevitably commit to support improved processes to both management and peers.

IV. Reveal process alternatives, process exceptions, undefined terms, and outstanding issues

I always have the analysis team start a use case by developing the "Main Course of Events" (see the sample use case). As the group develops a coherent and ordered set of process steps, team members tend to volunteer statements that begin with the words "what about..." - a clue to previously unidentified "Alternative Paths" to a successful outcome. The "Exception Paths" often arise in a similar way. More of these become obvious when the team considers what happens if any step in the "Main Course" fails. As the facilitator of team meetings, carefully listen for any jargon used by stakeholders. Write these terms down in front of the group and ask for a definition for each one. Later, you'll add these definitions into the project glossary. Also, listen for issues as they arise. Is a process step fuzzy? Is there an area that needs more research, or an item on which team members disagree? Write these down as well and later include them in a project issue log.

V. Expose what belongs outside project scope

Constraints on the project may limit resources and/or the project timeline. As a result, the analysis team may need to prioritize development work, or separate project deliverables into phases.

You can help the analysis team by creating a catalog of the use case titles, and arranging them into some meaningful order (e.g., by sub-system or umbrella process). With this catalog, the analysis team can prioritize the use cases. They may decide that some fall outside the project scope, or that some are not needed in the first project phase. Either way, you have given the stakeholders an opportunity to declare which functions they need the most, or which ones they need first.

VI. Transform manual processes into automated processes

When software is being designed to automate aspects of an existing system, the analysis team usually begins by writing "as is" use cases to describe the current business processes. While this effort is time consuming, the result is valuable. Besides revealing the details of an existing business process (including business rules, alternative paths, and exception paths), you will create a launching pad for the team's imagination. As they are writing the use cases, they often discover an improved process, recognize unnecessary steps, or reach agreement on "best operational practices". The "as is" use cases may also allow the system architect to propose high-level process flow diagrams that represent how the new system could work. While the first attempts may not be viable, iterative review and revision by the analysis team may generate a workable architecture for the new system. Use cases help the development team...

VII. Understand business processes

Software developers often lack an understanding of the customer's business. It is easy to forget that software systems should help business people get work done -- effectively, efficiently, and inexpensively. To achieve these objectives, the development team must understand not only the business process the software must support, but also the process' alternatives and exceptions. Use cases provide this information in clear, structured language that developers can readily understand.[2] Use cases also offer a valuable perspective on the stakeholders' business goals, assumptions, and operational rules. These features provide developers with a solid foundation for developing cost-effective solutions to business challenges.

VIII. Recognize patterns and contexts in functional requirements

Developers may view a set of use cases horizontally. For example, one use case requires a customer lookup function. Another use case requires a similar function but with customer data sorted in a different order. The clever development team can find such patterns within a set of use cases. Patterns are often discovered in the "Business Rules" section of use cases as well. Developers may transform these patterns into universal software objects.

As another aid to developers, use cases also reveal operational context. The "Stakeholders Goals", "Pre-Conditions", "Assumptions", and "Post-Conditions" give developers a sense of how the software will be used. By reading these sections, the developer understands what the role identified in the use case is trying to accomplish, and what motivates him or her. Although the analysis team may have prioritized and winnowed the use cases, the development team views them from a far different perspective.[1] As a good development teams writes code, they search for coding efficiencies. While the analysis team may want 12 use cases completed in phase one, the technical manager and

the development team may see cost-savings in delivering phase one software for the 12 use cases, plus two more from phase two that are cheaper to build as part of phase one. Of course, the analysis team and the development should jointly consider the effect of this change.

IX. Discover gaps between the requirements and the delivered software

Some years ago, I was asked to join a troubled project in which the system design phase was nearly complete. Unfortunately, detailed functional requirements were nowhere to be seen, and the developers had already begun writing code! In order to catch up, I taught a team of functional users to write use cases themselves. Although we completed the narratives quickly, the developers largely ignored our use cases. That condition changed, however, after the developers installed their first software release. It was clear to us that critical features were missing. The rooky analysis team and I compared the delivered software to our use cases. Although we created a long list of missing features, we challenged the developers to close the gaps rapidly. The next installation was acceptable.

X. Ensure the delivered software works properly

While use cases significantly differ from test cases, the former may be used to derive the latter. The "Assumptions", "Pre-Conditions", and "Post-Condition", "Main Course", "Alternative Paths", "Exception Paths", and "Business Rules" sections are all source material for creating good test scripts. Bundles of use cases organized into system-wide process flows become a source for writing comprehensive endto- end test scripts. As an added bonus, the testing team develops test scripts from the use cases as the development team begins its work. The test scripts are now ready for use as developers complete programs.[8]

Example of use case diagram
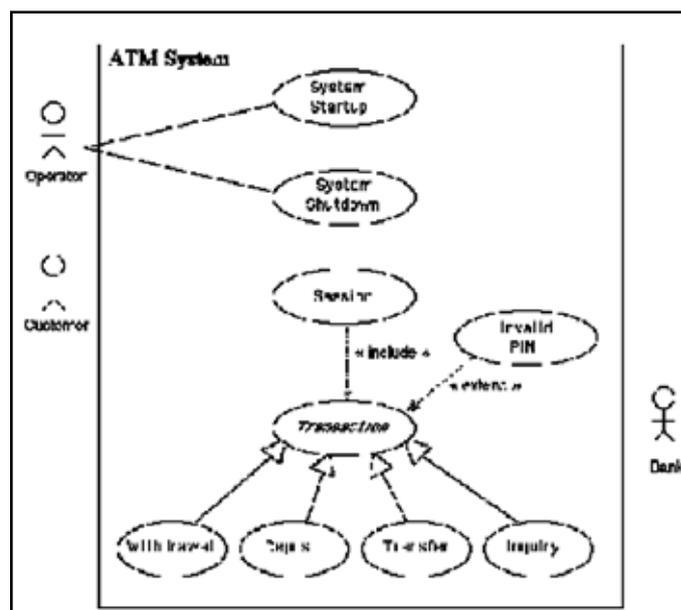
Test case:

Test Cases are the implementation of a test case design which will help the software tester to detect defects in the application or the system being tested. This should be the primary goal of any test case or set of test cases. When I write a test case, I think of both

types of test cases, positive test cases and negative test cases. Positive test cases are those which execute the happy path in the application and make sure that the happy path is working fine. Negative test cases as the name suggests are destructive test cases which are documented with some out-ofbox thinking to break the system.[10] A Test Case should be documented in a manner that is useful for the current test cycle and any future test cycles. At a bare minimum each test case should contain: Sr No, Summary or Title, Description, Steps to reproduce, Expected Results, Actual Results and Status of the test case or remarks.

Test Case in Sdlc

Software Development Life Cycle, or Software Development Process, defines the steps/stages/phases in the building of software. There are various kinds of software development models like:

 Waterfall model
 Spiral model
 Iterative and incremental development (like 'Unified Process' and 'Rational Unified Process')
 Agile development (like 'Extreme Programming' and 'Scrum')

Models are evolving with time and the development life cycle can vary significantly from one model to the other. It is beyond the scope of this particular article to discuss each model. However, each model comprises of all or some of the following phases/activities/tasks.

Test case vs. use cases

A Use Case is not a substitute for a Test Case. I start with this point because there is a growing trend of organizations using Use Cases as Test Cases. Writing Use Cases takes a lot less time, requires fewer resources and less expertise. Use Cases are user scenarios—typical sequences of tasks performed on the software by a typical user. A Use Case is useful for one purpose, in User Acceptance Test (UAT), to verify the software works correctly in typical workflows. Use Cases will include normal flow and alternate flow sequences, but they are still confined to fairly normal end-user workflows. Test Cases cover the software more thoroughly and in more detail than Use Cases. Test Cases include every function that the software is capable of (or is supposed to be capable of); handling every type of data input/output, every expected behavior, every design item, and every class of defect. There are a lot of Requirements that are not covered in Use Cases. But all Requirements must be covered in Test Cases. To satisfy a Test Case, there may be one, two, or more test scripts. Ideally, test scripts have stepby- step, click-by-click instructions that any person off the street could see and instantly perform with no training. (But because of reality constraints, test scripts often assume knowledge common to the designated testers.) When the test scripts pass, the Test Case passes. When the Test Cases pass, the Requirements pass. Every part of a Test Case must be traceable to specific items in the Requirements document, which is not complete until you have captured implied requirements, and converted them into documented Requirements.[9] For example, if I'm testing to verify that closing "print preview" takes the user back to the "print dialog box," then the Requirements document better state that closing "print preview" must take the user back to the "print dialog box." If I am testing the boundary of max characters allowed in a field, the Requirements document better state the max characters allowed in that field. Then you can trace the test back to the requirement.

The tool

The tool, which we call GenTCase (Generator for Test Cases), can be used to layout the usecase diagram of any system. The tool is also able to automatically generate the test cases of the system according to the use-case diagram that has been formed previously. The tool is developed using object-oriented approach with C++ programming language. The tool has 3 major components as shown in The workspace is used as a place for a user to provide the system's requirements by means of a use-case diagram. In the workspace, a Toolbox is used to create, edit and display the use-case diagram. The Toolbox consists of standard symbols and arrows for a use-case diagram such as symbols for an actor and a use case, and arrows for connecting an actor with use cases as well as arrow for generalizations. In the Workspace, a user can also type-in the text for each of the use cases used in the Text Box provided by the tool. The Workspace will allow a user of the tool to layout the use- case diagram according to any system. Once the use-case diagram has been finalized, the user can generate the test cases by using the generator of the tool. The Engine will take all the use cases and search the keywords used in the provided database. The database consists of most standard keywords of a use case. Once the use case used matches the keyword inside the database, the engine will generate its respective test cases according to its use case. Intelligent search technique is used to search all the metadata fields in the entire database.

The intelligent searching technique includes three major processes. First, the keywords are pre-processed by some automatic text operation methods. The result is a collection of metadata, which is considered the logical view of the use case diagram. Next, the metadata describing the logical views are used to construct a metadataoriented index. An index such as this "allows fast searching over large volumes of metadata field".

During the retrieval, the information retrieval engine first performs similar text operations on the user query as those performed on the original use cases. The output of the text operation is a list of metadata, each of which is used to locate, through the index, a list of all the documents in which it occurs. When multiple metadata are present in the query, the search returns the union of the additional information retrieved by all the words. In short, searching is a process of matching keywords in the use cases with those in the query. Lastly, every retrieved metadata is evaluated by its relevance to the query and the additional information of use cases. The way the engine works is by choosing the shortest time-to-locate the object being searched. This will ensure the result returns in few seconds.

The tool will produce the test cases based on the use-case diagram provided in the workspace. These test cases are generated automatically from the tool as the output of the tool. The output is displayed on the screen as well as stored in a file with extension .txt, namely output.txt. A user can open this output file by using a Notepad or Microsoft Word. The output can be used as a checklist for a programmer to test the system that he or she will develop according to the provided test cases. These test cases can also be used to validate the results of the test cases so the requirements of the system are meet.

User who uses the tool can layout the use cases using the Workspace. The Toolbox is used in order to ease the drawing of the use-case diagram. Then, the button for Generator of test cases (GTC) in the Workspace can be used to generate the test cases.[7]

XI. Conclusion and Future Work

Gent Case is a tool that is able to generate the test cases automatically according to the system's requirements. The test cases can be used as a checklist for a programmer to validate that the system meets its requirements. The purpose of Gent Case is to reduce the cost of testing the system. However, Gent Case has its limitations where the use cases used are only for functional requirements of a system. The tool is unable to capture the non-functional requirements of a system. Therefore, the nonfunctional requirements need to be captured and tested outside of the tool.

Dr. B. V.Ramana Murthy has done his PhD from Osmania University, presently he working as Professor in Computer Science and Engineering, has 18 years of experience in Teaching and R&D. His primary area of interest is Software Engineering & Web Engineering.

References

[1]. A. Bahrami Object oriented systems development : using the unified modeling language, Mc-Graw Hill, Singapore. (1999)

[2]. C. Nebut, F. Fleurey and Y.L. Traon, Automatic Test Generation: A Use Case Driven Approach, IEEE TRANSACTION ON SOFTWARE ENGINEERING Vol.32, No.3 (2003)

[3]. D. Wood and J. Reis (1999). Use Case Derived Test Cases, Software Quality Engineering for Software Testing Analysis and Review (STAREAST99) Online. http://www.stickyminds.com/

[4]. I. Jacobson, G. Booch, J. Rumbaugh. The Unified SoftwareDevelopment, England (1992)

[5]. J. Gutierez, Escalona M.J. and Torres M.M. An Approach to Generate Test Cases from Use Cases, Proceedings of the 6th International Conference on Web Engineering. pp. 113-114 (2006).

[6]. J. Heumann, Generating Test Cases from Use Cases, Rational Software, IBM. (2001).

[7]. J. Jansen Using an Intelligent Agent To Enhance Search Engine Performance http://www.firstmonday.org (1996)

[8]. R.V. Binder Testing Object-Oriented System. Addison-Wesley. USA (2000)

[9]. Rational. (2003). Mastering Requirements Management with Use Cases, Rational Software, IBM.

[10]. T. Stanley, Intelligent Searching Agent on the Web, http://ariadne.ac.uk/issue7/searchengine

Mr. V Padmakar is pursuing PhD in CSE and has done his M Tech (CSE) from JNTUH, presently working as Professor in Computer Science and Engineering has 17 years of experience in Teaching and Industry. His primary area of interests is Software Engineering, Network Security and Data mining

Mrs. A.Vasavi has done her M.Tech (CSE) from JNTUH, presently She is working as Associate Professor in Computer Science and Engineering department, has 10 years of experience in Teaching. Her area of interest is Network Security and Formal Languages.

Selection of nutrients for polygalacturonase production by *Aspergillus awamori* MTCC 9166 using Plackett-Burman design

K Anuradha[1], P Naga Padma[1], S Venkateshwar[2] and Gopal Reddy[3]*

[1]Department of Microbiology, BVB Vivekananda College, Secunderabad 500094, India
[2]College of Technology and [3]Department of Microbiology, Osmania University, Hyderabad 500 007, India

Selection of the best nutrients is one of the most critical stage in media optimization for polygalacturonase production. Plackett-Burman design was used to screen various pectin substrates, nitrogen sources and mineral nutrients for polygalacturonase production by *Aspergillus awamori* MTCC 9166. Fifteen different pectin sources like crude pectin, polygalacturonic acid, orange peel, citrus peel, jackfruit peel, etc. were selected for polygalacturonase production using 16 experimental design of Plackett-Burman. Similarly, eleven nitrogen sources like yeast extract, tryptone, casein hydrolysate, sodium nitrate, ammonium chloride, etc. and eleven mineral nutrients like NaCl, $MgSO_4$, KH_2PO_4, $CaCl_2$, etc. were screened for polygalacturonase production using 12 experimental design of Plackett-Burman. The enzyme production was studied for 5 d, where the maximum production was observed on 3rd d and so this data was analyzed using Indostat software to obtain regression coefficients and t-values. Based on these values significant nutrients like seven pectin sources (orange peel, jack fruit rind, apple peel, pine apple peel, mango peel, banana peel & tomato pulp), four nitrogen sources (urea, yeast extract, casein hydrolysate & potassium nitrate) and four mineral nutrients (NaCl, KH_2PO_4, $CaCl_2$ & KH_2PO_4) were selected for second level screening of efficient nutrients for polygalacturonase production using 16 experimental design of Plackett-Burman. Orange peel as pectin source, casein hydrolysate as nitrogen source and NaCl showed maximum enzyme production and so were selected for further quantitative optimization.

Keywords: *Aspergillus awamori* MTCC 9166, mineral nutrients, nitrogen sources, pectin sources, Plackett-Burman design, polygalacturonase

Introduction

Pectinases are a group of enzymes that degrade pectins present in middle lamella and primary cell walls of plant tissues[1]. Pectinases produced by different microbes are divided into depolymerizing enzymes and saponifying enzymes. Depolymerizing enzymes are polymethylgalacturonases, pectin lyases, polygalacturonases and pectate lyases, and saponyifying enzymes are pectinesterases[2,3]. These enzymes have wide applications in food industry for clarification of fruit juices and wines[2,4], coffee and tea fermentations[2], extraction of essential oils[5], etc. They have significant commercial value and today 75% of the estimated sale of industrial enzymes is contributed by pectinases[6].

The production of pectinolytic enzymes has been widely reported in bacteria and filamentous fungi[7]. Fungal polygalacturonases are very significant for clarification of fruit juices and wines, and for extraction of vegetable oils[8]. Their significance in clarification of fruit juices is due to the fact that their optimal pH is closer to that of many fruit juices.

Nutritional factors like pectin, nitrogen, mineral nutrients are significant as components of low cost production media that is of great interest in the industry. It is also known that 30-40% of the production cost of industrial enzymes is accounted for the cost of growth or fermentation medium[6,9]. In our earlier study, a fungal polygalacturonase producer along with multienzyme production ability was screened[10]. Effective screening and selective isolation of pectinolytic microorganisms from different sources was done using enrichment culture technique. Different bacteria, yeasts and molds for enzyme production were screened. They were tested for pectinolytic activity and multienzyme production and one isolate characterized as *Aspergillus awamori* MTCC 9166 was selected for the study and it was deposited at Microbial Type Culture Collection and Gene Bank (MMTC), Institute of Microbial Technology, Chandigarh, India. The strain had a positive character of pellet formation, which could be very useful in product recovery.

_____
*Author for correspondence:
Tel: +91-40-27682246/27090661
Mobile: +91-9948693767
E-mail: gopalred@hotmail.com

Polygalacturonase is known to be produced by different fungal strains like those of *Aspergillus, Penicillium* and *Rhizopus* using pectin as substrate[11]. It is reported that *A. niger* produced 14.5 U/mL[12], *P. frequentans* produced 3 U/mL[13] and *A. awamori* produced 0.046 U/mL[14]. The strain under study, *A. awamori* MTCC 9166 produced 17.8 U/mL initially[10] and it improved after the media optimization. As a result, the enzyme yields increased to an average of 800 U/mL for pectin sources and 30 U/mL for nitrogen and mineral nutrients.

In the present study, locally available wastes or cheaper materials were used as pectic substrates. Different nitrogen and mineral nutrients were screened using Plackett-Burman[15] statistical design in an attempt to optimize suitable production medium. This design is a statistical methodology used to screen up to n-1 variables in just n number of experiments.

Materials and Methods

Microorganism

A. awamori MTCC 9166 strain was isolated from vegetable dump yard soil and maintained on PDA slants in a refrigerator[10].

Inoculum Preparation

Fungal spores were scrapped from PDA slants and added to water to get a concentration of 10^6 spores/mL spore suspension.

Pretreatment of Solid Substrates

Peels of various fruits like apple, banana, citrus (sweet lime), jackfruit rind, mango, pine apple, etc. were subjected to water treatment till sugar free. These were dried and powdered and their pectin content was determined by carbazole method[10].

Screening of Nutrients

Sixteen run Plackett-Burman (PB) design of 15 variables at two levels (+1 and -1) was used for screening of pectin rich sources (Table 1). Submerged fermentation was carried out in 250 mL Erlenmeyer flasks containing 50 mL Czapek broth with 1% commercial pectin (citrus peel pectin, S D Fine Chemicals) and other raw pectins. The flasks were inoculated with 1×10^6 spores/mL. The spore number was estimated by direct microscopic count using haemocytometer. Flasks were incubated for 5 d at 28°C in an Orbital shaker incubator at 200 rpm. Broth samples were collected after 48 h (3rd d) and assayed for the enzyme activity.

The fifteen pectin sources, namely, pectin crude (S D Fine Chemical), polygalacturonic acid, orange peel, sweet lime peel, jack fruit peel, apple pomace, sapota peel, pineapple peel, mango peel, banana peel, guava pulp, sugar cane bagasse, papaya peel, tomato pulp and lemon peel, were tested for their significant effect on production of polygalacturonase (PGUase) enzyme. Eleven nitrogen sources (including organic and inorganic), namely, urea, yeast extract, tryptone, casein hydrolysate, corn steep liquor, peptone, ammonium sulphate, sodium nitrate, ammonium chloride, ammonium nitrate and potassium nitrate, were tested for their significant effect on production of PGUase enzyme using 12 run Plackett-Burman design[15]. Based on

Table 1—Plackett-Burman 16 experimental design for 15 pectin sources for PGUase production *by A. awamori* MTCC 9166

Runs	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Set1	Set2
1	+	-	-	-	+	-	-	+	+	-	+	-	+	+	+	854*	825*
2	+	+	-	-	-	+	-	-	+	+	-	+	-	+	+	657	647
3	+	+	+	-	-	-	+	-	-	+	+	-	+	-	+	484	474
4	+	+	+	+	-	-	-	+	-	-	+	+	-	+	-	647	637
5	-	+	+	+	+	-	-	-	+	-	-	+	+	-	+	555	567
6	+	-	+	+	+	+	-	-	-	+	-	-	+	+	+	927	935
7	-	+	-	+	+	+	+	-	-	-	+	-	-	+	+	628	658
8	+	-	+	-	+	+	+	+	-	-	-	+	-	-	+	620	630
9	+	+	-	+	-	+	+	+	+	-	-	-	+	-	-	825	840
10	-	+	+	-	+	-	+	+	+	+	+	-	-	+	-	925	900
11	-	-	+	+	-	+	+	+	+	+	+	-	-	-	+	880	870
12	+	-	-	+	+	-	+	-	+	+	+	+	-	-	-	850	840
13	-	+	-	-	+	+	-	+	-	+	+	+	+	-	-	650	640
14	-	-	+	-	-	+	+	-	+	-	+	+	+	+	-	680	670
15	-	-	-	+	-	-	+	+	-	+	-	+	+	+	+	780	760
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	620	630

*PGUase activity (U/mL)
[A, Pectin crude; B, Polygalacturonic acid; C, Orange peel; D, Sweet lime peel; E, Jack fruit peel; F, Apple pomace; G, Sapota peel; H, Pineapple peel; I, Mango peel; J, Banana peel; K, Guava pulp; L, Sugar cane bagasse; M, Papaya peel; N, Tomato pulp; & O, Lemon peel]

unidimensional experiments, concentrations of variables were fixed. The lower and upper levels fixed for the selected carbon sources were 0.1 and 1% and for the selected nitrogen sources were 0.02 and 0.2%, respectively. Similarly eleven mineral nutrients, namely, NaCl, $MgSO_4$, KH_2PO_4, $CaCl_2$, $CuSO_4$, $FeCl_3$, $MnSO_4$, $ZnSO_4$, $CoCl_2$, $ZnCl_2$ and K_2HPO_4, were selected for PGUase production and their lower and upper levels were 0.005 and 0.05%, respectively. The physical parameters like temperature, pH and agitation were held constant at 28°C, 5.5 and 200 rpm, respectively.

Enzyme Assay

Fermented broth was cold centrifuged at 4°C, 5000 rpm for 10 min and supernatant was taken as enzyme source. Sodium acetate buffer (0.05 M, pH 5.5) was used for assaying PGUase. One mL of enzyme with 1 mL substrate (1%) was incubated at 50°C temperature and the D-galacturonic acid released from polygalacturonic acid as substrate was measured[16,17]. One unit of enzyme activity is defined as the amount of enzyme required to produce 1 µ mole of galacturonic acid per minute at 50°C[8,16].

Statistical Analysis

All experiments were conducted in triplicates and repeated thrice. Statistical analysis of the data was done using INDOSTAT software. The enzyme production was studied for 5 d, but maximum production was recorded on 3rd d and this data was analyzed using Indostat software to obtain regression coefficients and t-values. The most important nutrients under different categories were selected after statistical analysis based on regression coefficients and highest t-values. Those with p-values less than 0.005 were considered to be significant and shortlisted for further optimization studies.

Results and Discussion

Screening of fifteen pectin sources was done for PGUase production by *A. awamori* MTCC 9166 using the sixteen run Plackett-Burman design. PGUase production was found to be maximum in combination 6 followed by 10 (Table 1). Seven variables, namely, orange peel, jack fruit peel, apple pomace, pine apple peel, mango peel, banana peel and tomato pulp, were found to be significantly affecting PGUase production as their P values were equal to zero with positive regression coefficients (Table 2). These were selected for further screening.

Similarly when 11 nitrogen sources were screened using 12 run design and PGUase production was found to be maximum in combination 5 (Table 3). Among the 11 variables, 4 variables were found to be significantly effecting PGUase production with P values <0.001 (Table 4). These were urea, yeast extract, casein hydrolysate and potassium nitrate. They had positive coefficients over enzyme production and they could be selected for further screening. Other variables, ammonium chloride, ammonium nitrate, sodium nitrate, tryptone, potassium nitrate, peptone and corn steep liquor were found to be insignificant. Among 11 variables screened, NaCl, K_2HPO_4, $CaCl_2$ and KH_2PO_4 were comparatively more significant in affecting PGUase production (Table 5) as their regression

Table 2—Estimated effects and coefficients of pectin sources for PGUase production by *A. awamori* MTCC 9166 using Plackett-Burman design

Variable	Term	Effect	Regression coefficient	Standard error coefficient	t	p	Significance
	Constant	363.91	727.81	6.31	115.34	0.000	
A	Pectin Crude	4.33	8.65	1.99	4.33	0.001	*
B	Polygalacturonic acid	-25.55	-51.09	1.99	25.6	0.000	*
C	Sweet lime peel	-4.70	-9.40	1.99	4.71	0.000	*
D	Orange peel	20.34	40.68	1.99	20.28	0.000	Significant
E	Jack Fruit peel	14.14	28.28	1.99	14.17	0.000	Significant
F	Apple pomace	6.35	12.71	1.99	6.37	0.000	Significant
G	Sapota peel	0.33	0.65	1.99	0.32	0.747	*
H	Pine apple peel	22.79	45.59	1.99	22.80	0.000	Significant
I	Mango peel	26.04	52.09	1.99	26.10	0.000	Significant
J	Banana peel	20.79	41.59	1.99	20.84	0.000	Significant
K	Guava pulp	-8.30	-16.60	1.99	8.34	0.000	*
L	Sugar cane bagasse	-22.54	-45.09	1.99	22.59	0.000	*
M	Papaya peel	-2.67	-5.34	1.99	2.67	0.017	*
N	Tomato pulp	18.01	36.03	1.99	18.05	0.000	Significant
O	Lemon peel	-20.7	-41.4	1.99	20.75	0.000	*

*Insignificant

Table 3—Plackett-Burman 12 experimental design for 11 nitrogen sources (NS) and 11 mineral nutrients (MNs) for PGUase production by *A. awamori* MTCC 9166

Runs	A	B	C	D	E	F	G	H	I	J	K	Set 1 NS (U/mL)*	Set 2 NS (U/mL)*	Set 1 MNs (U/mL)*	Set 2 MNs (U/mL)*
1	+	-	+	-	+	-	+	+	+	-	-	26.38	26.38	32.5	31.5
2	+	+	-	+	-	-	-	+	+	+	-	27.42	27.42	38.6	38.2
3	-	+	+	-	+	-	-	-	+	+	+	10.53	10.53	20.2	20.2
4	+	-	+	+	-	+	-	-	-	+	+	40.18	40.18	60.4	60.3
5	+	+	-	+	+	-	+	-	-	-	+	55.65	55.65	45.2	45.1
6	+	+	+	-	+	+	-	+	-	-	-	23.50	23.50	23.5	23.5
7	-	+	+	+	-	+	+	-	+	-	-	20.40	20.40	27.2	27.2
8	-	-	+	+	+	-	+	+	-	+	-	18.50	18.50	19.5	19.5
9	-	-	-	+	+	+	-	+	+	-	+	23.50	23.50	23.5	23.5
10	+	-	-	-	+	+	+	-	+	+	-	14.30	14.30	18.5	18.6
11	-	+	-	-	-	+	+	+	-	+	+	13.50	13.50	21.5	21.3
12	-	-	-	-	-	-	-	-	-	-	-	12.20	12.20	20.2	20.2

*PGUase activity

Nitrogen sources (NS): A, Urea; B, Yeast extract; C, Tryptone; D, Casein hydrolysate; E, Corn steep liquor; F, Peptone; G, Ammonium sulphate; H, Sodium nitrate; I, Ammonium chloride; J, Ammonium nitrate; & K, Potassium nitrate

Mineral Nutrients (MNs): A, NaCl; B, $MgSO_4$; C, KH_2PO_4; D, $CaCl_2$; E, $CuSO_4$; F, $FeCl_3$; G, $MnSO_4$; H, $ZnSO_4$; I, $CoCl_2$; J, $ZnCl_2$; & K, K_2HPO_4

Table 4—Estimated effects and coefficients of nitrogen sources for PGUase production by *A. awamori* MTCC 9166 using Plackett- Burman design

Variable	Term	Effect	Regression coefficient	Standard error coefficient	t	p	Significance
	Constant	11.11	22.22	1.29	17.10	0.000	
A	Urea	3.83	7.66	0.41	18.65	0.000	Significant
B	Yeast Extract	1.07	2.14	0.41	5.21	0.000	Significant
C	Tryptone	-0.07	-0.14	0.41	0.34	0.735	*
D	Casein hydrolysate	3.62	7.24	0.41	17.64	0.000	Significant
E	Corn steep liquor	0.385	0.77	0.41	1.88	0.087	*
F	Peptone	-0.76	-1.52	0.41	3.70	0.003	*
G	Ammonium sulphate	0.695	1.39	0.41	3.40	0.006	*
H	Sodium nitrate	-0.805	-1.61	0.41	3.92	0.002	*
I	Ammonium chloride	-1.81	-3.62	0.41	8.81	0.000	*
J	Ammonium nitrate	-1.68	-3.36	0.41	8.18	0.000	*
K	Potassium nitrate	1.89	3.78	0.41	9.21	0.000	Significant

*Insignificant

Table 5—Estimated effects and coefficients of mineral nutrients for PGUase production by *A. awamori* MTCC 9166 using Plackett- Burman design

Variable	Term	Effect	Regression coefficient	Standard error coefficient	t	p	Significance
	Constant	14.555	29.11	1.06	27.32	0.000	
A	NaCl	3.790	7.58	0.33	22.50	0.000	Significant
B	$MgSO_4$	-0.030	-0.06	0.33	0.19	0.847	*
C	KH_2PO_4	0.830	1.66	0.33	4.94	0.000	Significant
D	$CaCl_2$	3.240	6.48	0.33	19.24	0.000	Significant
E	$CuSO_4$	-1.965	-3.93	0.33	11.60	0.000	*
F	$FeCl_3$	0.100	0.20	0.33	0.59	0.565	*
G	$MnSO_4$	-0.885	-1.77	0.33	5.26	0.000	*
H	$ZnSO_4$	-1.685	-3.37	0.33	10.01	0.000	*
I	$CoCl_2$	-1.465	-2.93	0.33	8.70	0.000	*
J	$ZnCl_2$	0.465	0.93	0.33	2.77	0.018	*
K	K_2HPO_4	2.325	4.65	0.33	13.82	0.000	Significant

*Insignificant

coefficients were positive with P values ≤ 0.001. However $CuSO_4$, $MnSO_4$, $ZnSO_4$ and $CoCl_2$ had negative coefficients and found to be insignificant for PGUase production.

Nutritional parameters play vital role in enzyme production. The important nutrient substrates are mostly carbon and energy sources, a nitrogen source and mineral nutrients. With interest to screen the efficient nutrients for PGUase production, the effect of carbon sources, nitrogen sources and mineral nutrients were studied. Media optimization studies are generally done using unidimensional approach, which is both laborious and time consuming, especially for large number of variables. Statistical methods give scope for study of different nutrients at different levels by performing minimum experiments, which saves both time and materials. In the present study, the Plackett-Burman design[15] was selected for screening nutrients as n-1 variables in n experiments. The statistical approach also gives scope for interactive and collective effect of nutrients on production of a product. There are reports of use of Plackett-Burman design in production of pectin lyases[6] and protopectinase[18].

Selection of pectin rich raw substrates for enzyme production is important as they not only serve as carbon and energy sources but also induce the inducible enzymes like PGUase. Earlier, studies in *A. awamori* on effect of glucose and pectin on PGUase production reported that addition of 0.4% pectin gave maximum enzyme production[6]. Similarly Nair *et al*[19] also reported that *A. foetidus* NCIM 510 responded to the medium containing pectin without any additional sugars for pectinase production. Production cost of industrial enzymes is much influenced by the growth and production medium. Costs for pectic substrates, the chief carbon source, can be reduced by using fruit and vegetable waste as pectin sources for PGUase production. Earlier reports indicated the use of various agro-industrial wastes[20, 21, 22], such as, sugar cane bagasse, lemon peel and apple pomace, as substrates for PGUase production. Therefore, the present study concentrated on this aspect and pectin rich substrates like orange peel, jack fruit peel, apple pomace, pine apple peel, mango peel, banana peel and tomato pulp showed good response for PGUase production.

Nitrogen sources have a profound effect on the production of PGUase in culture medium. Nitrogen sources are very much required for enzyme biosynthesis as they supply amino acids and various cellular proteins. In the present study, urea, yeast extract, casein hydrolysate and potassium nitrate were found to be more significant variables for PGUase production (Table 4). Similar findings were reported for production of PGUase from *Mucor circinelloides* ITCC 6025[23]. Further, maximum PGUase activity was obtained when NH_4Cl was used as nitrogen source[24] and it was reported that nitrogen limitation had adverse effect on the PGUase production[25].

Mineral nutrients when tested for PGUase production by *A. awamori* MTCC 9166 revealed that among the 11 variables screened, NaCl, KH_2PO_4, $CaCl_2$ and K_2HPO_4 were more significant in affecting PGUase production (Table 5). This response could be due to the fact that NaCl and $CaCl_2$ showed good ion balancing nutrients, while phosphate sources like KH_2PO_4 and K_2HPO_4 provide the much necessary phosphates.

Thus, the present study was useful in providing a number cheaper and locally available carbon (pectin), nitrogen sources and mineral nutrients for PGUase production. Good response from cheaper pectin sources like fruit peels is significant as low cost production media can be designed. The statistical design allowed to efficiently screen n-1 variables in just n number of experiments saving both time and chemicals, which is also a very important aspect in designing production medium.

References

1 Ismail A-M S, Utilization of orange peels for the production of multienzyme complexes by some fungal strains, *Process Biochem*, 31(1996) 645-650.

2 Whitaker J R, Pectic substances, pectic enzymes and haze formation in fruit juices, *Enzyme Microb Technol*, 6 (1984) 341-349.

3 Whitaker J R, Microbial pectinolytic enzymes, in *Microbial enzymes and biotechnology* 2nd edn, edited by W M Fogarty & C T Kelly (Elsevier Science Ltd., London) 1990.

4 Alkorta I, Garbisu C, Llama M J & Serra J L, Industrial applications of pectic enzymes: A review, *Process Biochem*, 33 (1998) 21-28.

5 Jayani R S, Saxena S & Gupta R, Microbial pectinolytic enzymes: A review, *Procces Biochem*, 40 (2005) 2931-2944.

6 Sathyanarayana N G, & Panda T, Purification and biochemical properties of microbial pectinases—A review, *Process Biochem*, 38 (2003) 987-96.

7 Pedrolli D B, Gomes E, Monti R & Carmona E C, Studies on productivity and charecterisation of polygalacturonase from *Aspergillus giganteus* submerged culture using citrus pectin and orange waste, *Appl Biochem Biotechnol*, 144 (2008) 191-200.

8 Naidu G S N & Panda T, Production of pectolytic enzymes—A review, *Bioprocess Eng*, 19 (1998) 355-361.

9 Panda T & Naidu G S N, Rotating simplex method of optimization of physical parameters for higher production of extracellular pectinases in bioreactor, *Bioprocess Eng*, 23 (2000) 47-49.

10 Anuradha K, Naga Padma P, Venkateshwar S & Gopal Reddy, Fungal isolates from natural pectic substrates for polygalaturonase and multienzyme production, *Indian J Microbiol*, 50 (2010) 339-344.

11 Favela-Torres E, Volke-Sepulveda T & Vaniegra-Gonzalez G, Production of hydrolytic depolymerising pectinases, *Food Technol Biotechnol*, 44 (2006) 221-227.

12 Galiotou-Panayotou M, Rodris P & Kapantai M, Enhanced polygalacturonase production by *Aspergillus niger* NRRL-364 grown on supplemented citrus pectin, *Lett Appl Microbiol*, 17 (1993) 145-148.

13 Kawano C Y, Chellegatti M A, Said S & Fonseca M J, Comparitive study of intracellular and extracellular pectinases produced by *Penicillium frequentans*, *Biotechnol Appl Biochem*, 29 (1999) 133-140.

14 Blandino A, Dravillas K, Cantero D, Pandiella S S & Webb C, Utilisation of whole wheat flour for the production of extra cellular pectinases by some fungal strains, *Process Biochem*, 37 (2001) 497-503.

15 Plackett R L & Burman J P, The design of optimun multifactorial experiments, Biometrika, 33 (1946) 305.

16 Collmer A, Reid J L, & Mount M S, Assay procedures for pectic enzymes, *Methods Enzymol*, 161 (1988) 329-335.

17 Nelson N, A photometric adaptation of the Somogyi method for the determination of glucose, *J Biol Chem*, 153 (1944) 375-380.

18 Cavalitto S F & Mignone C F, Application of factorial and Doehlert designs for optimization of protopectinase production by a *Geotrichum klebahnii* strain, *Process Biochem*, 42 (2007) 175-179.

19 Nair S R, Rakshit S K & Panda T, Effect of carbon sources on the synthesis of pectinase by Aspergilli, *Bioprocess Eng*, 13 (1995) 37-40.

20 Solis-Pereira S, Favela-Torres E, Viniegra-Gonzalez G & Gutiérrez-Rojas M, Effects of different carbon sources on the synthesis of pectinase by *Aspergillus niger* in submerged and solid state fermentations, *Appl Microbiol Biotechnology*, 39 (1993) 36-41.

21 Solis-Pereira S, Favela-Torres E, Gutiérrez-Rojas M, Roussos S, Saucedo-Castaneda G *et al*, Production of pectinases by *Aspergillus niger* in solid state fermentation at high initial glucose concentrations, *World J Microbiol Biotechnol*, 12 (1996) 257-260.

22 Abbasi H, Shafighzadeh H & Rahimi, A continuous production of polygalacturonases (PGUases) by *Aspergillus awamori* using wheat flour in surface culture fermentation, *Iran J Biotechnol*, 9 (2011) 50-55.

23 Thakur A, Pahwa R, Singh S & Gupta R, Production purification, and characterization of polygalacturonase from *Mucor circinelloides* ITCC 6025, *Enzyme Res*, (2010) 170549. [doi:10.4061/2010/170549]

24 Kashyap D R, Soni K S & Tewari R, Enhanced production of pectinase by *Bacillus* sp. DT7 using solid-state fermentation, *Bioresour Technol*, 88 (2003) 251-254.

25 Pattat N H C, Condemine G, Nasser W & Reverchon S, Regulation of pectinolysis in *Erwinia chrysanthemi*, *Annu Rev Microbiol*, 50 (1996) 213-257.

Software Reuse – Changes in Process and Organizations

Dr. B V Ramana Murthy
Department of CSE,
Jyotishmathi College of Technology and Science,
Shamirpet, Hyderabad, India

Mr. Vuppu Padmakar
Department of CSE
Guru Nanak Institutions Technical Campus
Ibrahimpatnam, Hyderabad, India

Ms. A Vasavi
Department of CSE
Jyotishmathi College of Technology and Science,
Shamirper, Hyderabad, India

Abstract: The transition form no reuse to informal code reuse in which chunks of code are copied adapted slightly, and then incorporated the new systems occurs when developers are familiar with each other's code and trust each other, later on the trend has changed and the programming paradigms' has changed there is evolution of object orientations, which formally " Never rewrite the code but reuse the code" reusability can be achieves by inheritance at the programming level but the context here is at the product level, which can be achieved by using component technologies which is order of the day, component is a readily available software module which can be used directly or can be tailor made according to the specification. For better reusability the company must have vision towards the market to find out which companies they create, the organizational strength must emphasize on domain engineering and application engineering. The company has to maintain reuse manager for the management of these components in a better way. Using component technologies the company can able to save development cost, time and can deliver product with quality.

Keywords: Software Reuse, Domain Engineering, Software Application Engineering, Software Cost.

I. INTRODUCTION

The basic concept of systematic software reuse is simple. Develop systems of components of a reasonable size and reuse them. Then extend the idea of "Component Systems" beyond code alone to requirements, analysis models, design, and test. All the stages of the software development process are subject to "reuse".

Developers can save problem-solving effort all along the development chain.[5] They can minimize redundant work. They can enhance the reliability of their work because each reused component system has already been reviewed and inspected in the course of its original developments. Code components have passed unit and system test elsewhere and often have stood the test of use in the field. By these means developers can reduce development time from years to months or to weeks instead of months.

II. REUSE INVOLVE CONCURRENT PROCESSES

The reuse community has come to understand on the basis of its experience that making systematic reuse effective requires major changes in the way organizations develop software. In the past the software process has focused on developing each application from scratch. At most, individual developers have shared code on an ad hoc basis.

The new way links many application development projects with processes that identify and create reusable assets. To do so, they must overhaul their business and organizational structures. We have come to understand that

this significant organizational change can be thought of in terms of business process reengineering. It is rethinking of everything pertaining to software from there stand point of those who ultimately benefit from good software obtained quickly reliably and inexpensively.

Substantial reuse requires, first of all, that reusable assets be identified in terms of a system architecture. Then the assets must be created and appropriately packaged and stocked. Potential users must have confidence in the components integrity, secondly an organization must refashion its systems engineering process so that developer can identify opportunities for reuse and work selected components into the process.

Systematic software reuse is thus the purposeful creation, management, support, and reuse of assets. As illustrated in figure below this can be expressed in terms of four concurrent processes. We call the people in the reusable asset processes, creators, and those in the development projects, reusers.
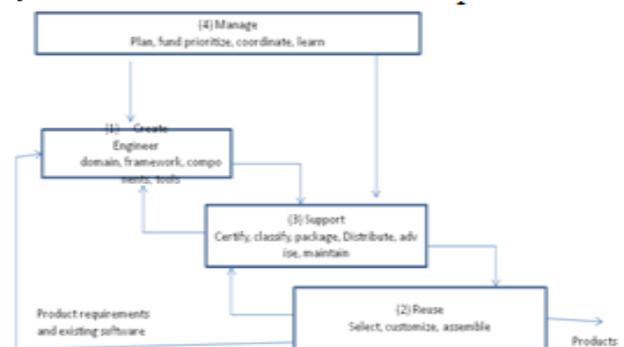

Figure: 1

a. **Create:** This process identifies and provides reusable assets appropriate to the needs of the reusers. These assets may be new, reengineered, or purchased of various kinds such as code, interfaces, architectures, tests, tools and so on. This process may include activities such as inventory and analysis of existing applications and assets, domain analysis, architecture, definition, assessment of reusers needs technology evolution reusable asset testing and packaging.[1]

b. **Reuse** This process uses the reusable assets to produce applications or products. Activities include the examination of domain models and reusable assets, the collection and analysis of end-user needs the design and implementation of additional components adaptation of provided assets, and the construction and testing of complete applications.

c. **Support:** This process supports the overall set of processes and manages and maintains the reusable asset collection. Activities may include the certification of submitted reusable assets. Classification and indexing in some library, announcing and distributing the asset, providing additional documentation, collecting feedback and defect reports from reusers.

d. **Manage:** This process plans, initiates, resources, tracks and coordinates the other processes. Activities include setting priorities and schedules for new asset construction, analyzing the impact and resolving conflict concerning alternative routes when a needed asset is not available, establishing training and setting direction.

A. *Domain engineering:*

In most reuse programs to date, a key activity associated with the create process is a fairly systematic way of identifying potentially reusable assets, and an architecture to enable their reuse.[2] This activity is called domain engineering in the systematic reuse community. The development of reuse process is also sometimes called application system engineering. The essence of systematic software reuse is that initial investment by the creator to identify and carefully structure reusable assets will enable reusers to build application rapidly and cost effectively.

Domain engineering reflects the idea that sharing between related applications occurs in one or more application domain or problem domain or solution domains. Reuse of the assets then occurs during a subsequent application system engineering phase.

Sometimes domain engineering has been loosely described as just lke ordinary systems engineering such as structure analysis structured design or object oriented analysis object oriented design except that it applies to a family of systems rather than just one.[4] It is like systems engineering but it is also more that one of kind systems engineering. It seeks the family of similar systems that can inhabit a domain. As a result domain engineering is more complex that established systems engineering. Therefore management should not turn to it without forethought and should establish domain engineering only when it foresees a business benefit in reuse.

B. *Application System Engineering:*

This activity has long existed in the form of building applications from scratch, possibly with the aid of a few

back pocket programs. The goal now is to make use of the extensive set of reusable assets that have been provided. The intent is to build the application much more rapidly and cost effectively.[3]

Application system engineering specializes and assembles these components into application. These applications are largely constrained to fit the architecture and the components. Typical applications usually consist of components from several different sets of components.

Starting from the models of the architecture and reusable components, the reusers puts together available reusable assets to meet at least the bulk of the new set of requirements. This is sometimes called a delta implementation because it is an outgrowth of what already exists.

The reusers have to find and specialize components by exploiting a variability mechanisms provided. If it is not possible to meet all the new requirements with the available reusable components additional programming will be needed. This programming may be done by the creator, producing new reusable components or by the reusers.

Finally the components are integrated and the application tested.

Table: 1

Domain engineering	Application system Engineering
Define and scope domain	Do delta analysis and design relative to domain model and architecture
Analysis examples needs trends	Use component systems as starting point
Develop domain model and architecture	Find specialize and integrate components
Structure commonality and variability	Exploit variability mechanism language generators.
Engineer reusable component systems languages and tools	

III.   REUSE REQUIRES CHANGED IN ORGANIZATION

The traditional software organization was a senior manager over a number of project managers. The senior manager allocated resources, such as people coming off projects that were completing, to projects that were building up. Each project manager ran his or her own project. There was no organized source of reusable components. An organization geared for reuse is different.[4]

A systematic reuse process is different because it involves two primary functions, which usually find expression as two organizations. One is the creator or domain engineering organization. The second is the reuser, or application engineering organization.[8] Companies with experience in systematic use generally find that a third function evolves that of support it in turn finds expression in organizational form as shown fig.
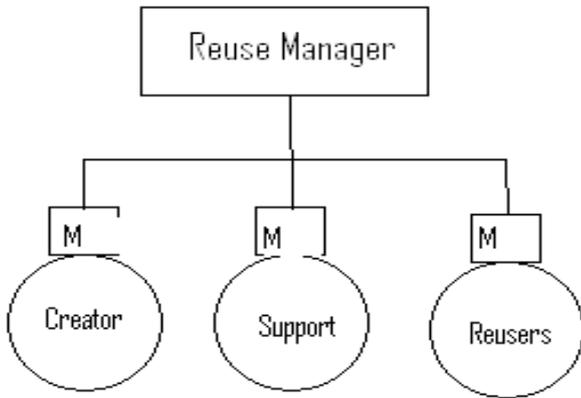
Figure: 2

Experience shows some problems with other organizational structures. For example if creators are put into the project organizations under project managers focused on getting something out the door, that objective often results in delaying, or even forgetting the creator objectives.[7] This pressures explains why setting goals on how much software is to be contributed to a library and establishing financial rewards for reuse have not worked.

However, if creator and reusers functions are totally separated, as happens when a reuse repository is set up in a geographically separate area, the creators tend to be working in a vacuum. That is the reusable components do not meet the practical needs of the reusers or they may appear too late to meet schedule needs.

The creators must be close enough to the reusers to keep reusable components practical. At the same time they must be insulated from daily project pressures if they are to get reusable components designed and built. The result is the three-function organization diagrammed in figure above.

Even with this organization structure, the pressures are still present. The creator and reusers functions have distinct goals. Creators need to build high quality assets that will serve the needs of many reusers over years of product cycles. Reusers have the usual business goals more faster, cheaper for example a project manager facing tight deadlines and a high challenging problem might kill to get a high qualified creator on his or her team. That would interfere with the more long-range goals of the creator organization. There is no right answer to issues such as this one. That is why the diagram shows a senior manager over all three functions. He or she has to adjudicate the interests of creators and reusers. Some organizations have labeled this post the "reuse manager". That title has the advantage of focusing attention on the overall goal.

IV. INCREMENTAL ADOPTION OF REUSE

A company faces two conflicting pressures. On the one hand, it must keep the existing operations going. They are the activities that bring in the funds which keep the company going. Line managers are keenly aware of this need. On the other hand it must keep updating it practices because as it often seems, competition never sleeps. Unfortunately Line managers find it difficult to inaugurate new practice while keeping the old practices in motion.[10] Obviously a successful company has to do both. The adoption path common to several reuse strategies is to start with focused pilot projects. As these pilots meet a degree of success, expand them incrementally, increasing reuse coverage and penetration into the organization. Observation of the introduction of business process reengineering and indeed change management in general further reinforces this stepwise approach.
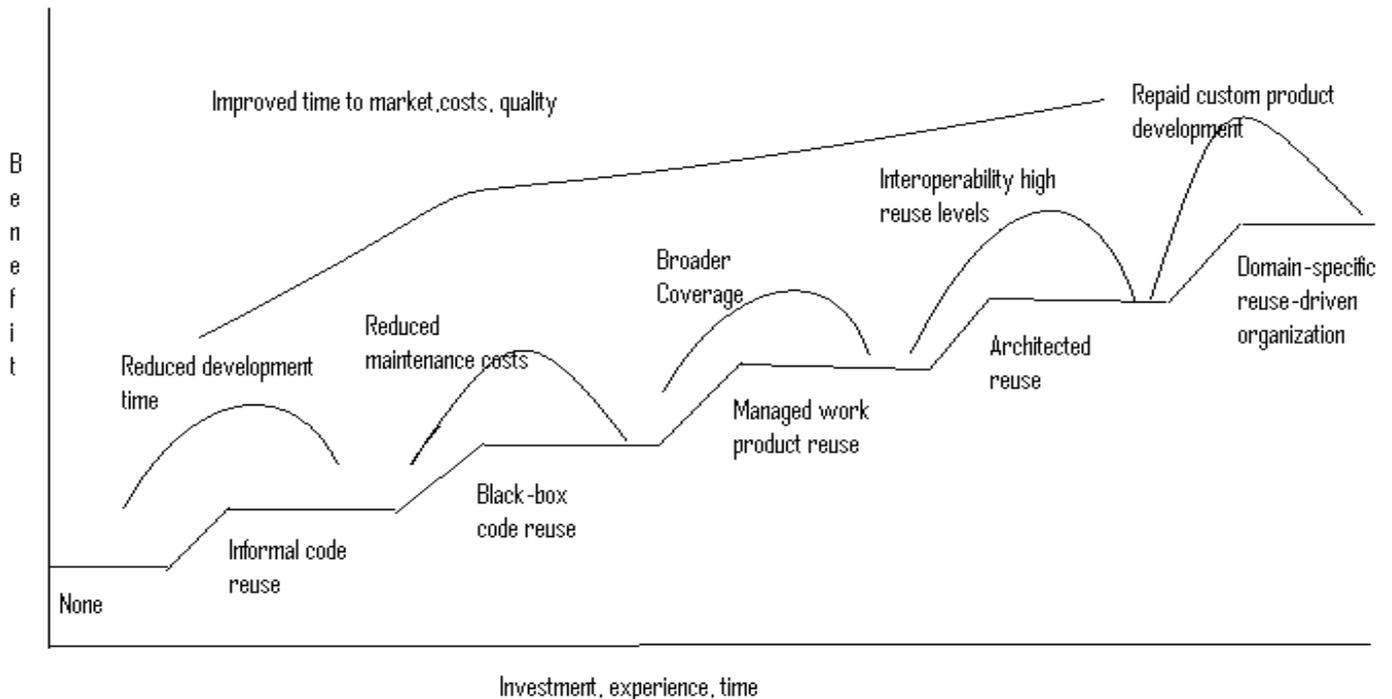

Figure: 3

The above figure illustrates some of the steps that a typical organization may progress through. This figure is based on synthesis of experience at several organizations.

What we observe is that the benefits due to reuse, such as improved time to market (TTM), or higher-quality systems, or lower overall development costs, increase as the levels of reuse and the sophistication of the reuse program

increase.[9] Furthermore it takes time investment and experience with reuse in each organization to get to those levels of reuse. So what seems to happen is that the organization moves from stage to stage as it consolidates it gain and feels the pressure for more improvement.

For example, the transition from no reuse to informal code reuse in which chunks of code are copied adapted slightly, and then incorporated into the new system occurs when developers.

a.   Are familiar with each other's code and trust each other

b.   Feel the need to reduce time to market, even though they would prefer to rewrite the software.

   a)   ***This strategy works*** – for a while. Development time is reduced, and testing is often less tedious than with totally new code. But as more products are developed using this approach, maintenance problems increase. Multiple copies of the software, each slightly different have to be managed. Defects found in one copy have to be found and fixed multiple times. This often leads to a black box code reuse strategy, in which a carefully chosen instance of code is reengineered, tested and documented for reuse.

   b)   ***Measure progress:*** Management will use a variety of measurements to gauge the progress of reuse programs. Fundamentally, they appear to fall into three categories. [6]

The first category measures levels of reuse within an application area for example each completed system employs 75% of reused components.

A second measures the properties of reusable components for the purpose of assessing their intrinsic reusability. These include measures of size, complexity, cohesion, and coupling to other components.

The third category measures process efficiency and savings in development time and cost.

An survey has taken out, the following are the metrics taken out by discussion from IT Professionals.

Table: 2

SNo	Item	With Reuse	Without Reuse
1	Time to delivery	Reduced by 40%	At delivery time
2	Cost	Reduced by 60%	Total product cost
3	Quality	Increments due to components usage 100%	Depends on the development up to 80%
4	Maintains	Easy & 100%	Has to work due to authentication engineering.

Scaling of reuse effect on product development. The following is the data compiled after having hands on experience on reuse factor of the software product development.

Scaling from 1- 5

Table: 3

Scale	Intensity	Remarks
1	Trivial	Not much impact on product.
2	Small	Less impact up to 10%
3	Medium	Impact on application developer
4	High	Good impact on application developer with respect domain engineering
5	Very High	Recommended to go for reuse

We have taken parameter of the product development and the results as follows.

Table: 4

S.No	Item	Scale
1	Time	4
2	Cost	5
3	Quality	4

Time, cost and quality are the basic principles of software engineering and the above table represents the success of reuse. The graphical representation of the above table
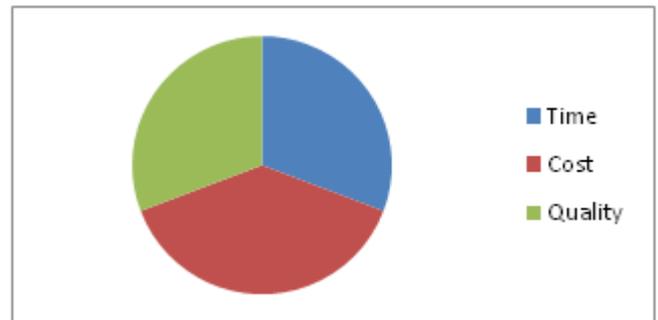

Figure: 4

A graph has been considered to show the effectiveness of reuse in the companies.

Table: 5

Reuse	%
With components	60%
Without components	0

Scaling from 1 – 10

Table: 6

SNo	Item	With Component Technology	Without Component Technology
1	Time to delivery	40%	More 10
2	Cost	60%	Max 10
3	Quality	100%	60%
4	Maintains	easy	40% product development cost.

V.   CONCLUSION

a.   A component has to be used three to five times in application projects to recover the initial cost of creating it and the ongoing cost of supporting it.

b.   It costs 1.5 to 3.0 times as much to create and support a reusable component as it does to implement a similar component for a single application.

c.   It costs only one quarter as much to utilize a reusable component as it does to develop a new one from scratch.

d.   It takes two or three product cycles, usually about three years, before the benefits of reuse become significant. It takes time for the accumulating benefits to pay off the start-up cost.

VI.   ACKNOWLEDGEMENTS

VII.   REFERENCE

[1].   Powell,T.A., Website Engineering Prentice Hall,1999.

[2].   Pressman, R. S.,"Can Internet Based Applications be Engineered?" IEEE Software, September 1998, pp. 104-110.

[3].   The Agile Alliiance Home Page, hhtp//www.agilealliance.org/home

[4].   Ambler ,S, "what is Agile Modelling http://www.agilemodeling.com/index.htm.

[5].   Cockburn A.,Agile Software Development: Addison Weley

[6].   Cockburn and J HighSmith ., What is Agile Software Development The People Factor "IEEE computing Vol 34 pp 131-133

[7].   DeMarco ,.T,and T Listener .Peopleware second edition

[8].   DeMarco ,.T and Boehm,"The Agile Methods fray "IEEE Computer Vol 35 pp 90-92.

[9].   HighSmith, J. Agile Software Ecosystem Addision–Wesley.

[10].   Highsmith J., "The Methodology Debate" Part -1 Vol 14.

Short Bio Data for the Authors

Dr. B. V.Ramana Murthy has done his PhD from Osmania University, presently he working as Professor in Computer Science and Engineering, has 18 years of experience in Teaching and R&D. His primary area of interest is Software Engineering & Web Engineering.

Mr. V Padmakar is pursuing PhD in CSE and has done his M Tech (CSE) from JNTUH, presently working as Professor in Computer Science and Engineering has 17 years of experience in Teaching and Industry. His primary area of interests is Software Engineering, Network Security and Data mining

Mrs. A.Vasavi has done her M.Tech (CSE) from JNTUH, presently She is working as Associate Professor in Computer Science and Engineering department, has 10 years of experience in Teaching. Her area of interest is Network Security and Formal Languages.

Energy Reduction under Different Cache Configurations by using Way Tag Architecture

Harika[1], D.VaraPrasada Rao[2]

M. Tech Scholar, VLSI and Embedded Systems, Turbo Machinery Institute of Technology and Sciences, INDIA
Associate Professor & HOD Dept of ECE, Turbo Machinery Institute of Technology and Sciences, INDIA

ABSTRACT

To perform operations the processor has to fetch the instructions from the memory in this process the time taken to fetch the instructions from the larger memory block (main memory) is more i.e., it does not reach the processor speed of execution, to decrease the gap between the processor speed of execution and data fetching of the processor we go for the cache memory. The cache memory performance is the most significant factor in achieving high processor performance because cache memory is the very small in size than the main memory it will helpful in fetching the data very fastly which increase the performance of the processor if the data is not present in the cache memory then it fetch the data from the main memory and stored in the cache memory.

The cache memory work on the principle of locality. Cache works by storing a small subset of the external memory contents, typically out of its original order. Data and instructions that are being used frequently, such as a data array or a small instruction loop, are stored in the cache and can be read quickly without having to access the main memory. Cache runs at the same speed as the rest of the processor, which is typically much faster than the external RAM operates at. This means that if data is in the cache, accessing it is faster than accessing memory.

In this paper we are going to increase the performance of the processor by a new policy called write-through and a new cache architecture referred to as way-tagged. In this way-tagged process we are having L1 cache and L2 cache and the address at which the data have to be stored is divided into three parts tag, index and offset address and the data which is going to be stored in the L1 & L2 caches are stored with reference with the tag address and the copy of the tag address is stored in the way-tag array. Way-tag array is an array where the way-tag address of the data is stored.

When the processor required the data to perform the required operations first it check the L1 cache and if the data is present in the L1 cache it fetches the data otherwise it check the L2 cache for the data and similarly if the data is not present in L2 cache the processor checks the data in the main memory .while processor fetching the data from the main memory it stores the data in the L2 & L1 cache respectively and stores the way-tag address in the respectively L1 and L2 way-tag arrays.

By this process of way-tag we are going to increase the performance of the processor than the previous cache process. Simulation results on the ModelSim and synthesis results on Xilinx demonstrate that the proposed technique achieves total power saving of 56.42% and dynamic power saving of 41.31% in L2 caches on average with small area overhead and no performance degradation.

Furthermore, the idea of way tagging can be applied to existing low-power cache design techniques to further improve energy efficiency.

Index Terms— Cache, dynamic power, write-through policy.

I. INTRODUCTION

A general-purpose processor is a finite-state automaton that executes instructions held in a memory. The state of the system is defined by the values held in the memory locations together with the values held in certain registers within the processor itself (see Fig. 1). Each instruction defines a particular way the total state should change and it also defines which instruction should be executed next.
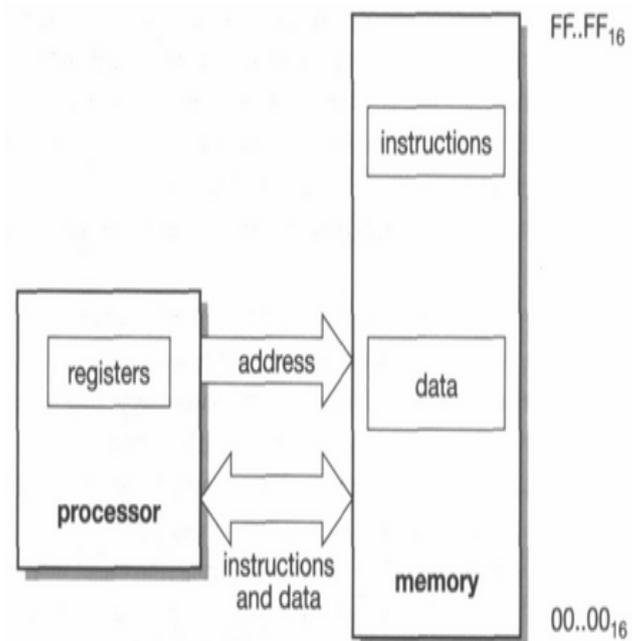

Fig.1: The state in a stored-program digital computer

If we want to make a processor go fast, we must first understand what it spends its time doing. It is a common misconception that computers spend their time computing, that is, carrying out arithmetic operations on user data. In practice they spend very little time 'computing' in this sense. Although

they do a fair amount of arithmetic, most of this is with addresses in order to locate the relevant data items and program routines. Then, having found the user's data, most of the work is in moving it around rather than processing it in any transformational sense.

At the instruction set level, it is possible to measure the frequency of use of the various different instructions. It is very important to obtain dynamic measurements, that is, to measure the frequency of instructions that are executed, rather than the static frequency, which is just a count of the various instruction types in the binary image.

A typical set of statistics is shown in Table. These statistics were gathered running a print preview program on an instruction emulator, but are broadly typical of what may be expected from other programs and instruction sets.

Instruction type	Dynamic usage
Data movement	43%
Control flow	23%
Arithmetic operations	15%
Comparisons	13%
Logical operations	5%
Other	1%

Table 1: Typical dynamic instruction usage

These sample statistics suggest that the most important instructions to optimize are those concerned with data movement, either between the processor registers and memory or from register to register. These account for almost half of all instructions executed. Second most frequent are the control flow instructions such as branches and procedure calls, which account for another quarter. Arithmetic operations are down at 15%, as are comparisons.

Now we have a feel for what processors spend their time doing, we can look at ways of making them go faster. The most important of these is pipelining. Another important technique is the use of a cache memory, which will be covered in Section 10.3 on page 272. A third technique, super-scalar instruction execution, is very complex, has not been used on processors.

In this paper we are concerned mainly about the Data movement by keeping the data very near to the processor by using the L1 & L2 Cache and by employing Write-through and Write-back polices. Under the write-back policy, a modified cache block is copied back to its corresponding lower level cache only when the block is about to be replaced. While under the write-through policy, all copies of a cache block are updated immediately after the cache block is modified at the current cache, even though the block might not be evicted. As a result, the write-through policy maintains identical data copies at all levels of the cache hierarchy throughout most of their life time of execution.

It has been reported that single-event multi bit upsets are getting worse in on-chip memories. Currently, this problem has been addressed at different levels of the design abstraction. At the architecture level, an effective solution is to keep data consistent among different levels of the memory hierarchy to prevent the system from collapse due to soft errors. Benfited from immediate update, cache write-through policy is inherently tolerant to soft errors because the data at all related levels of the cache hierarchy are always kept consistent. Due to this feature, many high-performance microprocessor designs have adopted the write-through policy.

II. TYPE RELATED WORK

To improve the performance of the processor we use Way-tagged cache this will help in storing the data in the L1 and L2 caches in a order that the data with same address tag are stored in the same location and the data with different address tag are stored in the different locations.
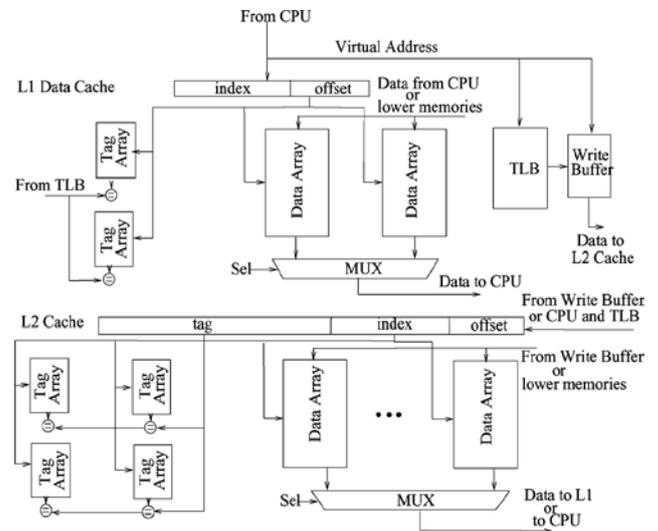

Fig. 2: Block diagram of way-tag cache

We consider a conventional set-associative cache system when the L1 data cache loads/writes data from/into the L2cache, all ways in the L2 cache are activated simultaneously for performance consideration at the cost of energy overhead.

By this process when the processor required the data for the execution of the instructions it directly check the any one of the way-tag array instead of checking all the memory location(all the way-tag array).This is shown in the Fig .2.

Consider the different data with different address

Data	Address
12342	00110011
12343	11001111
12344	01001100
12345	10100010
12346	00101010
12347	11001100
12348	10001111
12349	01010101

In this the data with address starting with 00 are stored in the same way-tag array in 00 location i.e., the data 12342 and 12346 are stored in same location. Similarly the data with address starting with 01,10,11 are stored in the same way-tag array in 01,10,11 location respectively.

Write-Back:

In this write-back police data is stored in memory when it is about to replace.

In this write-back policy there is a chance of data missing because it does not store the data instantly in the memory location when the data is modified. To over come this draw back we use write-through policy.

Write-Through:

In this write-through policy when ever the data is modified by the processor it stores the modified data in the memory location.

Different Operations perform in L1,L2 and Main Memory				
	Read_hit		Write_hit	
	Yes	No	Yes (If same data is not present)	No
L1 Cache	Yes	No	Need to update	Need to copy
L2 Cache	No need to check	Need to check (set-associative)	Need to update (direct mapping)	Need to copy (set-associative)
		yes | No		
Main Memory	No need to check	No need to check | Need to check	Need to update	Need to copy

Fig. 3:Different Operations perform in L1,L2 and Main Memory

Under the write- through policy, the L2 cache always maintains the most recent copy of the data. Thus, whenever a data is updated in the L1 cache, the L2 cache is updated with the same data as well. This results in an increase in the write accesses to the L2 cache and consequently more energy consumption.

For read process initially the processor check the L1 cache memory for the data, if the required data is present read_hit signal is set to Yes other wise No. If read_hit signal in L1 is Yes then no-need to check the L2 and Main memory. If it is No it has to check L2 cache in that if the required data is found in L2 cache then the read_hit signal is set to Yes other wise No. If the data found in the L2 Cache no need to go for Main memory otherwise it has to checks the main memory.

For write process the processor initially checks the address location in the L1 cache if the address location is found the it compare the data. If the same data is present then no need write other wise it has to update. Same update operation is carried out in L2 and main Memory. If the required address is not found in the L1 cache then it has to copy the data in the L1, L2 and Main Memory.

III. WAY-TAGGED CACHE

Fig. 4 shows the system diagram of proposed way-tagged cache. We introduce several new components: way-tag arrays, way-tag buffer, way decoder, and way register, all shown in the dotted line. The way tags of each cache line in the L2 cache are maintained in the way-tag arrays, located with the L1 data cache. Note that write buffers are commonly employed in write-through caches (and even in many write-back caches) to improve the performance. With a write buffer, the data to be written into the L1 cache is also sent to the write buffer.
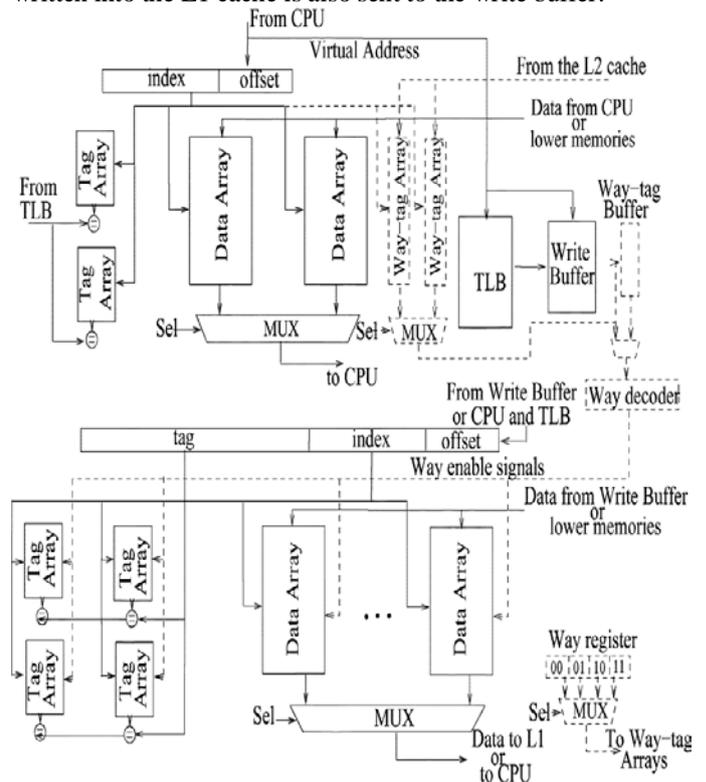

Fig. 4: Proposed way-tagged cache

The operations stored in the write buffer are then sent to the L2 cache in sequence. This avoids write stalls when the

processor waits for write operations to be completed in the L2 cache. In the pro- posed technique, we also need to send the way tags stored in the way-tag arrays to the L2 cache along with the operations in the write buffer. Thus, a small way-tag buffer is introduced to buffer the way tags read from the way-tag arrays. A way decoder is employed to decode way tags and generate the enable signals for the L2 cache, which activate only the desired way sin the L2 cache. Each way in the L2 cache is encoded into a waytag. A way register stores way tags and provides this information to the way-tag arrays.

IV. IMPLEMENTATION OF WAY-TAG CACHE

Way-Tag Array: Way-tag array stores the tag information of the data in different location depending on the starting address location. And when ever the data is needed by the processor, the processor check address in the way-tag and if the tag address is found then the data is fetched from the corresponding address location. If not then there is no need in check the memory location.
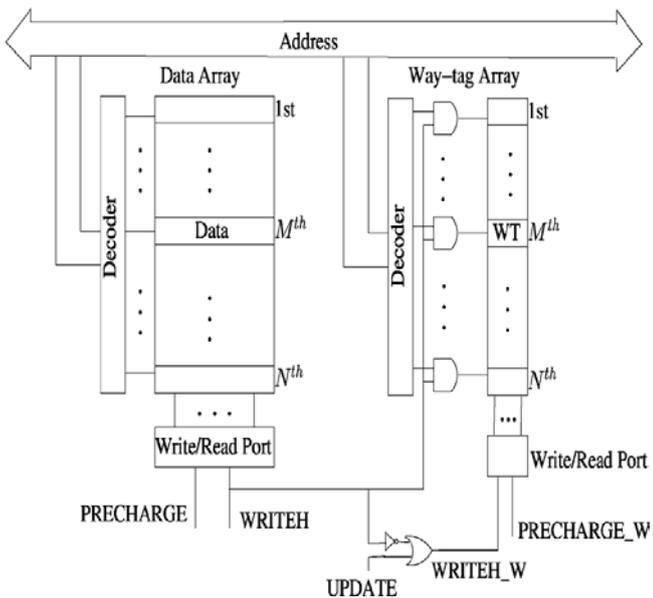
Fig. 5: Way-Tag Array

WRITEH	UPDATE	OPERATION
1	1	write way-tag arrays
1	0	read way-tag arrays
0	0	no access
0	1	no access

Table 2: Operations of Way-Tag array

Way-Tag buffer: Way-Tag buffer is used to mirroring the information from one place to another place. Way-tag buffer temporarily stores the way tags read from the way-tag arrays. Implementation is shown in below fig. 6.
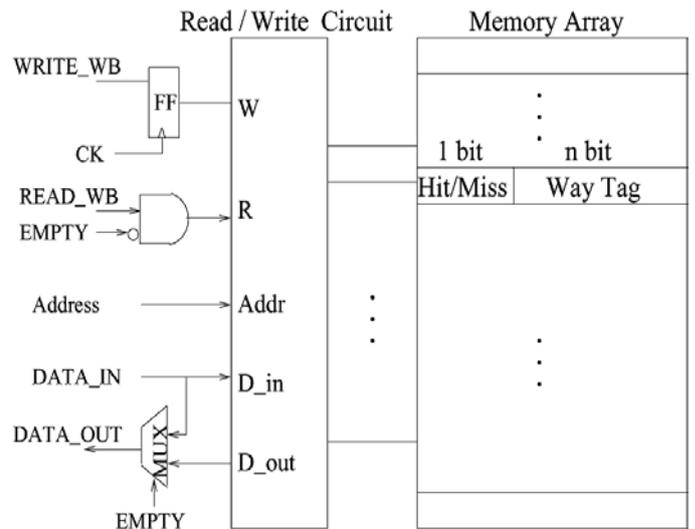
Fig. 6: Way-tag buffer.

Way-Decoder: Way decoders are used to select the way. And activate only the desired ways in the L2 cache. Below fig. 7 shows the block diagram of the Way-Decoder.
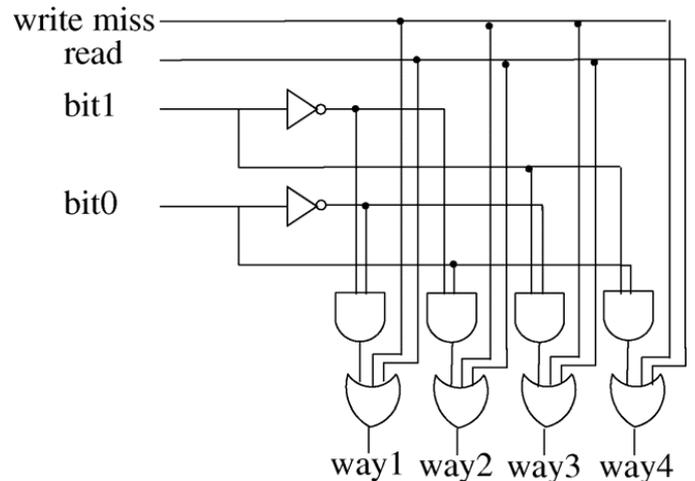
Fig. 7: Block diagram of Way-Decoder

Way Register: The way register are used to provide way tags for the way-tag arrays. When the data is carried from main memory to L2 cache and also form L2 to L1 cache i.e., when the data is carried the way-tag address is carried by way-register.

V. FURTHER EXTENSION

We can extend this 2-way tag L2 cache architecture to 4-way tag L2 architecture for more high performance. The below fig.8 shows the architecture of the 4-way tag L2Cache.
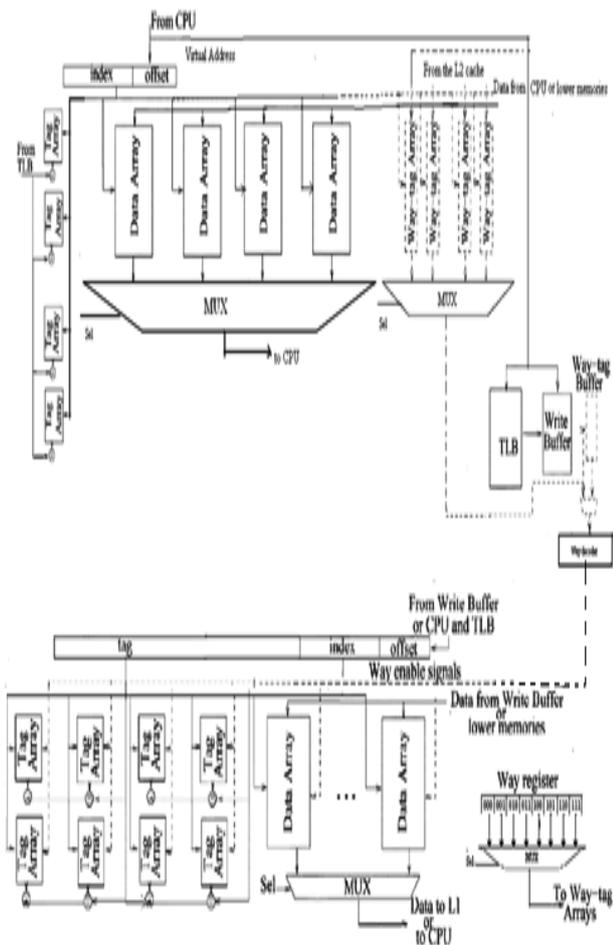
Fig. 8: The Architecture of the 4-way tag L2 Cache

Fig.9: Simulation Result of Top Module with Way-Tag
(capture 1)

VI. EVALUATION AND DISCUSSION

Simulation results of top module:

The below fig. 9 shows the simulation results of top module with Way-Tag of this project in that at the starting of the simulation we set CLK (clock) signal and initially we set RST(reset) signal as logic1 at that instant all the other signal values are at logic0.

In the next state we set the RST(reset) signal as logic0 then the operation of the cache controller take place in that process the processor will do two operation read and write.
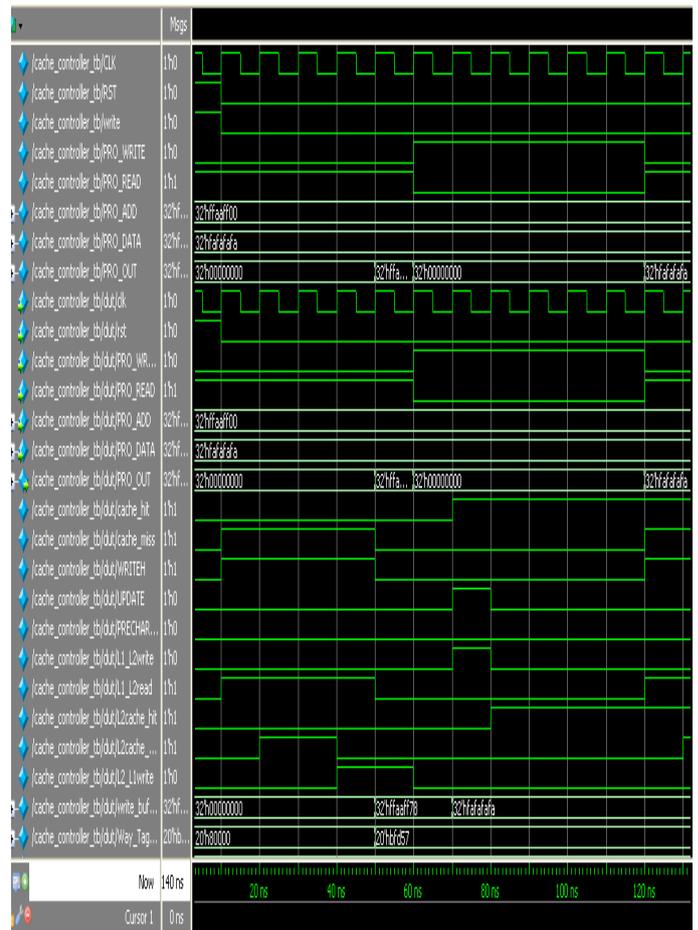
Depending on the instructions of the programmer at the starting read operation is take place in that process the processor checks for the required data in the nearest and the smallest memory location (L1cache) if the data present in the L1cache (i.e., L1way_tag array is having the required way-tag address and data) then the cache-hit signal is set to logic1 otherwise cache-miss signal is set to logic1. If cache-hit is logic1 then the processor fetch the data from the L1cache memory and carry out its operations. If the cache-miss signal is logic1 then the processor check for the data in the L2 cache memory in the similar way if the data found in the l2cache(i.e., L2way_tag array is having the required way _tag address and data) then the L2cache_hit signal is set to logic1 otherwise the L2cache_mis signal is set to logic1. If L2cache_hit signal is logic1 then the processor fetch the data from the L2cache memory and carry out its operations.
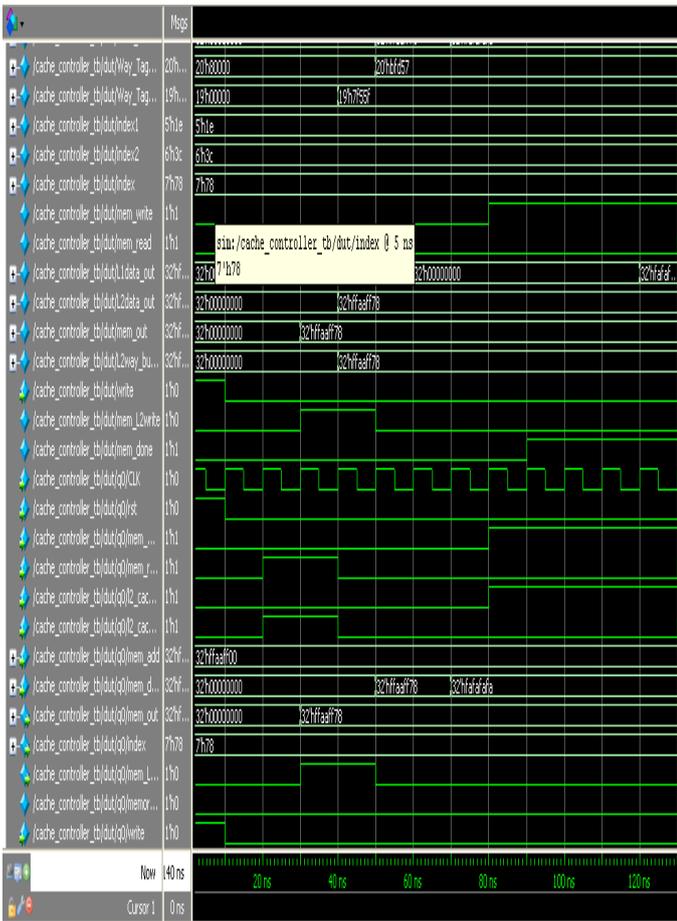
Fig. 10: Simulation Result of Top Module with Way-Tag
(capture 2)

If the L2cache_mis signal is logic1 then the processor check for the data in the main memory in the similar way if the data found in the main memory then the processor fetch the data from the main memory and in the processor the data is stored in the L1cache memory and L2cache memory and the way-tag address is stored in the way-tag array as shown in fig.10.

The below fig. 11 shows the simulation results of the top module without Way-Tag in this we don't have any tag-array signal if the processor required the data from the memory location it has to check the entire L1cache memory if the required data found it is fetched by the processor otherwise it has to check the L2cache memory if the data is found in the L2cache memory it is fetched by the processor otherwise it checks the main memory and fetch the data from the main memory and in the same process the copies of the data is stored in the L1 and L2 cache memories.
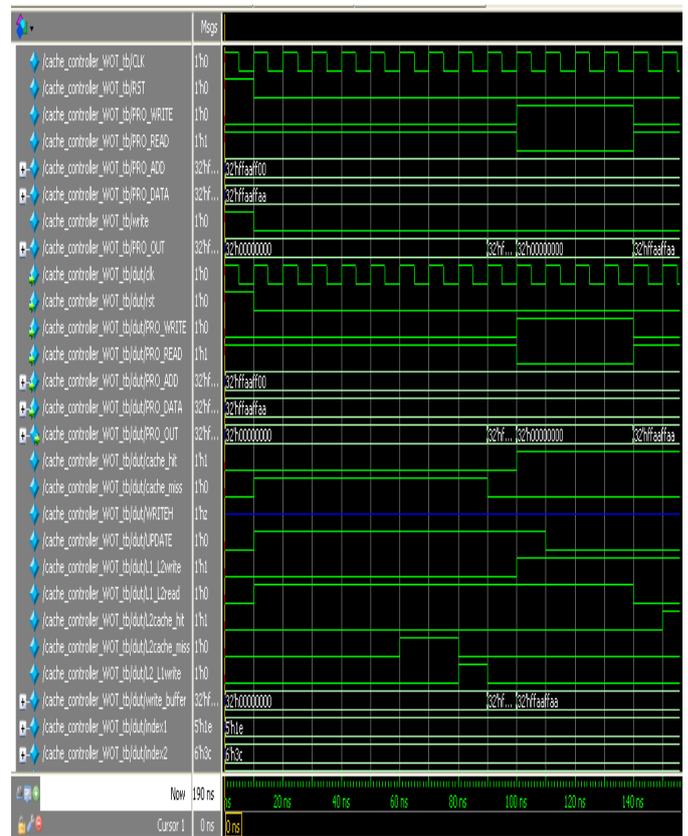
Fig. 11: Simulation Result of Top Module without Way-Tag

Synthesis Report:

Synthesis report without way-tag array

```
-----------------------------------------------------------
|             Power Supply Summary               |
-----------------------------------------------------------
|                    | Total| Dynamic | Quiescent|
-----------------------------------------------------------
| Supply Power (mW)| 1597.00| 355.56 | 1241.45 |
-----------------------------------------------------------
```

Synthesis report with way-tag array

```
-----------------------------------------------------------
|             Power Supply Summary               |
-----------------------------------------------------------
|                    | Total  | Dynamic | Quiescent |
-----------------------------------------------------------
| Supply Power (mW) | 901.15 | 146.89 | 1164.67 |
-----------------------------------------------------------
```

VII. CONCLUSION

This paper presents a new energy-efficient cache technique for high-performance microprocessors employing the write-through policy. The proposed technique attaches a tag

to each way in the L2 cache. This way tag is sent to the way-tag arrays in the L1 cache when the data is loaded from the L2 cache to the L1 cache. Utilizing the way tags stored in the way-tag arrays, the L2 cache can be accessed as a direct-mapping cache during the subsequent write hits, thereby reducing cache energy consumption. Simulation results demonstrate significantly reduction in cache energy consumption with minimal area overhead and no performance degradation. Furthermore, the idea of way tagging can be applied to many existing low-power cache techniques such as the phased access cache to further reduce cache energy consumption.

REFERENCES

[1] G. H.Asadi,V. Sridharan, M. B. Tahoori, Andd.Kaeli, "Balancing Performance And Reliability In The Memory Hierarchy," In Proc. Int. Symp.Perform. Anal. Syst. Softw., 2005, Pp. 269–279.

[2] C. Su And A. Despain, "Cache Design Tradeoffs For Power And Performance Optimization: A Case Study," In Proc. Int. Symp. Low Power Electron. Design, 1997, Pp. 63–68.

[3] C. Zhang, F. Vahid, And W. Najjar, "A Highly-Configurable Cache Architecture For Embedded Systems," In Proc. Int. Symp. Comput. Arch., 2003, Pp. 136–146.

[4] B. Brock And M. Exerman, "Cache Latencies Of The Powerpc Mpc7451," Freescale Semiconductor, Austin, Tx, 2006. [Online]. Available: Cache.Freescale.Com

[5] A.Ma, M. Zhang, And K.Asanovi, "Way Memoization To Reduce Fetch Energy In Instruction Caches," In Proc. Isca Workshop Complexity Effective Design, 2001, Pp. 1–9.

[6] T. Ishihara And F. Fallah, "A Way Memoization Technique For Reducing Power Consumption Of Caches In Application Specific Integrated Processors," In Proc. Design Autom. Test Euro. Conf., 2005, Pp. 358–363.

[7] R. Min, W. Jone, And Y. Hu, "Location Cache: A Low-Power L2 Cache System," In Proc. Int. Symp. Low Power Electron. Design, 2004, Pp. 120–125.

[8] B. Calder, D. Grunwald, And J Emer, "Predictive Sequential Associative Cache," In Proc. 2nd Ieee Symp. High-Perform. Comput. Arch., 1996, Pp. 244–254.

[9] T. N. Vijaykumar, "Reactive-Associative Caches," In Proc. Int. Conf. Parallel Arch. Compiler Tech., 2011, P. 4961.

[10] J. Dai And L. Wang, "Way-Tagged Cache: An Energy Efficient L2 Cache Architecture Under Write Through Policy," In Proc. Int. Symp. Low Power Electron. Design, 2009, Pp. 159 164.

[11] R.Min,W. Jone, And Y. Hu, "Phased Tag Cache: An Efficient Low Power Cache System," In Proc. Int. Symp. Circuits Syst., 2004, Pp. 23–26.

[12] About Cache Available at:
http://www.tfinley.net/notes/cps104/cache.html#direct
(Accessed: 20 Aprial 2014)

[13] About Cache Basics by Gene Cooperman Available at:
http://www.ccs.neu.edu/course/com3200/parent/NOTES/cache-basics.html
 (Accessed: 17 Aprial 2014)

[14] About Set Associative Cache Available at:
http://www.cs.umd.edu/class/sum2003/cmsc311/Notes/Memory/set.html
(Accessed: 03 May 2014)

[15] A brief tutorial on Xilinx. Available at:
https://www.digilentinc.com/Data/Documents/Tutorials/Xilinx%20ISE%20WebPACK%20VHDL%20Tutorial.pdf
(Accessed: 19 May 2014)

[16] About Predictions for Low-Power Cache Design Available at:
http://web.cse.ohio-state.edu/hpcs/WWW/HTML/publications/papers/TR-02-7.pdf (Accessed: 27 May 2014)

[17] About Literature Survey and Analysis of Low-Power Techniques for Memory and Microprocessors Available at:
http://users.ece.utexas.edu/~bevans/courses/ee382c/lectures/00_welcome/project2.html
(Accessed: 1 June 2014)

Significance of IPV6 in real time approach

Dr. B V Ramana Murthy[1], Prof. Vuppu Padmakar[2], Ms. A. Vasavi[3]

Department of CSE, Jyotishmathi College of Technology and Science, JCTS, Shamirpet, Hyderabad, India[1,3]

Department of CSE Guru Nanak Institutions Technical Campus, Hyderabad, India[2]

Abstract: Communication is a key learning skills. Students using Video conferencing gain opportunities for higher level of thinking via, live face to face interactions with peers, tutors or experts from around the world. It can allow face to face teaching and learning at colleges, universities, home or other locations. It reduces the disadvantage of distance for learning and offers great flexibility for arranging a common time. It allows additional educational services for rural and remote students. Video conferencing allows meetings without the time, cost and organization involved with travel. The interactive voice and image provides a great way establishing or maintaining relationships. For transmitting video/audio requires more bandwidth. Keeping in mind the bandwidth constraint in wireless networks, we are designing the model for many-many interactive video conferencing.
The following are the objectives of the proposed research.

➢ To provide collaboration top nation development between teachers or students through Video conferencing.
➢ To provide experience of collaborative working by interacting with university experts for knowledge sharing.
➢ To develop an environment for sharing of educational resources.
➢ To learn about remote environments, mentoring of individual students.
➢ To enhance distance learning. To design an environment for sharing experiences with students from different cultures.
➢ To enhance travel buddy projects. To enhance professional development of staff.

Key Words: IPV6, Nation Development, Distance Education, Virtual Learning.

I.   INTRODUCTION

Video conferencing enabled learning is a new way of acquiring knowledge, which is highly adaptable to different kinds of student profiles, from people that do not have time to attend normal courses to a practical enhancement of ordinary courses with additional access to the knowledge. Exchange of knowledge and consultation process among students and available expert authority (professor/instructor) , are very important aspects of learning, in addition to the static contents that are provided in books and different digital multimedia.

The goal of the usage of technology as a support to learning process is to make information instantly available to users. In order a learning process to be effective, a communication and exchange of the knowledge is required. Video conferencing based learning can provide the needed interaction. So it is a logical step to create learning tools that utilize the benefits of the video conferencing technology. Distance Education System are commonly used to increase effectiveness of educational process by offering solutions that address some of the shortcomings of the traditional classroom.

When the role of a technology within learning is assessed, there are two separate criteria to consider, those of effectiveness and efficiency. Effectiveness refers to the opportunity that technology offers to improve what is obtainable with traditional methods. Video conferencing is particularly aimed at supporting dialogue as a form of interaction. Efficiency refers to the opportunity that technology offers to improve the access to educational materials. Video conferencing service, used in combination with other educational services significantly eases this access by lowering the cost of original production of educational material and increasing the possibility to update educational materials more frequently.

Interactive videoconferences are often transmitted on dedicated T-1 phone lines. These high speed lines are very effective for videoconferencing, but they are typically leased circuits with an expensive monthly cost. The fixed monthly charge is usually based on distance, not usage. Therefore, the cost effectiveness of Interactive videoconference systems increases with use. Interactive videoconferencing systems can operate at different data rates, at various fractions of T-1 capacity, enabling the transmission of multiple simultaneous videoconferences over the same T-1 circuit. An Interactive videoconference system can also share a T-1 circuit with other digital data uses such as Internet transmissions or file transfers.

IPv6 protocol plays an important role in the next generation of Internet (NGI). It is expected that the elegant coexistence of IPv4 and IPv6 is the key point of IPv6 transition. To solve the transition problem, we propose a mesh unicast framework and a multicast framework in this paper. We describe two reference models for the mesh unicast framework, and put forward two potential solutions for the multicast framework. A Linux-based prototype is implemented for IPv4 over IPv6 scenario and a test bed is deployed with 8 nodes on CERNET2. The deployment demon-strates the advantages of the framework.

IPv6 with its 128-bit addressing system combines security and authentication, quality of service (reserving

bandwidth), plug-and-play for network device configuration, a hierarchically structured routing system, and is thereby ideal for use in IP enabled videoconferencing. Using IPv6 protocol, it is possible to achieve enhanced frame and transmission rate and bandwidth usage.

II.   IPV6 ARCHTECTURE

Video conferencing has become popular over the last decade. Video conferencing is when two or more parties communicate in real time in separate locations with both video and audio signals.

Technology Used in Video Conferencing

Video conferencing works by using a few different technologies. Some of these technologies are hardware, others technologies involved in the video conferencing process are software related. Here is a list of technologies that are common to a video conference set up.

Video Input

Video input usually consists of either a video camera or a web cam. Usually there are two video cameras, at least one camera at each location. For larger video conferences there can be many more cameras. Digital projectors are used frequently to show a presentation not only in one location but sending the presentation as well as part of the video conference. Besides a standard video camera, more and more people are using web cams to conduct their video conference.

Video Output

Video output can be in the form of any video output form such as a standard TV set, digital TV set, computer monitor, etc.

Audio Input

Audio input takes the form of microphone. Sometimes each person might be individually miked, some video conferences have one general microphone that is passed around or can consist of a microphone in a central location.

Audio Output

Audio output usually consists of speakers. These speakers can range from professional equipment, headphones or even tiny speakers on a laptop computer.

Data Transfer

Video conferencing can work in a number of ways depending on the technology being used. Video conferencing uses several technologies including Digital technologies, as well as analog technologies. ISND lines, a normal broadband internet connection and radio frequencies which can include Satellite transmission and even Wifi.

Data Compression Software

Software is extremely important to the video conferencing process. In order for digital video conferencing to take place over ISDN lines, broad band internet and Wifi there must be software to compress both the video and audio data. Video and audio data can take up a tremendous amount of space and can take a long time to travel from one location to another, it is important for any data being sent back and forth to be compressed and sent quickly and effectively. Today there are lots of software available to compress video and audio signals and unpack them once at the other location for high quality audio and video signals.

Acoustic Echo Cancellation

Another important software component is acoustic echo cancellation. Echo cancellation makes it possible for parties to talk to one another in real time without any distractions or interference. For instance, if one party is talking to another party and there is no echo cancellation software, they might hear themselves speaking a few seconds out of synch due to audio delays. In a few seconds of talking, each party wouldn't be able to understand the other party because of the distractions. Echo cancellation software processes audio to remove any distractions caused by delays

Advantages of Video Conferencing

Video conferencing is used by many businesses usually to save both time and money. One of the great advantages of video conferencing is that two or more parties can have a virtual face to face meeting to conduct business, which is seen as more beneficial than just a conference call. Other parties such as educators and health professionals use video conferencing when giving lectures, teaching about topics that require visual cues or visual information. Health professionals can give a diagnosis by conducting an examination via a video conference. There are many advantages to this technology and this has a lot to do with its exponential growth in recent years.

III.   RELATED WORKS

MCSV6-IPV6 BASED

There are many issue and challenges have to be addressed in order to get MCS working with IPv6.

First Phase:

The MCS should be able to work on IPv6 islands which are interconnected over IPv4 network (mainly the Internet). As this scenario is the first phase of the IPv4 transition to IPv6 fully, the multicast tunneling software (MLIC) built in to the system will have to adapt v4 to v6 multicast and unicast transmission

Figure1 shows the MCS on IPV6 LAN
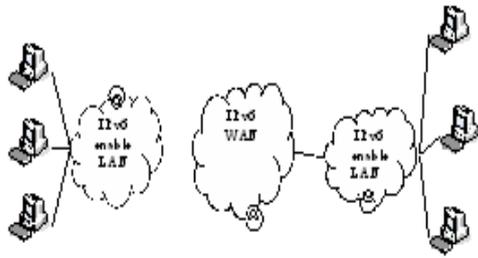
Second Phase

The IPv6 transition will results a mixture of IPv6 and IPv4 islands exist in the Internet itself. In order to allow transparency among the participants, MCSv6 will be able to interconnect all the participating LANs by tunneling the conference data over IPv6 Island and IPv4 islands.
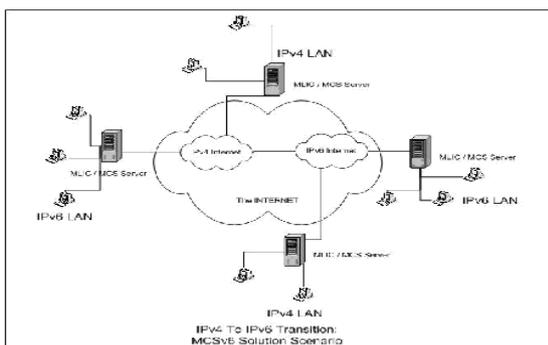
IMPLEMENATATION OF RESEARCH PROPOSAL FOR NATION DEVELOPMENT

The Tools and Supplies Needed for Video conferencing

In order to take advantage of video conferencing you need the right ingredients or tools. There are some basic components that anyone, whether an organization, educational facility or individual needs before they can communicate with others using video conferencing technology.

Of course the most basic piece of equipment necessary is a camera. A camera will allow a user to capture video information at their site and transmit it to someone at another site. Parties using video conferencing will also need a video display to display the video at their site, a microphone to hear the video and speakers to play the audio material.

Video conferencing Equipment

Most video conferencing terminals also require what is called a codec or Compressor/Decompressor interface. This piece of equipment helps compress information being passed from audio to video to make transmission of materials feasible over the Net. Without this piece of equipment most files would be too large to send from one computer to another. The process of compression data using a codec machine is often referred to as decoding and encoding information.

Finally, a computer and reliable internet connection are also necessary to facilitate video conferencing. A high speed connection is recommended to make the video conferencing experience not only endurable but also enjoyable. The actual computer you have is not as important as the size of your display. Remember that when using video conferencing equipment, the larger your display the better your picture and the more easily a time you will have 'conferencing' with other people on the Web.

Recommended Hardware

The following recommendations are based on our experience with active customer installations. If you have a favorite brand or spare camera not on our list, give it a try.

For PC & Laptop Users
Webcams & Cameras

Microsoft® HD Lifecam This is a USB 2.0 webcam that captures video in high definition at 720p.

Headsets with Boom Microphones

Headsets are strongly recommended for PC and laptop users. However, if you require external microphones and speakers, no problem. Please see the echo canceller microphone section below.

Plantronics Audio .610 single-ear USB

Audio Equipment
Standard Echo Canceller Microphones

Phoenix Audio Solo
The Solo is recommended for small conference rooms.

ClearOne Chat 150 Conference Room Microphone

The effective pickup range for this microphone is 10ft or less. Please remember to update your driver/firmware for this product. You can find those updates here.

Revolab Wireless Microphone

Recommended for trainers who need to move around a room or workstations where wiring is difficult.

Omni-Directional Microphones

Revolabs Fusion 4 Channel System (Wireless)
Designed for boardrooms and conference rooms.

Revolabs Fusion 8 Channel System (Wireless)
The Fusion 8 is shown at left, it is recommended for very large, or very long conference rooms. Each microphone provides good coverage for 4 to 6 feet.

Echo Cancellation Mixers

Headsets with earpieces and boom microphones are strongly recommended for desktop users, but in conference rooms, boardrooms and some training facilities, external speakers are required. In these cases, echo canceling audio inputs are required.

The Clear One product line is a mainstay in high-end video conferencing and telepresence installations, with multiple inputs, mixing, and standard audio out. It is suitable for medium and large boardrooms and applications where the highest quality is required. Almost every telepresence installation uses Clear One audio equipment.

For small conference rooms, tabletop units with speakers and built-in echo canceling mics are available from Phoenix Audio, Yamaha and others. The best choice depends on your budget, the size of your conference room and the application. The staff at Nefsis helps customers to configure A/V peripherals for boardrooms and conference rooms.

ClearOne Converge 560/590
The Converge 560 and 590 conferencing systems deliver optimum audio performance and configuration flexibility for medium-sized rooms requiring up to nine

microphones. They feature innovative microphone distribution boxes that deliver significant cost savings and flexibility for users.

3 x ClearOne Mic - Unidirectional Table Top Design

3.5 mm (M) - RCA (M) Y-Adapter

RCA (M) - RCA (F)

PC Video Capture Cards

Hauppauge 1250
This is a multipurpose, single-slot PCI Express x1 adapter for cable TV and ATSC high definition digital signals. In addition to standard and HD video capture, the built-in tuner can be used with cable TV inputs, which may be useful if you have TV in your conference room. In addition to Nefsis compatibility, this card supports Microsoft Media Center. This is a half-height card with a full-height bracket supplied.

Hauppauge 1850
Similar to the 1250 above, but full-height card with more hardware-based accelerators for better system performance. For details, please visit the Hauppauge Computer Works website.

Aja Kona LHi HD (Recommended) - For Sony EVI-HD1 or equivalent HD video input -
The Aja Kona LHi is an excellent general purpose HD-capable capture card. It can manage analog SD composite and s-video inputs, and the latest digital 3Gb SDI and HDMI video streams. In particular the high definition Sony EVI-HD1 conference room camera (see above) was tested with this card. *Compatible with Windows Vista & Windows 7.

PCIe Video Capture Cards
Deck link SD for analog video only (PCI or PCIe)
- Available in PCI or PCIe slot format
- Uses BNC connections
- Must configure the Decklink card to use the NTSC/PAL (Y in)
- Compatible connectors

This adapter requires a BNC cable input. If you are using a video camera or other video device with s-video outputs, you must also purchase an s-video to BNC adapter

(female-to-female). Video inputs using RCA/Composite connectors must purchase an RCA/Composite to BNC adapter (female-to-female).

Recommended software's

- ➢ Codec or compressor/ decompression tools (mpeg)
- ➢ Web based application (free ware like java /php, mysql / postgresql)
- ➢ Linux Operating system (free ware of fedora)
- ➢ Microsoft windows operating systems

Budget proposal to implementation of ipv6 video conference.

S.No	Particulars	Qty	Approximate Cost in Rs.
1.	Video / Web Camera	03	25000.00
2.	Headset with microphone	01	2500.00
3.	Audio standard echo canceller microphone	01	25000.00
4.	Revolab wireless microphone	01	28000.00
5.	PC Video capture cards	01	10000.00
6.	HP xw8400 Workstation	01	320000.00
7.	Server (high configuration)	01	375000.00
8.	Codec tools	01	45000.00
9.	Operating systems	01	25000.00
10.	Network peripherals	01	800000.00
11.	High speed internet connection white bandwidth	01	1200000.00
			2855500.00

CONCLUSION

Communication is a key learning skills. Students using Video conferencing gain opportunities for higher level of thinking via, live face to face interactions with peers, tutors or experts from around the world. It can allow face to face teaching and learning at colleges, universities, home or other locations. It reduces the disadvantage of distance for learning and offers great flexibility for arranging a common time. It allows additional educational services for rural and remote students. Video conferencing allows meetings without the time, cost and organization involved with travel. The interactive voice and image provides a great way establishing or maintaining relationships. For transmitting video/audio requires more bandwidth. Keeping in mind the bandwidth constraint in wireless networks, we are designing the model for many-many interactive video conferencing.

IPV6 enabled Video Conferencing Program

True or near-reality human-size video rendering of participants with immersive environment. High-quality presentation and displays.

Video conferencing enabled learning is a new way of acquiring knowledge, which is highly adaptable to different kinds of student profiles, from people that do not have time to attend normal courses to a practical enhancement of ordinary courses with additional access to the knowledge. Exchange of knowledge and consultation process among students and available expert authority (professor/instructor), are very important aspects of learning, in addition to the static contents that are provided in books and different digital multimedia.

The goal of the usage of technology as a support to learning process is to make information instantly available to users. In order a learning process to be effective, a communication and exchange of the knowledge is required.

FUTURE SCOPE

Aim and Scope of Video conferencing based learning can provide the needed interaction. So it is a logical step to create learning tools that utilize the benefits of the video conferencing technology. Distance Education System are commonly used to increase effectiveness of educational process by offering solutions that address some of the shortcomings of the traditional classroom.

REFERENCES

[1] IPv6 Essentials by Silvia Hagen
[2] Deploying IPv6 Networks by Ciprian Popoviciu
[3] IPv6 Network Administration by David Malone
[4] EEE Trans. On Image Processing, Vol. 6, No. 12, December 1997.
[5] Information Security Journal: A Global Perspective,   Volume 19, Issue 5 2010 , pages 282 - 293 Publication Frequency: 6 issues per year
[6] Journal of Mobile Communication Year: 2008 | Volume: 2 | Issue: 2 | Page No.: 59-63 DOI: 10.3923/ jmcomm.2008.59.63
[7] Deering, S., Hinden, R. (1998). Internet Protocol Version   6 (IPv6) Specification. RFC 2460.IETF.
[8] Huston, G. (2007). IPv4 Address Depletion and Transition to IPv6. The Internet Protocol Journal, Volume 10, Number 3.
[9] Cisco Self-Study: Implementing Cisco IPv6 Netw... by Regis Desmeules
[10] IPv6 Core Protocols Implementation (The Morgan Kaufman... by Qing Li
[11] Global IPv6 Strategies: From Business Analy... by Patrick Grossetete
[12] IPv6 Mandates: Choosing a Transition Strategy, Pr... by Karl A. Siil
[13] IPv6 Advanced Protocols Implementation (The Morgan Kau... by Qing Li
[14] Voice and Video Conferencing Fundamentals by Scott Firestone, Thiya Ramalingam, and Steve Fry (Paperback - Mar. 26, 2007)

BIOGRAPHIES

Dr. B. V.Ramana Murthy has done his PhD from Osmania University, presently he working as Professor in Computer Science and Engineering, has 18 years of experience in Teaching and R&D. His primary area of interest is Software Engineering & Web Engineering.

Mr. V Padmakar is pursuing PhD in CSE and has done his M Tech (CSE) from JNTUH, presently working as Professor in Computer Science and Engineering has 17 years of experience in Teaching and Industry. His primary area of interests is Software Engineering, Network Security and Data mining

Mrs. A.Vasavi has done her M.Tech (CSE) from JNTUH, *presently She is* working as Associate Professor in Computer Science and Engineering department, has 10 years of experience in Teaching. Her area of interest is Network Security and Formal Languages.

Combined Logic 32-Bit Carry Select Adder by using Dominos CMOS Logic

S. Narendra Chowdary[1], D.VaraPrasada Rao[2]

[1]M. Tech Scholar, VLSI and Embedded Systems, Turbo Machinery Institute of Technology and Sciences, INDIA

[2]Associate Professor & HOD Department of ECE, Turbo Machinery Institute of Technology and Sciences, INDIA

ABSTRACT

Highly-increasing requirement for mobile and several electronic devices want the use of VLSI circuits which are highly power efficient. The most primitive arithmetic operation in processors is addition and the adder is the most highly used arithmetic component of the processor. Carry Select Adder (CSA) is one of the fastest adders and the structure of the CSA shows that there is a possibility for increasing its efficiency by reducing the power dissipation and area in the CSA. This research paper presents power and delay analysis of various adders and proposed a 32-bit CSA that is implemented using Dominos CMOS logic style. This work evaluates and analyses the performance of the proposed designs in terms of area, delay, power, and their products in 90nm CMOS process technology. The results analysis is showing that the proposed CSA structure shows better result in terms of area, power and PDP (Power Delay Product) than the others.

Keywords--- power dissipation; adders; PDP; Dominos CMOS.

I. INTRODUCTION

In recent years, the increasing demand for high-speed and low power arithmetic units in floating point co-processors, image processing units and DSP chips has resulted in the development of high-speed adders, as addition is an obligatory and mandatory function in these units. A compact and a high-performance adder play an important role in most of the hardware circuits. Adders are used in microprocessor system based application for arithmetic addition and for computation in large electronics circuit. Less efficient and low power adders would lead to an increase in the total power dissipation in the circuit and delay as well, so processing in these devices is required to be accomplished by making use of low-power; area-efficient circuits processing at a higher speed.

On the basis of requirements such as area, delay and power consumption, different types of adder, such as ripple carry, carry-skip and carry look-ahead are present in the literature [1-7]. Ripple carry adders shows the most compact design but slowest in speed, whereas carry look-ahead adder is the fastest one but it consumes more area. On the other hand, carry select adders act as a compromise between the two adders because it reduces the problem of carry propagation delay. However, the CSA generates partial sum and carry by using multiple pairs

of Ripple Carry Adders (RCA) so it requires large area. CMOS circuits are most commonly used building blocks in digital integrated circuits. One of the major concerns in VLSI design is power consumption. Power consumption has become an important factor due to continuous decline in size of CMOS circuits and increase in chip density and frequency at which circuits are operating.

Logic styles used in a particular logic circuit affect various parameters such as power dissipation, operating speed, size and wiring complexity of those logic circuits [2], [3]. Pass Transistor Logic (PTL) logic styles that have been developed in recent times are more efficient and exhibit better results, in comparison with traditional CMOS logic for some designs of arithmetic unit. In terms of power dissipation, delay and area PTL and CMOS logic have their respective advantages and disadvantages, so at the circuit level, by combining PTL with static CMOS logic that is Hybrid PTL/CMOS logic very low power dissipation, low power delay product and less area can be achieved in the circuit. Amount of power saved in Hybrid PTL/CMOS logic circuit is more than 60 percent as compared to conventional static CMOS logic circuit. [2]

This paper presents a comparative analysis of various adders and proposed design of a new 32 bit carry select adder by sharing common Boolean logic term using Hybrid PTL/CMOS logic style, which shows least power dissipation and PDP than other adders with less transistor count.

This brief is structured as follows. Section II surveys various digital adders. Section III presents Hybrid PTL/CMOS logic style. The proposed CSA using Hybrid PTL/CMOS logic presented in Sections IV. The simulation results are analyzed in Section V. Finally, the work is concluded in Section VI.

II. ADDERS

A. Carry ripple Adder

Carry-ripple adder (CRA) consists of cascaded "N" single-bit full-adders. Output carry of previous full adder becomes the carry input for the next full adder. Carry propagation delay exists between any two full adders in sequence For an

N-bit full-adder as shown in Fig. 1, the critical path is equal to N-bit carry propagation path in the cascaded full-adders. As the value of N increases, the corresponding delay of carry- ripple adder will increase in a linear way. CRA has the slowest speed amongst all adders because of the large carry propagation delay but occupies the least area.
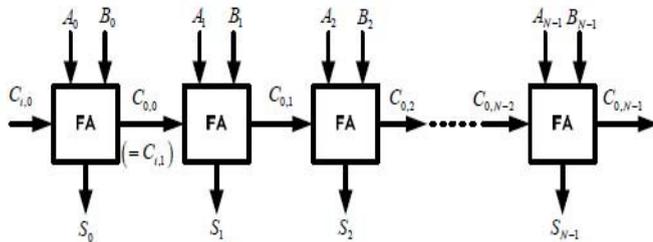

Figure 1. N- bit CRA using N set single bit full adders [1].

B. Conventional Carry Select Adder

The block diagram of conventional carry select (CSA) adder is shown in Fig. 2. CSA uses CRA to generate sum and carry values using initial carry as 0 and 1 respectively, before the actually carry comes in. Upper CRA is fed with carry initial value as logic "0" while lower CRA is fed with carry initial value as logic "1". Multiplexer selects the result of carry "0" path if the previous carry is logic '0' or the result of carry "1" path if the previous carry is logic '1 i.e. actual carry is used to select the sum and carry using a multiplexer.
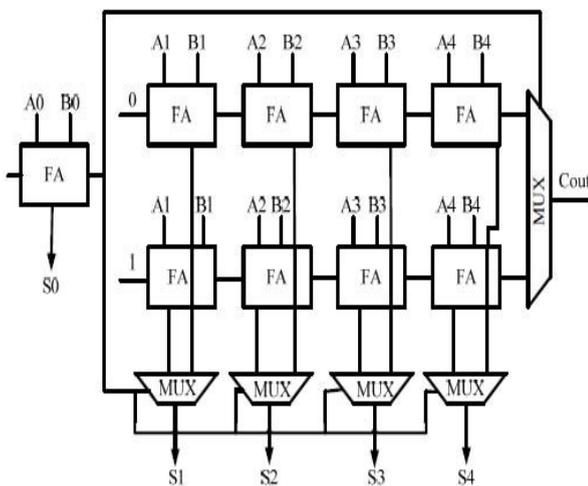
Figure 2. Block diagram of conventional CSA [1], [2], [3].

Each CRA pair in CSA can compute in parallel the value of sum before the previous stage carry comes. This reduces the critical path of an N bit adder. Delay in CSA is much lesser than CRA because the critical path in case of conventional adder is N-bit carry propagation path and one sum generating stage while in case of CSA, the critical path is (N/L)-bit carry propagation path and L stage multiplexer with one sum generating stage in the N- bit CSA,

where L is number of stages in CSA. Since L is much less than N and multiplexer delay is less than the delay in full adder, hence the delay in the CSA is much less than that in the CRA but there exists duplication of hardware in every stage which leads to an increase in the amount of power consumption and cost.

C. Improved Carry Select Adder

The truth table shown in Fig. 3 of a single-bit full-adder indicates that output sum (S0) is Ex-OR of inputs A and B when carry initial is logic "0" while output S0 is Ex-NOR of inputs A and B when carry initial is logic "1" as illustrate as two red circles in truth table. The improved CSA can be implemented by using this technique of sharing the common Boolean logic term in summation generation as shown in Fig. 4.

Cin	A	B	S0	C0
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Figure 3. Truth table for 1-bit full adder [1].

Hence we need to use Ex-OR gate and INV gate to generate the output sum signal pair. Sum output either the Ex-OR or the Ex-NOR could be selected using the multiplexer with select line as previous carry signal. The truth table also reveals that output carry (C0) is AND of A, B inputs when initial carry is logic "0" while C0 is OR of A, B when initial carry is logic "1".Same previous carry as select line to second multiplexer is used to select the carry output of the first stage which would act as select line of the multiplexers in the second stage. As both sum generation and carry generation is carried out in parallel therefore there exist some competitiveness in speed also the power consumption reduces as duplication of the hardware doesn't exist in improved CSA as in case of the conventional.
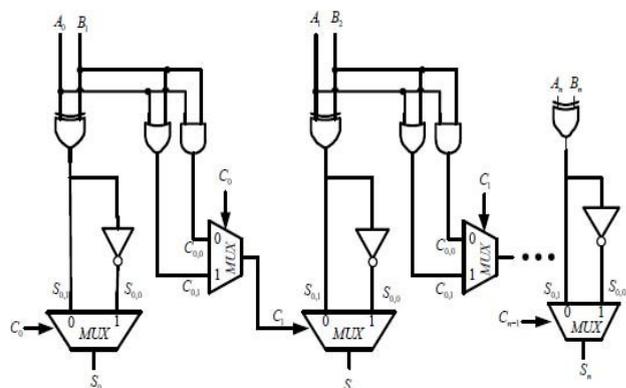

Figure 4. Improved CSA [1].

This paper proposed a 32-bit CSA by using improved CSA implementing with HYBRID PTL/CMOS logic style. PTL logic is used to implement the EX-OR, EX-NOR gates and multiplexer while AND, OR, NOT gates are designed using CMOS. Since PTL logic style doesn't gives a full swing so to overcome this two CMOS inverters are used because CMOS have a high noise margin so it correctly detects the output of PTL and generates a full swing at its output. An EX-NOR gate is designed using PTL followed by two CMOS inverters whose output again is an EX- NOR logic while for an EX-OR logic output is taken after the first CMOS inverter used in EX-NOR gate.

III. HYBRID Dominos CMOS LOGIC STYLE

PTL is considered to be better than static CMOS because it possesses the capability for carrying out a logic function with less number of transistor counts, less delay and less power dissipation [8], [9], [10], and [11]. In order to obtain full swing output, at output gate, restoring logic is required consequently power dissipation of Dominos CMOS circuits would increase along with slowing down the circuit with these level- restoring logics.

PTL based multiplexer structure and XOR have less power (which includes dynamic power as well as static leakage power), power Delay product and less area. For NAND and NOR intensive circuit [10], PTL doesn't give good results while static CMOS do. Hence PTL is not considered better than CMOS for implementation of all types of logic structures.

IV. PROPOSED CARRY SELECT ADDER

Implementation of proposed carry select adder has been done using Dominos CMOS logic style with the help of BDD. The schematic diagram of proposed CSA is shown in Fig. 5. In the proposed design, improved CSA design is implemented using HYBRID Dominos CMOS logic style, where bitonic circuits are implemented using PTL and monotonic circuits is implemented using CMOS logic style. In proposed CSA design, each unit represents 4 bit full adder. An instance of 4 bit full adder has been replicated 8 times to form 32 bit Proposed CSA. Carry out of each stage is input to the next stage carry input. It encapsulates the advantages of logic style.

V. LAYOUT AND SIMULATION RESULTS

Implementation of 32 bit Carry Select Adder using Dominos CMOS logic has been done on Predictive Model Beta Version 90nm CMOS technology.

Simulation results of Power Dissipation and PDP are shown in Table I. It has been found that the area, power dissipation, power delay product of the proposed 32 bit carry select adder using CMOS logic style is less than that of the improved CSA, conventional CSA, and conventional CRA. Analysis shows that it results in 48 to 52 percent less power dissipation and 40% less PDP when implementation is done using Dominos CMOS logic style in

comparison to improved design at 1.5 volts operating voltage. Fig. 6 depicts power dissipation comparison graph of CRA, Conventional CSA, and Improved CSA over different values of supply voltages (V_{dd}). Here Fig. 7 depicts power delay product comparison graph for all the four adders.
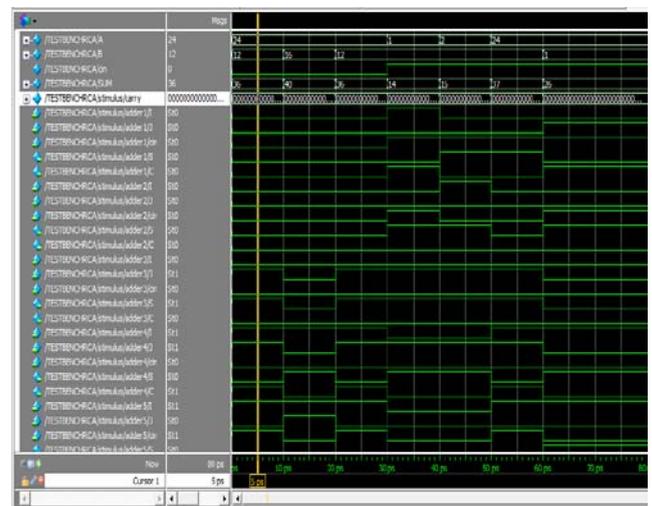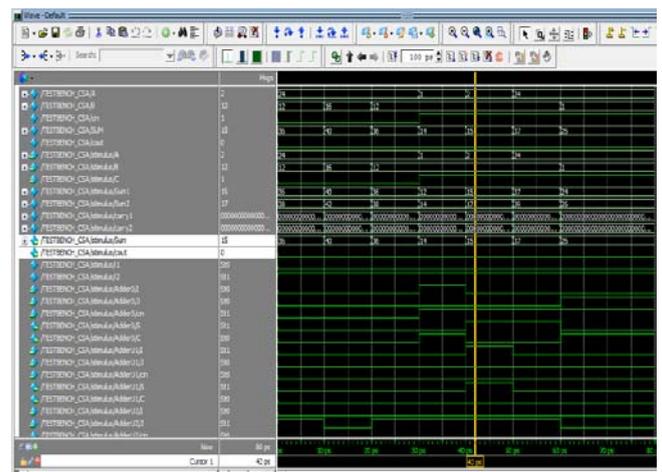

Figure 5:Simulation result for RCA 32 BIT Adder

Figure 6:Simulation result for CSA 32 BIT Adder
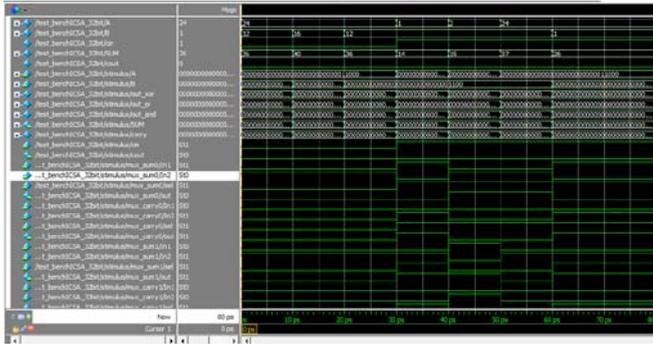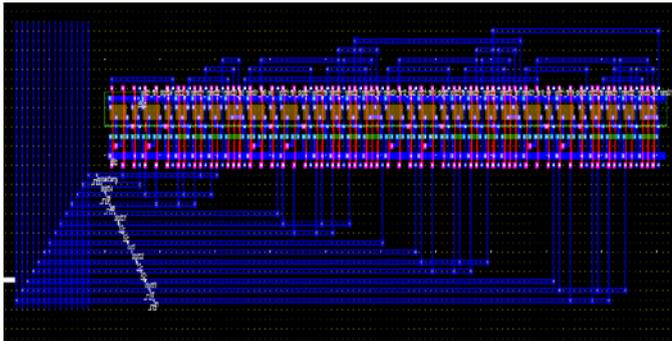
Figure 7:Simulation result for ICSA 32 BIT Adder

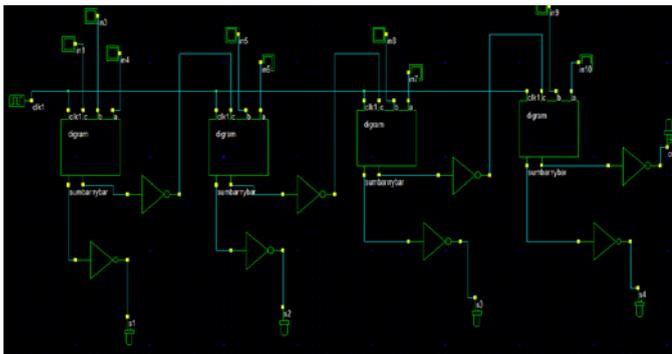Figure 7:Layout Result for ICSA 32 BIT Adder for DOMINOS CMOS

Figure 8:Schematic Result for ICSA 32 BIT Adder using DOMINOS CMOS Logic

	Power Delay Product		Power Dissipation	
VDD	1.5V	2V	1.5V	2V
Conventional Carry Select Adder	2.498E-13	5.991E-13	8.00E-04	2.08E-03
Improved Carry Select Adder	2.279E-13	5.931E-14	5.63E-04	9.95E-04
Proposed Carry Select Adder	8.415E-14	2.578E-13	2.81E-04	8.43E-04

Synthesis Result:

Ripple Carry Adder

RCA : Total 43.092ns (26.314ns logic, 16.778ns route)
(61.1% logic, 38.9% route)
RCA : Number of Slices: 36 out of 8672 0% Utilization
Number of 4 input LUTs: 63 out of 17344 0% Utilization
RCA : Total Dynamic Quiescent
Supply Power (mW) 182.50 23.54 158.97

Carry Select Adder

CSA : Total 37.390ns (25.966ns logic, 11.424ns route)
(61.3% logic, 38.7% route)
CSA : Number of Slices: 66 out of 8672 0% Utilization
Number of 4 input LUTs: 122 out of 17344 0% Utilization
CSA : Total Dynamic Quiescent
Supply Power (mW) 172.50 23.53 148.97

Improved Carry select Adder

ICSA : Total 35.462ns (23.018ns logic, 12.444ns route)
(60.8% logic, 39.2% route)
ICSA: Number of Slices: 37 out of 8672 0%
Number of 4 input LUTs: 64 out of 17344 0%
Power Report:
ICSA : Total Dynamic Quiescent
Supply Power (mW) 162.51 23.54 138.05

VI. CONCLUSION

In VLSI design, power and area are the constituent factors which limit the performance of any circuit. High Performance and power efficient circuits can be designed using Hybrid PTL/CMOS logic style. Hence 32 bit CSA using Hybrid PTL/CMOS logic style has been proposed. It has been found that the transistor count, power dissipation of the improved adder using Hybrid PTL/CMOS logic style is less than that of other conventional designs .The comparisons of adder design are based upon Predictive Model Beta Version 90nm CMOS technology in tanner EDA Tool.

REFERENCES

[1] I-chyn Wey, Cheng Chen Ho, Yi-Sheng Lin ,and Chien- Chang Peng "An Area Efficient Carry Select Adder design by sharing the Boolean Logic term"vol-II,IMECS 2012,March 14- 16 2012,Hong Kong.

[2] O.Bedrij,"Carry Select Adder",IRE trans on Electronic Computers Vol EC-II,pp 340-346.1962.

[3] JM Rabaey,"Digital Integrated Circuits",IEEE trans on VLSI SYSTEMS 2003.

[4] Shen Fu Hsiao,Member,IEEE,Mingyu Tsai, and Chia ShengWen "Circuits and Systems-II";Express Briefs ,Vol 57,No1 January 2010.

[5] B. Ramkumar and Hrish M kittur, "Low-Power and Area Efficient Carry Select Adder" in IEEE Transaction on Very Large Scale Integration (VLSI) Systems, Vol.20, No.2, February 2012.

[6] Padma Devi, Ashima Girdhar, Balwinder Singh, "Improved Carry Select Adder with Reduced Area and Low Power Consumption"in International Journal of Computer Applications, Vol.3, No.4, June 2010.

[7] B. Ramkumar, H.M. Kittur, and P. M. Kannan, "ASIC implementation of modified faster carry

save adder," Eur. J. Sci. Res., vol. 42, no. 1, pp.53–58, 2010.

[8] Geetanjali Sharma, Uma Nirmal, Yogesh Mishra, "Comparative Analysis of High Performance Full Subtractor using Hybrid PTL/CMOS Logic" in proceeding of International Conference on Advances in Information Communication Technology and VLSI Design, Coimbatore, India, August 2010.

[9] Geetanjali Sharma, Uma Nirmal, Yogesh Mishra, "Synthesis of Hybrid PTL/CMOS Logic for Low Area/Power Applications" in proceeding of International Conference on System Dynamics and Control, India, August 2010.

[10] Shen-Fu Hsiao Ming-Yu Tsai, and Chia-Sheng Wen,"Low Area/Power Synthesis using Hybrid Pass Transistor/CMOS Logic Cells in Standard Cell-based Design Environment," IEEE Trans. Circuits and Systems vol. 57, NO.1, Jan 2010.

[11] G. R. Cho and T. Chen, "Synthesis of Single/Dual-Rail Mixed PTL/Static Logic for Low-Power Applications," IEEE Trans. Computer-Aided Design Integration Circuits Syst., vol.23, no. 2, pp. 229–242, Feb. 2004.

Comparative Analysis of Software Development Process Models

1 Dr. B V Ramana Murthy,
Department of CSE,
Jyotishmathi College of Technology,
and Science, Shamirpet, India

2 Prof. Vuppu Padmakar
Department of CSE
Chilkur Balaji Institute of Technology,
Aziz nagar, Hyderabad, India

3 Ms. A. Vasavi,
Dept. of CSE
JCTS, Shamirpet
Hyderabad, India

Abstract: Software engineering is the establishment and application of sound engineering principals for obtaining economically feasible and reliable software that can run efficiently on any real time machine. The main objective of software engineering is to develop and deliver high quality software which basically is an intangible element that has no weight, volume or color. Software processes is an integral part of software engineering which helps in the development of product/software. Different software processes are available and each has it own significance depending on the type of the project. Software process models are the step by step activities to be taken out for the development of product. The main purpose of software processes model is to attain the feature within cost, within time and with good quality. Different process models are available in the industry; right process model is administered depending on the type of project, domain of type, size of project and so on. An attempt has been made to take out the comparative study of software processes model by signifying out the number scale from 0-5, influence increase from 0 to 5 on activity and process models.

Keywords
Software Engineering, Software cost, Universal models. Agile model, feature of software projects.

I.   Introduction

The Software Process Model defines a distinct set of activities, actions, task, milestones and work product that required to develop quality software. Process model describes a road map for software engineering work. The process model provides stability, control and organization to an activity. The process guides a software team through a set of framework activities that are organized into a process flow that may be linear, incremental or evolutionary.[2]
The software process models are listed:

II.   Waterfall Model or Classical Life Cycle Model:

It suggests a systematic, sequential approach to the software development that begins with customer specification of the requirements and progress through planning, modeling, construction and deployment. [1]
Phases of Water Model:
a) Communication:
 It is concern with the project initialization and requirements gathering for the development of the project.
b) Planning:
It emphasis on the estimation of Cost, Schedule and other related thing for the development of the project
c) Modeling:
It is concern with the analysis and design of software development.
d) Construction:
It converts the design into coding with help of programming Language and after the completion of the coding then testing will be performed.
e) Deployment:
It is concern with delivery of the software to the customer and customer will provide feedback to the developer.
   Advantages of Waterfall Model:
  1)   It provides for baseline Management, which identifies a fixed set of documents produced as a result of each phase in the life cycle.
  2)   It is a sequential process for the development of software [3]

Limitations of Waterfall Model:
  1)   Real projects rarely follow the sequential flow. In these changes results in confusion as the project team proceeds [6]
  2)   It is often difficult for the customer to the state all requirements at ones
  3)   A working version of the program will not be available until late in the software development.
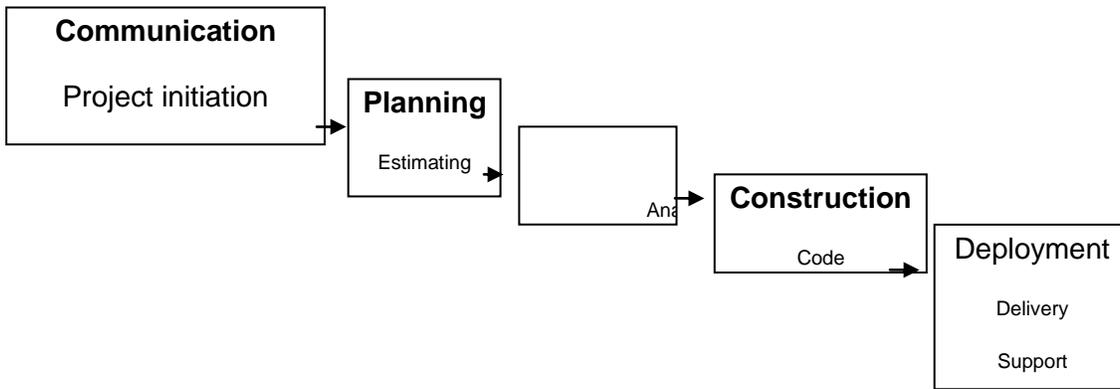
III.   Incremental Process Model:

In these model, the system and the software concepts and requirements are first identifies and then remaining activities of the software development are repeated each time there is a new release of the software.

It consist of two models
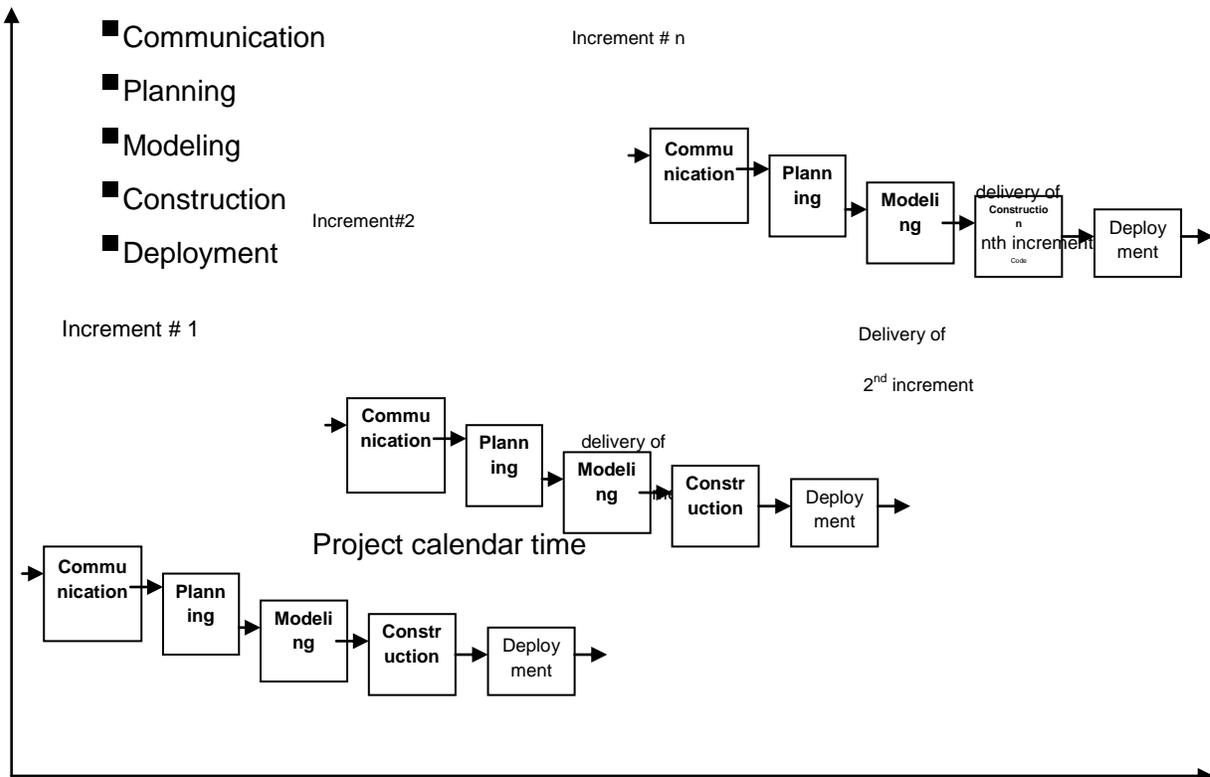1) Incremental Model
2) Rapid Application Development model.
Incremental Model :
The incremental model combines the elements of the waterfall model applied in an iterative fashion .Each linear sequence produces a deliverable increment of the software.

In this model the first increment is often called a core product. The core product is used by the customer as a result of the use or evaluation a plan will be developed for the next increment. This plan addresses the modification to core product to meet the needs of the customer these process is repeated until the complete product is produced

The Incremental Model

IV.   Rapid Application Development model (RAD)

RAD is an incremental software process model that emphasizes a short development cycle. It is a high speed adaptation of the waterfall model. If the requirements are understood and project scope is constrained then RAD team creates a fully functional system in with in a short time period example (60 -90) days.

Advantages of RAD Model:

This model is used to develop software in the fastest manner.

2 These model is used for large software development

Limitations of RAD model:

1 It is used for large projects and not for small projects.

2 If developer and customer is not committed for the rapid fire activities then RAD model is not used

3 RAD may not be appropriate when technical risk is high

The RAD Model
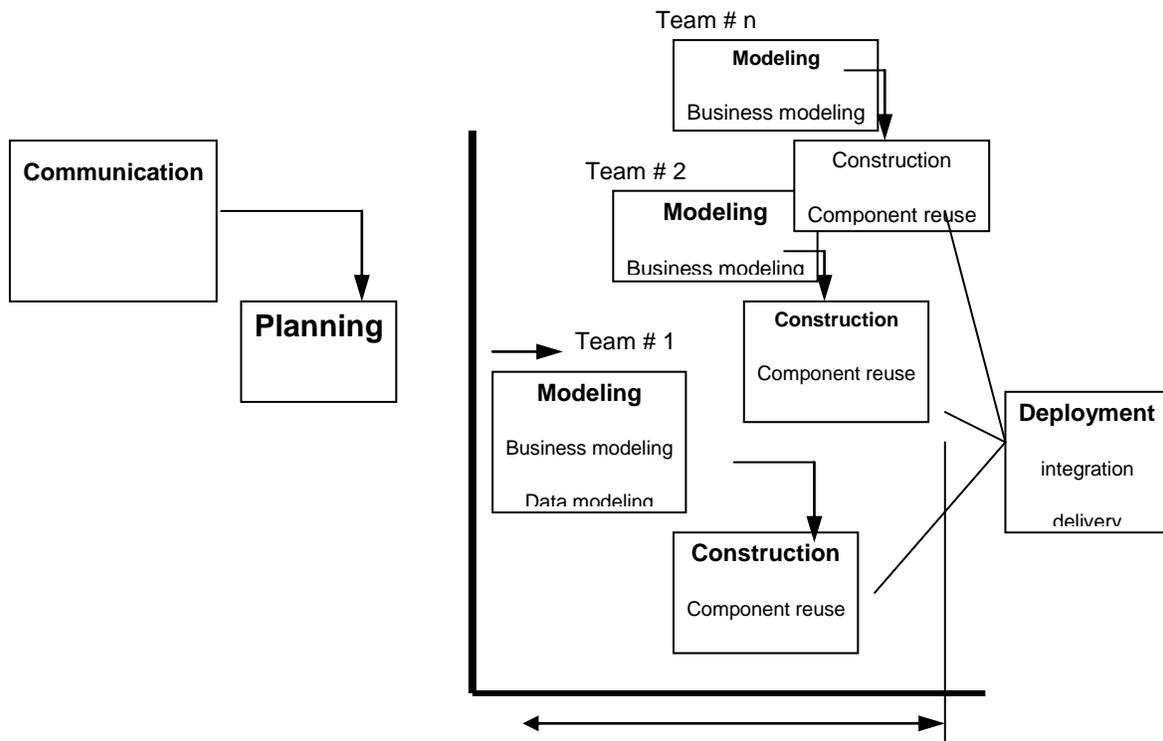
Evolutionary process model:

Evolutionary process model are iterative. They are characterized in a manner that enables software engineers to develop increasingly more complete version of the software.[4]

It consists of three models:

1) Prototype Model
2) Spiral Model and
3) win –win spiral model

V. Prototype Model:

When a customer is not identify detail input processing and output requirement and if the developer may be ensure of the efficiency of an algorithm or adaptability of the operating system. In the above situations prototype process model is used to assist the software engineers and the customers to better understand what is being developed when requirements are fuzzy.

The prototype model begins with communication [1]. The software engineer and the customer meet and define the overall objective of the software then prototype iteration is planned quickly and then modeling occurs.

The quick design leads to construction of the prototype then the prototype will be evaluated by the customer and feedback of the customer is used to refine the requirements iterations occurs as the prototype is tuned to satisfy the customer while at the same time enabling the developer to better understand the what needs to be done.

Advantages of Prototype model:
1. It first develops the working version
    of the programs.
2. The customer understand the software development process easily
3. Customer gives the feedback for the
   next increment of the prototype

Limitation of Prototype Model:
1. The customer sees what appears to
    be a working version of the software,
   unaware that the prototype is
   incomplete.
2. The developer is often makes
   implementation compromises in order
   to get a prototype work quickly.

Evolutionary Models: Prototype
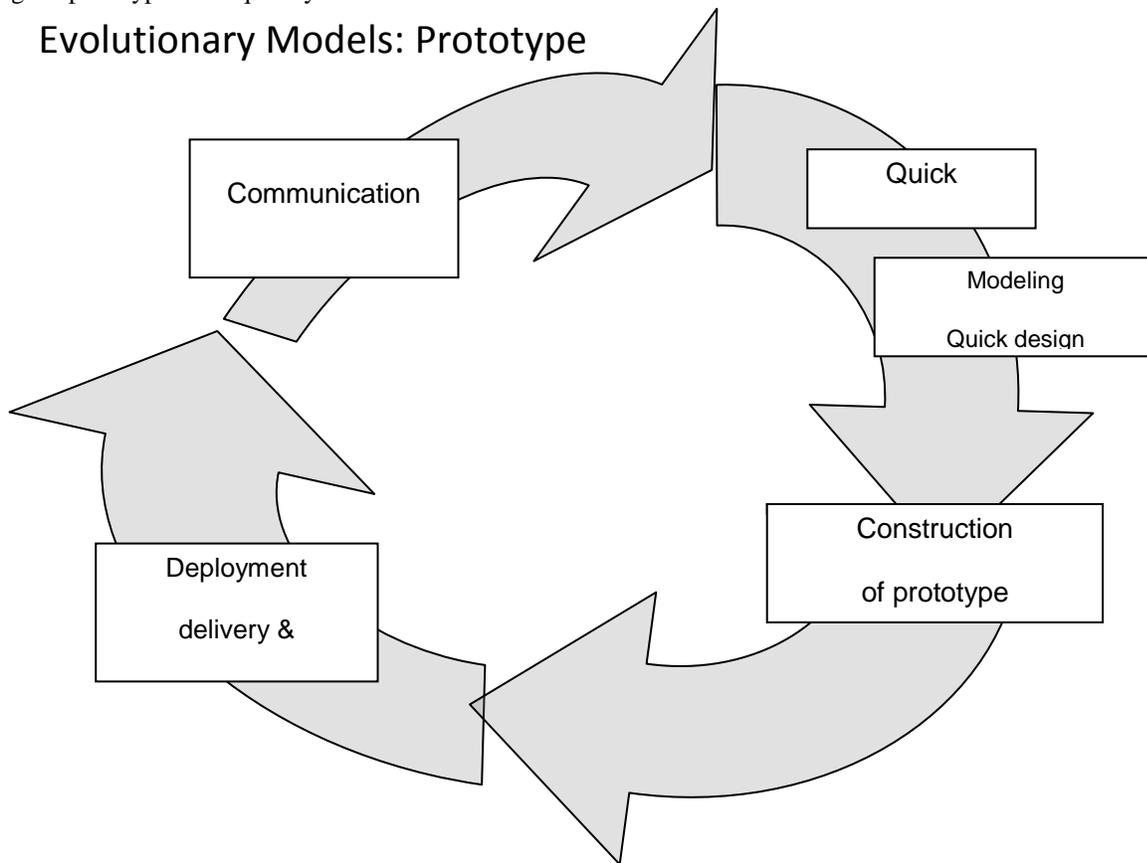
VI. Spiral Model:

The spiral model is the iterative nature of the prototyping with the controlled and systematic aspects of the water model. In the spiral model software is developed in a series of the evolutionary releases.[6] A spiral model is divided into a set of frame work activities defined by the software engineering team. The software team performs the activities tat are implied by a circuit around the spiral in the clockwise direction, beginning at the center.

The first circuit around the spiral might result in in the development of the product specification. Each pass through the planning region results in the adjustment to the project plan, cost and schedule are adjusted based on the feedback from the customer

The first circuit around the spiral might represent the "concept of the development project" which starts at the center of the spiral and continues for multiple iterations until the concept of development is complete. In spiral model risk is considered at each activity of the software development.

The spiral model is used for large scale systems and software.
Advantages of spiral model:
1. It is an iterative and interactive
   development of the software.
2. It consider risk analysis at each phase of the spiral model
3. It terminates a project if it is too risky.
Limitations of Spiral Model:
1. Origin of objective, constraints and alternatives are unclear in the spiral model
2. It does not define the organizations major milestones for development of the software
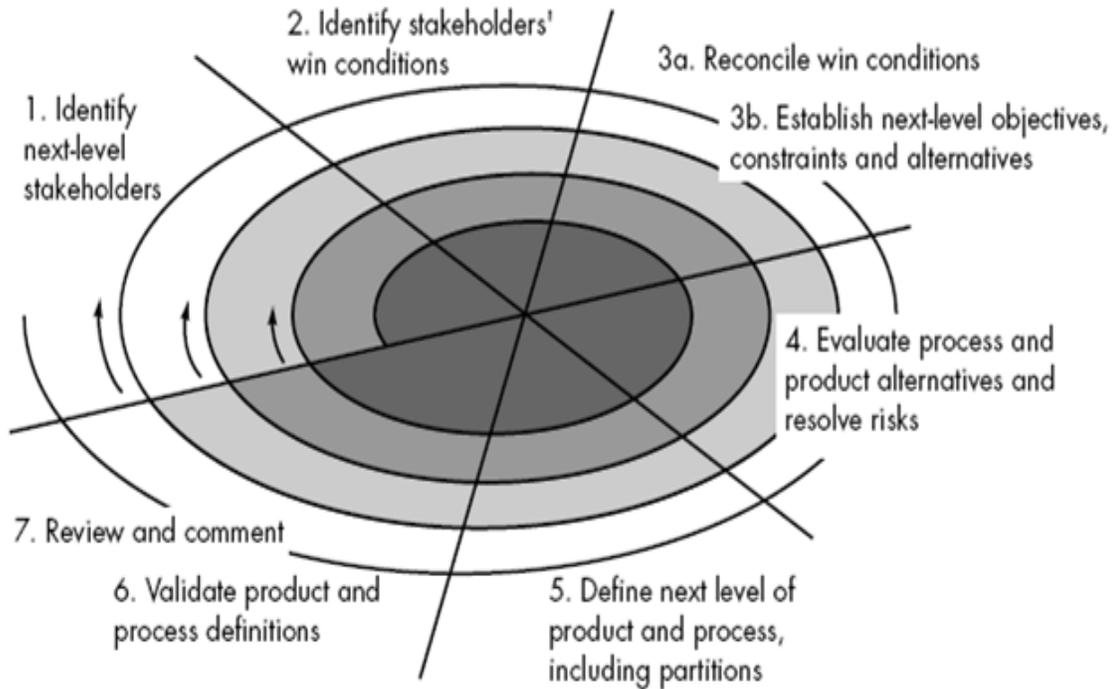
Win – win Spiral **model**:
The win – win spiral model has a provision for the system stakeholders (example customers, developers maintainers testers and general public) to hold a unique mutually satisfactory specification. [3] An industrial grade win – win groupware tool is being developed by terming it as win –win negotiation model. This model facilitates negotiation of the mutually satisfactory system specification by distributed stakeholders.
An agreement with the stakeholders is accompanied by a fundamental reason. These agreement covers win–win condition. During negotiation stakeholders adopt an option relative to an agreement. Associated with each option in an issue relative to the win conditions
Advantages of win – win Spiral Model:
1) It involves stakeholders in the development of the software
2) It provides the basis for a unified effort in tackling the essential difficulties of the software development.
Limitations of Win – win spiral model:
1) The win – win spiral model doesn't address the issues of how developers specify and design.
2) It doesn't specify the conceptual structure of the software.

Comparative Analysis
A comparative study of software process model has taken out with numerical scaling which depicts the influence on feature vs process model. The below comparative study is taken out on discussion and research to find out optional work schedules to be adopted for the software development life cycle depending on the nature of the project. Scaling influences from 0 to 5
- 0 – No influence
- 1 – trivial influence
- 2 – less influence
- 3- modern influence
- 4 – strong influence
- 5 – very strong influence

Feature/ Model	Waterfall	Prototype	Incremental	Spiral	RAD
Requirement Specifications	3	2	3	3	2
Understanding Requirements	5	3	4	3	3
Development Cost	4	3	3	3	2
Guarantee of Success	2	4	4	4	3
Risk Involvement	4	2	2	2	1
Expertise Required	5	3	3	3	2
Changes Incorporated	5	3	4	2	4
Overlapping phases	5	2	4	3	4
Flexibility	5	4	4	3	3
Maintenance	5	2	2	2	2
Reusability	5	2	2	3	4

VII. Conclusion

The software process model differ in the amount of detail with the software process is described, the number of work product products that are identified and used in the process, the interdependency factor, project tracking and control, requirement engineering, glenity in work structure with represent to product development and the above table represents that the development of product vs process model which depicts that for the project which has complete requirements and analysis waterfall model is advisable because it does not have back tracking and it is linear in nature any change to the product it is difficult to incorporate. Similarly a product with incomplete requirements and less in size RAD model is preferable than the other models. The comparative study will help to choose right process model to the project specification. Software processes model is core for software development life cycle in a phased phase. New processes model can be evolved by research depending on the type of projects, domain of the project and client specification. Software processes model can be tailor made to software projects and requirements. Many organizations has their own processes model to taken.

References

[1]   Yourdon, e. "When good enough is Best", IEEE software, vol.12 no.3, may 1992, PP 79-81
[2]   Gibb, T, Principals of software engineering management, addrison – wesly 1988
[3]   Hanna, M, "Farewell to waterfalls" software magazine may 1995 PP 38-46
[4]   Butle J, "Rapid Application Development in action", Managing system development, applied computer research, vol.14 no.5, may 1994, PP 6-8.
[5]   Bochm, B, "A spiral model for software development and enhancements" computer, vol. 21, No5 , May 1998, PP 61-72
[6]   Bochm B, "Using win-win spiral model : A case study," Computer Vol. 31, No7, July 1998, PP 33-44.
[7]   Rothi, J.,Yen, D, "System Analysis and Design in End User Developed Applications", Journal of Information Systems Education, 1989.
[8]   Fowler, M. (2000), "Put Your Process on a Diet", Software Development"

Significances and Issues of Network Security

Dr. B V Ramana Murthy[1], Prof. Vuppu Padmakar[2], Ms. A. Vasavi[3]

Department of CSE Jyotishmathi College of Technology and Science, Shamirpet, Hyderabad, India[1,3]

Department of CSE, Chilkur Balaji Institute of Technology, Aziz nagar, Hyderabad, India[2]

Abstract: This is the age of universal electronic connectivity, where the activities like hacking, viruses, electronic fraud are very common. Unless security measures are taken, a network conversation or a distributed application can be compromised easily. Information security has been affected by two major developments over the last several decades. First one is introduction of computers into organizations and the second one being introduction of distributed systems and the use of networks and communication facilities for carrying data between users & computers. These two developments lead to 'computer security' and 'network security', where the computer security deals with collection of tools designed to protect data and to thwart hackers. Network security measures are needed to protect data during transmission. But keep in mind that, it is the information and our ability to access that information that we are really trying to protect and not the computers and networks.

Keywords: Security, Authentication, VPN, Firewalls, Antivirus

I. INTRODUCTION

Network security consists of the provisions and policies adopted by a network administrator to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security covers a variety of computer networks, both public and private, that are used in everyday jobs conducting transactions and communications among businesses, government agencies and individuals. Networks can be private, such as within a company, and others which might be open to public access. Network security is involved in organizations, enterprises, and other types of institutions.

Network security is becoming more and more important as people spend more and more time connected. Compromising network security is often much easier than compromising physical or local security, and is much more common.

- Increasing online transactions
- Personal and sensitive information shared over network
- Protect Network and related resources from unauthorized access
- Monitor and measure its activeness

1. SECURITY SERVICES

It is a processing or communication service that is provided by a system to give a specific kind of production to system resources. Security services implement security policies and are implemented by security mechanisms

1.1 CONFIDENTIALITY

Confidentiality is the protection of transmitted data from passive attacks. It is used to prevent the disclosure of information to unauthorized individuals or systems. It has been defined as "ensuring that information is accessible only to those authorized to have access". The other aspect of confidentiality is the protection of traffic flow from analysis. **Ex:** A credit card number has to be secured during online transaction.

1.2 AUTHENTICATION

This service assures that a communication is authentic. For a single message transmission, its function is to assure the recipient that the message is from intended source. For an ongoing interaction two aspects are involved. First, during connection initiation the service assures the authenticity of both parties. Second, the connection between the two hosts is not interfered allowing a third party to masquerade as one of the two parties. Two specific authentication services defines in X.800 are

1.3 PEER ENTITY AUTHENTICATION

Verifies the identities of the peer entities involved in communication. Provides use at time of connection establishment and during data transmission. Provides confidence against a masquerade or a replay attack.

1.4 DATA ORIGIN AUTHENTICATION

Assumes the authenticity of source of data unit, but does not provide protection against duplication or modification of data units. Supports applications like electronic mail, where no prior interactions take place between communicating entities.

1.5 INTEGRITY

Integrity means that data cannot be modified without authorization. Like confidentiality, it can be applied to a stream of messages, a single message or selected fields within a message. Two types of integrity services are available. They are

1.6 CONNECTION – ORIENTED INTEGRITY

SERVICE: This service deals with a stream of messages, assures that messages are received as sent, with no duplication, insertion, modification, reordering or replays. Destruction of data is also covered here. Hence, it attends to both message stream modification and denial of service.

CONNECTIONLESS-ORIENTED INTEGRITY SERVICE: It deals with individual messages regardless of larger context, providing protection against message

modification only. An integrity service can be applied with or without recovery. Because it is related to active attacks, major concern will be detection rather than prevention. If a violation is detected and the service reports it, either human intervention or automated recovery machines are required to recover.

NON-REPUDIATION**:** Non-repudiation prevents either sender or receiver from denying a transmitted message. This capability is crucial to e-commerce. Without it an individual or entity can deny that he, she or it is responsible for a transaction, therefore not financially liable.

ACCESS CONTROL: This refers to the ability to control the level of access that individuals or entities have to a network or system and how much information they can receive. It is the ability to limit and control the access to host systems and applications via communication links. For this, each entity trying to gain access must first be identified or authenticated, so that access rights can be tailored to the individuals.

AVAILABILITY: It is defined to be the property of a system or a system resource being accessible and usable upon demand by an authorized system entity. The availability can significantly be affected by a variety of attacks, some amenable to automated counter measures i.e authentication and encryption and others need some sort of physical action to prevent or recover from loss of availability of elements of a distributed system.

II.   ISSUES IN NETWORK SECURITY

1.   SECURITY MANAGEMENT
Security management for networks is different for all kinds of situations. A home or small office may only require basic security while large businesses may require high-maintenance and advanced software and hardware to prevent malicious attacks from hacking and spamming.

2.   HOMES AND SMALL BUSINESSES
Basic firewall or a unified threat management system. For Windows users, basic Anti virus software. An anti-spyware program would also be a good idea. There are many other types of antivirus or anti-spyware programs available.

When using a wireless connection, use a robust password. Also one could try to use the strongest security supported by their wireless devices, such as WPA2 with AES. TKIP may be more widely supported by their devices and should only be considered in cases where they are NOT compliant with AES.

If using Wireless: Change the default SSID network name, also disable SSID Broadcast; as this function is unnecessary for home use. (Security experts consider this to be easily bypassed with modern technology and some knowledge of how wireless traffic is detected by software).

Enable MAC Address filtering to keep track of all home network MAC devices connecting to one's router. (This is not a security feature per se; However it can be used to limit and strictly monitor one's DHCP address pool for unwanted intruders if not just by exclusion, but by AP association.)

Assign STATIC IP addresses to network devices. (This is not a security feature per se; However it may be used, in conjunction with other features, to make one's AP less desirable to would-be intruders.)

Disable ICMP ping on router. Review router or firewall logs to help identify abnormal network connections or traffic to the Internet.

Use passwords for all accounts. For Windows users, Have multiple accounts per family member and use non-administrative accounts for day-to-day activities.

Raise awareness about information security to children. Medium businesses: A fairly strong firewall or Unified Threat Management System Strong Antivirus software and Internet Security Software. For authentication, use strong passwords and change them on a bi-weekly/monthly basis. When using a wireless connection, use a robust password. Raise awareness about physical security to employees. Use an optional network analyzer or network monitor.

An enlightened administrator or manager: Use a VPN, or Virtual Private Network, to communicate between a main office and satellite offices using the Internet as a connectivity medium. A VPN offers a solution to the expense of leasing a data line while providing a secure network for the offices to communicate. A VPN provides the business with a way to communicate between two in a way mimics a private leased line. Although the Internet is used, it is private because the link is encrypted and convenient to use. A medium sized business needing a secure way to connect several offices will find this a good choice.

Clear employee guidelines should be implemented for using the Internet, including access to non-work related websites, sending and receiving information.

Individual accounts to log on and access company intranet and Internet with monitoring for accountability. Have a back-up policy to recover data in the event of a hardware failure or a security breach that changes, damages or deletes data.

Disable Messenger: Assign several employees to monitor a group like CERT which studies Internet security vulnerabilities and develops training to help improve security.

Large businesses: A strong firewall and proxy, or network Guard, to keep unwanted people out. A strong Antivirus software package and Internet Security Software package. For authentication, use strong passwords and change it on a weekly/bi-weekly basis.

When using a wireless connection, use a robust password. Exercise physical security precautions to employees. Prepare a network analyzer or network monitor and use it when needed. Implement physical security management like closed circuit television for entry areas and restricted zones. Security fencing to mark the company's perimeter. Fire extinguishers for fire-sensitive areas like server rooms and security rooms. Security guards can help to maximize physical security.

School: An adjustable firewall and proxy to allow authorized users access from the outside and inside. Strong Antivirus software and Internet Security Software packages. Wireless connections that lead to firewalls. Children's Internet Protection Act compliance. (Only schools in the USA) Supervision of network to guarantee updates and changes based on popular site usage.

Constant supervision by teachers, librarians, and administrators to guarantee protection against attacks by both internet and sneaker net sources. An enforceable and easy to understand acceptable use policy which differentiates between schools owned and personally owned devices FERPA compliance for institutes of higher education network.

Large government: A strong firewall and proxy to keep unwanted people out. Strong antivirus software and Internet Security Software suites. Strong encryption.

White list authorized wireless connection, block all else. All network hardware is in secure zones. All hosts should be on a private network that is invisible from the outside. Host web servers in a DMZ, or a firewall from the outside and from the inside. Security fencing to mark perimeter and set wireless range to this. Inventory controls of government owned mobile.

To port sweep is to scan multiple hosts for a specific listening port. The latter is typically used in searching for a specific service, for example, an SQL-based computer worm may port sweep looking for hosts listening on TCP port 1433

Idle scan is a TCP port scan method that consists of sending spoofed packets to a computer to find out what services are available. This is accomplished by impersonating another computer called a "zombie" (that is not transmitting or receiving information) and observing the behavior of the "zombie" system.

III.   ACTIVE DENIAL-OF-SERVICE ATTACK
In computing, a **denial-of-service (DoS)** or **distributed denial-of-service (DDoS) attack** is an attempt to make a machine or network resource unavailable to its intended users. Although the means to carry out, motives for, and targets of a DoS attack may vary, it generally consists of efforts to temporarily or indefinitely interrupt or suspend services of a host connected to the Internet. As clarification, DDoS (Distributed Denial of Service) attacks are sent by two or more persons, or bots. (See botnet) DoS (Denial of Service) attacks are sent by one person or system.

Perpetrators of DoS attacks typically target sites or services hosted on high-profile web servers such as banks, credit card payment gateways, and even root nameservers. DoS threats are also common in business,[1] and are sometimes responsible for website attacks. This technique has now seen extensive use in certain games, used by server owners, or disgruntled competitors on games, such as server owners' popular Minecraft servers. Increasingly, DoS attacks have also been used as a form of resistance. Richard Stallman has stated that DoS is a form of 'Internet Street Protests' The term is generally used relating to computer networks, but is not limited to this field; for example, it is also used in reference to CPU resource management.

One common method of attack involves saturating the target machine with external communications requests, so much so that it cannot respond to legitimate traffic or responds so slowly as to be rendered essentially unavailable. Such attacks usually lead to a server overload. In general terms, DoS attacks are implemented by either forcing the targeted computer(s) to reset, or consuming its resources' that it can no longer provide its intended service or obstructing the communication media between the intended users and the victim so that they can no longer communicate adequately.

Denial-of-service attacks are considered violations of the Internet Architecture Board's Internet proper use policy, and also violate the acceptable use policies of virtually all Internet service providers. They also commonly constitute violations of the laws of individual nations. Spoofing In computing

A denial-of-service (DoS) or **distributed denial-of-service (DDoS) attack** is an attempt to make a machine or network resource unavailable to its intended users. Although the means to carry out, motives for, and targets of a DoS attack may vary, it generally consists of efforts to temporarily or indefinitely interrupt or suspend services of a host connected to the Internet. As clarification, DDoS (Distributed Denial of Service) attacks are sent by two or more persons, or bots. (See botnet) DoS (Denial of Service) attacks are sent by one person or system.

Perpetrators of DoS attacks typically target sites or services hosted on high-profile web servers such as banks, credit card payment gateways, and even root name servers. DoS threats are also common in business, and are sometimes responsible for website attacks. This technique has now seen extensive use in certain games, used by server owners, or disgruntled competitors on games, such as server owners' popular Mine craft servers. Increasingly, DoS attacks have also been used as a form of resistance. Richard Stallman has stated that DoS is a form of 'Internet Street Protests'. The term is generally used relating to computer networks, but is not limited to this field; for example, it is also used in reference to CPU resource management.

One common method of attack involves saturating the target machine with external communications requests, so much so that it cannot respond to legitimate traffic or responds so slowly as to be rendered essentially unavailable. Such attacks usually lead to a server overload. In general terms, DoS attacks are implemented by either forcing the targeted computer(s) to reset, or consuming its resources so that it can no longer provide its intended service or obstructing the communication media between the intended users and the victim so that they can no longer communicate adequately.

Denial-of-service attacks are considered violations of the Internet Architecture Board's Internet proper use policy, and also violate the acceptable use policies of virtually all Internet service providers. They also commonly constitute violations of the laws of individual nations.

Man in the middle: In computing a denial-of-service (DoS) or distributed denial-of-service (DDoS) attack is an attempt to make a machine or network resource unavailable to its intended users. Although the means to carry out, motives for, and targets of a DoS attack may vary, it generally consists of efforts to temporarily or indefinitely interrupt or suspend services of a host connected to the Internet. As clarification, DDoS (Distributed Denial of Service) attacks are sent by two or more persons, or bots. DoS (Denial of Service) attacks are sent by one person or system.

ARP poisoning: ARP spoofing is a technique whereby an attacker sends fake ("spoofed") Address Resolution Protocol (ARP) messages onto a Local Area Network. Generally, the aim is to associate the attacker's MAC address with the IP address of another host (such as the default gateway), causing any traffic meant for that IP address to be sent to the attacker instead. ARP spoofing may allow an attacker to intercept data frames on a LAN, modify the traffic, or stop the traffic altogether. Often the attack is used as an opening for other attacks, such as denial of service, man in the middle, or session hijacking attacks. The attack can only be used on networks that make use of the Address Resolution Protocol (ARP), and are limited to local network segments.

Smurf attack: The Smurf Attack is a distributed-of-service attack in which large numbers of Internet Control Message Protocol (ICMP) packets with the intended victim's spoofed source IP are broadcast to a computer network using an IP Broadcast address. Most devices on a network will, by default, respond to this by sending a reply to the source IP address. If the number of machines on the network that receive and respond to these packets is very large, the victim's computer will be flooded with traffic. This can slow down the victim's computer to the point where it becomes impossible to work on. The name *Smurf* comes from the file "smurf.c", the source code of the attack program, which was released in 1997 by TFrea Buffer overflow : The **Smurf Attack** is a distributed denial-of-service attack in which large numbers of Internet

Control Message Protocol (ICMP) packets with the intended victim's spoofed source IP are broadcast to a computer network using an IP Broadcast address. Most devices on a network will, by default, respond to this by sending a reply to the source IP address. If the number of machines on the network that receive and respond to these packets is very large, the victim's computer will be flooded with traffic. This can slow down the victim's computer to the point where it becomes impossible to work on. The name *Smurf* comes from the file "smurf.c", the source code of the attack program, which was released in 1997 by TFrea

Heap overflow: The **Smurf Attack** is a distributed denial-of-service attack in which large numbers of Internet Control Message Protocol (ICMP) packets with the intended victim's spoofed source IP are broadcast to a computer network using an IP Broadcast address. Most devices on a network will, by default, respond to this by sending a reply to the source IP address. If the number of machines on the network that receive and respond to these packets is very large, the victim's computer will be flooded with traffic. This can slow down the victim's computer to the point where it becomes impossible to work on. The name *Smurf* comes from the file "smurf.c", the source code of the attack program, which was released in 1997 by TFrea

Format string attack : The Smurf Attack is a distributed denial-of-service attack in which large numbers of Internet Control Message Protocol (ICMP) packets with the intended victim's spoofed source IP are broadcast to a computer network using an IP Broadcast address. Most devices on a network will, by default, respond to this by sending a reply to the source IP address. If the number of machines on the network that receive and respond to these packets is very large, the victim's computer will be flooded with traffic. This can slow down the victim's computer to the point where it becomes impossible to work on. The name *Smurf* comes from the file "smurf.c", the source code of the attack program, which was released in 1997 by TFrea

SQL injection : The Smurf Attack is a distributed denial-of-service attack in which large numbers of Internet Control Message Protocol (ICMP) packets with the intended victim's spoofed source IP are broadcast to a computer network using an IP Broadcast address. Most devices on a network will, by default, respond to this by sending a reply to the source IP address. If the number of machines on the network that receive and respond to these packets is very large, the victim's computer will be flooded with traffic. This can slow down the victim's computer to the point where it becomes impossible to work on. The name *Smurf* comes from the file "smurf.c", the source code of the attack program, which was released in 1997 by TFrea

CVBER attack: The Smurf Attack is a distributed denial-of-service attack in which large numbers of Internet Control Message Protocol (ICMP) packets with the

intended victim's spoofed source IP are broadcast to a computer network using an IP Broadcast address. Most devices on a network will, by default, respond to this by sending a reply to the source IP address. If the number of machines on the network that receive and respond to these packets is very large, the victim's computer will be flooded with traffic. This can slow down the victim's computer to the point where it becomes impossible to work on.

Cloud computing security: Cloud computing security or, more simply, cloud security is an evolving sub-domain of computer security, network security, and, more broadly, information security. It refers to a broad set of policies, technologies, and controls deployed to protect data, applications, and the associated infrastructure of cloud computing. Cloud security is not to be confused with security software offerings that are cloud-based such as security as a service.

Crime ware : Crime ware is a class of malware designed specifically to automate cybercrime. Crime ware (as distinct from spyware and adware) is designed to perpetrate identity theft through social engineering or technical stealth in order to access a computer user's online accounts at financial services companies and online retailers for the purpose of taking funds from those accounts or completing unauthorized transactions that enrich the thief controlling the crime ware. Crime ware also often has the intent to export confidential or sensitive information from a network for financial exploitation. Crime ware represents a growing problem in network security as many malicious code threats seek to pilfer confidential information.

Cyber security standards : Cyber security standards are security standards which enable organizations to practice safe security techniques to minimize the number of successful cyber security attacks. These guides provide general outlines as well as specific techniques for implementing cyber security. For certain standards, cyber security certification by an accredited body can be obtained. There are many advantages to obtaining certification including the ability to get cyber security insurance. (Spelling of Cyber Security or Cyber security depends on the institution, and there have been discrepancies on older documents. However, since the U.S. Federal Executive Order (EO) 13636, "Improving Critical Infrastructure Cyber security", most forums and media have embraced spelling "cybersecurity" as a single word.

Data Loss Prevention: Data loss/leak prevention solution is a system that is designed to detect potential data breach / data ex-filtration transmissions and prevent them by monitoring, detecting and blocking sensitive data while in-use (endpoint actions), in-motion (network traffic), and at-rest (data storage). In data leakage incidents, sensitive data is disclosed to unauthorized personnel either by malicious intent or inadvertent mistake. Such sensitive data can come in the form of private or company information, intellectual property (IP), financial or patient information, credit-card data, and other information depending on the business and the industry.

The terms "data loss" and "data leak" are closely related and are often used interchangeably, though they are somewhat different Data loss incidents turn into data leak incidents in cases where media containing sensitive information is lost and subsequently acquired by unauthorized party. However, a data leak is possible without the data being lost in the originating side.

Greynet greynet (or Grayware) is an elusive networked computer application that is downloaded and installed on end user systems without express permission from network administrators and often without awareness or cognition that it is deeply embedded in the organization's network fabric. These applications may be of some marginal use to the user, but inevitably consume system and network resources. In addition, greynet applications often open the door for end use systems to become compromised by additional applications, security risks and malware.

Information Leak Prevention: Data loss/leak prevention solution is a system that is designed to detect potential data breach / data ex-filtration transmissions and prevent them by monitoring, detecting and blocking sensitive data while **in-use** (endpoint actions), **in-motion** (network traffic), and **at-rest** (data storage). In data leakage incidents, sensitive data is disclosed to unauthorized personnel either by malicious intent or inadvertent mistake. Such sensitive data can come in the form of private or company information, intellectual property (IP), financial or patient information, credit-card data, and other information depending on the business and the industry.
The terms "data loss" and "data leak" are closely related and are often used interchangeably, though they are somewhat different. Data loss incidents turn into data leak incidents in cases where media containing sensitive information is lost and subsequently acquired by unauthorized party. However, a data leak is possible without the data being lost in the originating side.

Mobile security: Mobile security or mobile phone security has become increasingly important in mobile computing. It is of particular concern as it relates to the security of personal and business information now stored on smart phones. More and more users and businesses use smart phones as communication tools but also as a means of planning and organizing their work and private life. Within companies, these technologies are causing profound changes in the organization of information systems and therefore they have become the source of new risks. Indeed, smart phones collect and compile an increasing amount of sensitive information to which access must be controlled to protect the privacy of the user and the intellectual property of the company. According to ABI Research the Mobile Security Services market will total around $1.88 billion by the end of 2013.
All smart phones, as computers, are preferred targets of attacks. These attacks exploit weaknesses related to smart

phones that can come from means of communication like SMS, MMS, wifi networks, and GSM. There are also attacks that exploit software vulnerabilities from both the web browser and operating system. Finally, there are forms of malicious software that rely on the weak knowledge of average users.

Different security counter-measures are being developed and applied to smart phones, from security in different layers of software to the dissemination of information to end users. There are good practices to be observed at all levels, from design to use, through the development of operating systems, software layers, and downloadable apps.

Network Security Toolkit: The Network Security Toolkit (NST) is a Linux-based Live CD that provides a set of open source computer security and networking tools to perform routine security and networking diagnostic and monitoring tasks. The distribution can be used as a network security analysis, validation and monitoring tool on servers hosting virtual machines. The majority of tools published in the article "Top 125 security tools" by Insecure.org are available in the toolkit. NST has package management capabilities similar to Fedora and maintains its own repository of additional packages.

TCP Gender Changer: TCP Gender Changer refers to a method of making an internal TCP/IP based network server accessible beyond their protective firewall. It consists of two nodes, one resides on the internal the local area network where it can access the desired server, and the other node runs outside of the local area network, where the client can access it. These nodes are respectively called CC (Connect-Connect) and LL (Listen-Listen). The reason behind naming the nodes is the fact that Connect-Connect node initiates two connections one to the Listen-Listen node and one to the actual server. The Listen-Listen node, however, passively listens on two TCP/IP ports, one to receive a connection from CC and the other one for an incoming connection from the client. The CC node, which runs inside the network, will establish a control connection to the LL, and waiting for LL's signal to open a connection to the internal server. Upon receiving a client connection LL will signal the CC node to connect the server, once done CC will let LL know of the result and if successful LL will keep the client connection and thus the client and server can communicate while CC and LL both relay the data back and forth.

TCP sequence prediction attack: A TCP sequence prediction attack is an attempt to predict the sequence number used to identify the packets in a TCP connection, which can be used to counterfeit packets. The attacker hopes to correctly guess the sequence number to be used by the sending host. If they can do this, they will be able to send counterfeit packets to the receiving host which will seem to originate from the sending host, even though the counterfeit packets may in fact originate from some third host controlled by the attacker. One possible way for this to occur is for the attacker to listen to the conversation occurring between the trusted hosts, and then to issue packets using the same source IP address. By monitoring the traffic before an attack is mounted, the malicious host can figure out the correct sequence number. After the IP address and the correct sequence number are known, it is basically a race between the attacker and the trusted host to get the correct packet sent. One common way for the attacker to send it first is to launch another attack on the trusted host, such as a Denial-of-Service attack. Once the attacker has control over the connection, it is able to send counterfeit packets without getting a response.

If an attacker can cause delivery of counterfeit packets of this sort, he or she may be able to cause various sorts of mischief, including the injection into an existing TCP connection of data of the attacker's choosing, and the premature closure of an existing TCP connection by the injection of counterfeit packets with the RST bit set. Theoretically, other information such as timing differences or information from lower protocol layers could allow the receiving host to distinguish authentic TCP packets from the sending host and counterfeit TCP packets with the correct sequence number sent by the attacker.

Another solution to this type of attack is to configure any router or firewall to not allow packets to come in from an external source but with an internal IP address. Although this does not fix the attack, it will prevent the potential attacks from reaching their targets. If such other information is available to the receiving host, if the attacker cannot also fake that other information, and if the receiving host gathers and uses the information correctly, then the receiving host may be fairly immune to TCP sequence prediction attacks. Usually this is not the case, so the TCP sequence number is the primary means of protection of TCP traffic against these types of attack.

Wireless LAN Security: Wireless security is the prevention of unauthorized access or damage to computers sing wireless networks. The most common types of wireless security are Wired Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA). WEP is a notoriously weak security standard. The password it uses can often be cracked in a few minutes with a basic laptop computer and widely available software tools. WEP is an old IEEE 802.11 standard from 1999 which was outdated in 2003 by WPA or Wi-Fi Protected Access. WPA was a quick alternative to improve security over WEP. The current standard is WPA2; some hardware cannot support WPA2 without firmware upgrade or replacement. WPA2 uses an encryption device which encrypts the network with a 256 bit key; the longer key length improves security over WEP.

Many laptop computers have wireless cards pre-installed. The ability to enter a network while mobile has great benefits. However, wireless networking is prone to some security issues. Hackers have found wireless networks relatively easy to break into, and even use wireless technology to hack into wired networks. As a result, it is very important that enterprises define effective wireless

security policies that guard against unauthorized access to important resources. Wireless Intrusion Prevention Systems (WIPS) or Wireless Intrusion Detection Systems (WIDS) are commonly used to enforce wireless security policies. The risks to users of wireless technology have increased as the service has become more popular. There were relatively few dangers when wireless technology was first introduced. Hackers had not yet had time to latch on to the new technology and wireless was not commonly found in the work place. However, there are a great number of security risks associated with the current wireless protocols and encryption methods, and in the carelessness and ignorance that exists at the user and corporate IT level. Hacking methods have become much more sophisticated and innovative with wireless. Hacking has also become much easier and more accessible with easy-to-use Windows or Linux-based tools being made available on the web at no charge.

Some organizations that have no wireless access points installed do not feel that they need to address wireless security concerns. In-Stat MDR and META Group have estimated that 95% of all corporate laptop computers that were planned to be purchased in 2005 were equipped with wireless. Issues can arise in a supposedly non-wireless organization when a wireless laptop is plugged into the corporate network. A hacker could sit out in the parking lot and gather info from it through laptops and/or other devices as handhelds, or even break in through this wireless card-equipped laptop and gain access to the wired network.

Wireless security: Is the prevention of unauthorized access or damage to computers using wireless networks. The most common types of wireless security are Wired Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA). WEP is a notoriously weak security standard. The password it uses can often be cracked in a few minutes with a basic laptop computer and widely available software tools.

WEP is an old IEEE 802.11 standard from 1999 which was outdated in 2003 by WPA or Wi-Fi Protected Access. WPA was a quick alternative to improve security over WEP. The current standard is WPA2; some hardware cannot support WPA2 without firmware upgrade or replacement. WPA2 uses an encryption device which encrypts the network with a 256 bit key; the longer key length improves security over WEP.

Many laptop computers have wireless cards pre-installed. The ability to enter a network while mobile has great benefits. However, wireless networking is prone to some security issues. Hackers have found wireless networks relatively easy to break into, and even use wireless technology to hack into wired networks.

As a result, it is very important that enterprises define effective wireless security policies that guard against unauthorized access to important resources. Wireless Intrusion Prevention Systems (WIPS) or Wireless

Intrusion Detection Systems (WIDS) are commonly used to enforce wireless security policies.

IV. CONCLUSION

The risks to users of wireless technology have increased as the service has become more popular. There were relatively few dangers when wireless technology was first introduced. Hackers had not yet had time to latch on to the new technology and wireless was not commonly found in the work place. However, there are a great number of security risks associated with the current wireless protocols and encryption methods, and in the carelessness and ignorance that exists at the user and corporate IT level.

Hacking methods have become much more sophisticated and innovative with wireless. Hacking has also become much easier and more accessible with easy-to-use Windows or Linux-based tools being made available on the web at no charge. Some organizations that have no wireless access points installed do not feel that they need to address wireless security concerns. In-Stat MDR and META Group have estimated that 95% of all corporate laptop computers that were planned to be purchased in 2005 were equipped with wireless.

Issues can arise in a supposedly non-wireless organization when a wireless laptop is plugged into the corporate network. A hacker could sit out in the parking lot and gather info from it through laptops and/or other devices as handhelds, or even break in through this wireless card-equipped laptop and gain access to the wired network.

REFERENCES

[1]   Dowd, P.W.; McHenry, J.T., "Network security: it's time to take it seriously," Computer, vol.31, no.9, pp.24-28, Sep 1998

[2]   Kartalopoulos, S. V., "Differentiating Data Security and Network Security," Communications, 2008. ICC '08.

[3]   IEEEInternationalConferenceon,pp.1469-1473,19-23May2008[3]"Securityve rview,"www.redhat.com/docs/manuals/enterprise/RHEL-4-Manual/security-guide/ch-sgs-ov.html.

[4]   Molva, R., Institut Eurecom,"Internet Security Architecture," in Computer Networks & ISDN Systems Journal, vol. 31, pp. 787-804, April 1999

[5]   Sotillo, S., East Carolina University, "IPv6 security issues,"August 2006,

[6]   www.infosecwriters.com/text_resources/pdf/IPv6_SSotillo.pdf.

[7]   Andress J., "IPv6: the next internet protocol," April 2005, www.usenix.com/publications/login/2005-04/pdfs/andress0504.pdf.

[8]   Warfield M., "Security Implications of IPv6," Internet Security Systems White Paper, documents.iss.net/whitepapers/IPv6.pdf

[9]   Adeyinka, O., "Internet Attack Methods and Internet Security Technology," Modeling & Simulation, 2008. AICMS 08. Second Asia International Conference on, vol., no., pp.77-82, 13-15 May 2008

[10]   Marin, G.A., "Network security basics," Security & Privacy, IEEE , vol.3, no.6, pp. 68-72, Nov.-Dec. 2005

[11]   Landwehr, C.E.; Goldschlag, D.M., "Security issues in networks with Internet access," Proceedings of the IEEE, vol.85, no.12, pp.2034-2051, Dec 1997

[12]   "Intranet." Wikipedia, The Free Encyclopedia. 23 Jun 2008, 10:43 UTC. WikimediaFoundation,Inc.2Jul2008<http://en.wikipedia.org/w/index.php?title =Intranet&oldid=221174244>.

[13]   "Virtual private network." Wikipedia, The Free Encyclopedia. 30 Jun 2008, 19:32 UTC. Wikimedia Foundation, Inc. 2 Jul 2008 <http://en.wikipedia.org/w/index.php?title=Virtual_private_network&oldid=2 22715612>.

[14]   Tyson, J., "How Virtual private networks work,"http://www.howstuffworks.com/vpn.htm .

[15]   ] Al-Salqan, Y.Y., "Future trends in Internet security," Distributed Computing Systems, 1997., Proceedings of the Sixth IEEE Computer Society Workshop on Future Trends of , vol., no., pp.216-217, 29-31 Oct 1997

BIOGRAPHIES

Dr. B. V.Ramana Murthy has done his PhD from Osmania University, presently he working as Professor in Computer Science and Engineering, has 18 years of experience in Teaching and R&D. His primary area of interest is Software Engineering & Web Engineering.

Mr. V Padmakar is pursuing PhD in CSE and has done his M Tech (CSE) from JNTUH, presently working as Professor in Computer Science and Engineering has 17 years of experience in Teaching and Industry. His primary area of interests is Software Engineering, Network Security and Data mining

Mrs. A.Vasavi has done her M.Tech (CSE) from JNTUH, presently She is working as Associate Professor in Computer Science and Engineering department, has 10 years of experience in Teaching. Her area of interest is Network Security and Formal Languages.

HIGH THROUGHPUT AND HIGH SPEED BLOWFISH ALGORITHM FOR SECURE INTEGRATED ECIRCUITS

Article · January 2014

Some of the authors of this publication are also working on these related projects:

it is under low power VLSI View project

Speech Enhancement View project

24

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

HIGH THROUGHPUT AND HIGH SPEED BLOWFISH ALGORITHM FOR SECURE INTEGRATED CIRCUITS

Kumara Swamy V., Dr. Prabhu Benakop

Aurora's Engineering College, JNTUH, Bhongir, Nalgonda Dist., Andhra Pradesh, India

ABSTRACT: Information Security is prime focus for current computer data communications. Insecurity in data transmission has increased cybercrimes through hacking. This paper presents four different implementations of Blowfish algorithm and analyzed the performance of it with and without Wave Dynamic Differential Logic (WDDL) style to provide security against Differential Power Analysis (DPA) attack. It compares propagation delay (T_t) and frequency (F) of Blowfish, Modified Blowfish with and without WDDL logic [VBS09, VBS10]. Throughput [S+12, SSS11] of Blowfish (BF) with modified modulo adder and WDDL Logic implementation has 840 Mbps compared to 570 Mbps of that of BF with modulo adder [VD12, TN08] and WDDL logic implementation. This paper is implemented using ModelSim6.1d, Leonardo Spectrum8.1 and Xilinx webpack9.2i with Verilog Hardware Description language.
KEYWORDS: WDDL, SIC, BF and DPA.

I. INTRODUCTION

Plaintext is encrypted to produce cipher-text for data transmission through wired or wireless means. The cipher-text message contains all the information of the plaintext, but is not in a format readable by a human or computer without the proper mechanism to decrypt it. If key length is more, number of iterations is more, the possibility of hacking is less and vice versa. At the encryption we apply plaintext and key as inputs and it produces cipher-text. At the other end, cipher-text and key are the input to decryption and the result is the recovery of original plaintext as shown in the figure no.1. It is a symmetric key algorithm.

Figure 1: Process of Encryption and Decryption with symmetric Key

Analyzing Data Encryption Standard (DES), Triple DES, Advanced Encryption Standard (AES) and BF, BF algorithm is highly secured and yields high throughput (T_p) with large key size and its chosen as choice of cryptographic algorithm to implement secure ICs [TV04, TV06].

a. Wave Dynamic Differential Logic (WDDL)
WDDL logic is a constant power consumption logic which can overcome the DPA attack by the hacker. It consists of a parallel combination of two positive complementary gates, one calculating the true output using the true inputs, the other the false output using the false inputs. A positive gate produces a zero output for an all zero input. The AND gate and the OR gate are examples of positive gates. The AND gate fed with true input signals and the OR gate fed with false input signals are two dual gates [VBS10].

During the Precharge phase (clk-signal high), the normal and complemented outputs of the digital circuit produce equal outputs. Thus the differential power analysis results in zero differential power to not to allow the hacker to gain the information from the hardware integrated circuits. During evaluation phase (clk-signal low), it generates actual outputs as per logic with correct key.

Figure 2: WDDL XOR GATE

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

25

In fig no.2, when clock is precharge mode (high), output is zero for both. When clock is evaluation mode (low), outputs are complemented and worked as XOR and XNOR.

b. *Blowfish Algorithm*

Blowfish is a 64-bit block cipher [AM12, PR12] is the replacement for DES (Data Encryption Standard). DES was the standard cryptographic algorithm for more than 19 years. It has a variable-length key block cipher of up to 448 bits. Although a complex initialization phase is required, the encryption of data is very efficient and highly secured. WDDL can be implemented for any logic design. Since the discussion moves around crypto processors, it would be wise to consider a cryptographic algorithm called Blowfish is a fast algorithm [S+12, VBS09].

II. ANALYSIS OF BLOWFISH ALGORITHM

Blowfish is a symmetric block cipher that encrypts and decrypts data in 8-byte (64-bit) blocks. The algorithm has two parts, key expansion and data encryption. Key expansion consists of generating the initial contents of one array (P-array), namely, eighteen 32-bit sub-keys, and four arrays (the S-boxes), each of size 256 by 32 bits, from a key of at most 448 bits (56 bytes). The data encryption and Decryption uses a 16-round Feistel Network as shown below in fig no.3 and fig no.4 [VBS09, VBS10] respectively.

Figure 3: Blowfish Encryption

The encryption algorithm can be defined by the following pseudocode equation no.1:

$$
\begin{aligned}
&\text{For } i = 1 \text{ to } 16 \text{ do} \\
&\qquad RE_i = LE_{i-1} \oplus P_i; \\
&\qquad LE_i = F[RE_i] \oplus RE_{i-1}; \\
&LE_{17} = RE_{16} \oplus P_{18}; \\
&RE_{17} = LE_{16} \oplus P_{17}; \qquad\qquad\qquad (1)
\end{aligned}
$$

The Decryption algorithm can be defined by the following pseudo code equation no.2:

$$
\begin{aligned}
&\text{For } i = 1 \text{ to } 16 \text{ do} \\
&\qquad RD_i = LD_{i-1} \oplus P_i; \\
&\qquad LD_i = F[RD_i] \oplus RD_{i-1}; \\
&LD_{17} = RD_{16} \oplus P_1; \\
&RD_{17} = LD_{16} \oplus P2; \qquad\qquad\qquad (2)
\end{aligned}
$$

Figure 4: Blowfish Decryption

III. DESIGN OF BLOWFISH ALGORITHM

Encryption consists of sixteen rounds of operations. Each round-one operation consists of xor, 8-bit to 32-bit substitution, 32-bit modulo addition, xor, 32-bit modulo addition and swapping of result of Left Encryption (LE) to Right side and Right Encryption (RE) to left side of the data flow as shown in fig no.3. After performing 16 round-one operations right side output(31:0) xored with subkey p16 (31:0) and left hand side output (31:0) xored with subkey p17 (31:0) and then we get final cipher text(63:0).

Decryption is same as that of encryption except we applied sub keys p0 to p17 in reverse order. Input data is the cipher text (output of encryption) and

26

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

then we get the output as Plaintext. Decryption consists of sixteen- round one operation. Each round-one operation consists of xor, 8-bit to 32-bit substitution, 32-bit modulo addition, xor, 32-bit modulo addition and swapping of result of Left Encryption (LE) to Right side and Right Encryption (RE) to left side of the data flow as shown in fig no.4. The input data ciphertext (63:0) performs 16 round-one operations with 16 subkeys (p17 to 2) and then after performing 16 round-one operations right side output (31:0) xored with subkey p1(31:0) and left hand side output (31:0) xored with subkey p0 (31:0) and then we get final plaintext. A crypto processor implementing Blowfish algorithm may be shown in fig no.5.

Figure 5: Top level module of Blowfish Crypto-processor

A. Substitution Boxes (S-boxes)

A substitution box (or S-box) is a basic component of symmetric key algorithm used to obscure the relationship between the plaintext and the cipher text In general, an S-box takes some number of input bits, 8-bit, and transforms them into some number of output bits, 32-bit: an 8×32 S-box, implemented as a lookup table [1, 3, 8].

B. Feistel Function Block

Figure 6: Function Block Internal Structure

Function 'F' is used to create 'confusion' to thwart cryptanalysis based on statistical analysis. 'Confusion' seeks to make the relationship between the statistics of the cipher text and the value of encryption key as complex as possible. One

advantage of this model is that the round function F does not have to be invertible, and can be very complex as shown in fig no.6 [AM12, S+12, VBS09].

C. Modulo 32-bit adder

To increase the speed of blowfish adders in this fig no.7 can be operated in parallel. one adder adds Two h-bit residues, X and Y to form their sum $S_1+2^h C_{out1}$ .Another one is 3-operand adder that computes "X+Y+m". Note that if $m=2^n+1$, we have h=n+1.It has been reported that if either Cout1 or Cout2 of this addition is '1' then the output is X+Y+m instead of X+Y. However, in the following we illustrate that only if the carry of "X+Y+m" is '1', it is sufficient to select it as the final output [VD12, TN08].

Figure 7: Modulo M –bit adder

D. Sub-key Generation Unit

The sub-key generation unit expands the given 448-bit key into 14 sub-keys and 4 more subkeys are internally generated, each of 32 bits, so that they can be used at different stages in the algorithm. The sub key generation process is designed to preserve the entire entropy of the key and to distribute that entropy uniformly throughout the sub keys. It is also designed to distribute the set of allowed sub keys randomly throughout the domain of possible sub keys. Then bit wise XOR of the P-array and K-array is performed reusing the words from K-array as needed shown in equation no.3:

$$P_1= P_1 \wedge K \ldots P_{14}= P_{14} \wedge K_{14}$$
$$P_{15}= P_{15} \wedge K_1 \ldots P_{18}= P_{18} \wedge K_4 \qquad (3)$$

The performance parameter throughput (TP) is defined as number of bits encrypted and decrypted per second.

$$TP = \frac{Number\ of\ bits\ encrypted}{Propagation\ delay} \qquad (4)$$

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

27

IV. RESULTS AND DISCUSSION

The encryption and decryption modules are integrated in the top level module to obtain the blowfish crypto-processor and the simulation and synthesis results are analyzed. Comparison is done for four forms i.e., Blowfish (BF), Modified Blowfish (MBF), Blowfish with WDDL (BFWDDL) and Modified Blowfish with WDDL (MBFWDDL) is given below in the table no.1 and the corresponding bar charts are shown in the fig no.8, 9 and 10 for performance parameters Et, Dt and Tt respectively.

Table 1: Comparison of four implementations of Blowfish Algorithm for Et, Dt and Tt

SNo	Name of Crypt-algorithm	Performance parameters		
		Et(ns)	Dt(ns)	Tt(ns)
1	Blowfish	98.663	98.663	99.395
2	Modified Blowfish	70.08	70.08	71.067
3	Blowfish with WDDL	107.62	107.62	112.56
4	Modified Blowfish with WDDL	73.985	73.985	76.337

Et: Encrypt Time, Dt: Decrypt Time, Tt: Total Time

Figure 8: Bar Chart for Performance parameter Encryption Time of four implementations of Blowfish Algorithm

Figure 9: Bar Chart for Performance parameter Decryption Time of four implementations of Blowfish Algorithm

Figure 10: Bar Chart for Performance parameter Total Time (i.e., Propagation Delay) of four implementations of Blowfish Algorithm

Blowfish Algorithm is implemented in four forms and compared its performance parameters which are given below in the table no.2 and the MBF with WDDL is yielded better results in terms of propagation delay (76.337ns) and throughput (840 Mbps) compared to that of BFWDDL with 112.56ns and 570 Mbps respectively . Analysis is done for blowfish with and without WDDL logic to secure the ICs against DPA attack by the hackers.

Table 2: Comparison of four implementations of Blowfish Algorithm for propagation delay, frequency and Throughput

SNo	Name of Crypt-algorithm	Performance parameters		
		Tt(ns)	F (MHz)	TP (Mbps)
1	Blowfish	99.395	10.06	640
2	Modified Blowfish	71.067	14.07	900
3	Blowfish with WDDL	112.566	8.884	570
4	Modified Blowfish with WDDL	76.337	13.09	840

Tt: Propagation Delay, F; Frequency, TP: Throughput

Comparison is also shown below in the form of bar charts in fig no.11, 12 and 13 for performance parameters Tt, F and TP respectively.

Figure 11: Bar Chart for Performance parameter propagation delay of four implementations of Blowfish Algorithm
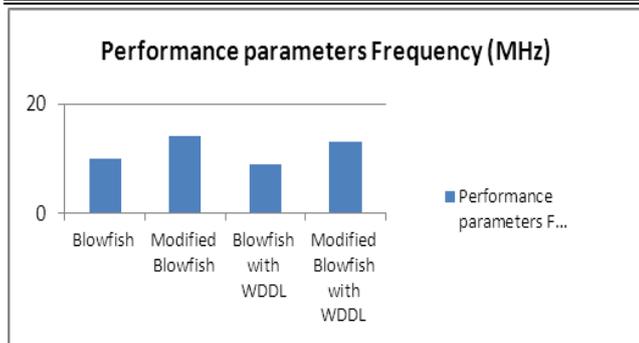
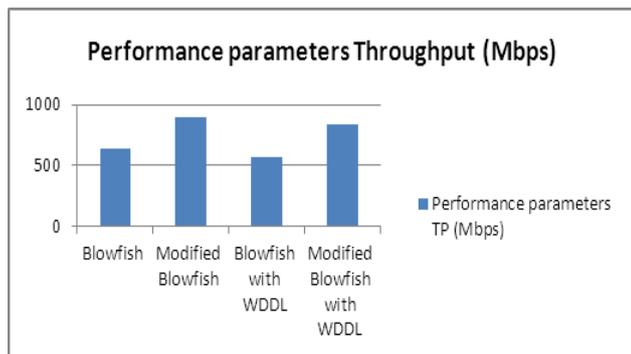**Figure 12: Bar Chart for Performance parameter Frequency of four implementations of Blowfish Algorithm**

Figure 13: Bar Chart for Performance parameter Throughput of four implementations of Blowfish Algorithm

V. CONCLUSION

In this paper, an implementation of Blowfish Algorithm is designed using WDDL Logic style. In the implementation bottom-up approach is used. The sub-keys generated for a particular key can be used for the encryption of the entire data to be encrypted with that key. The sub keys are given in reverse direction of the decryption data path without changing the design for decryption. The crypto processor has been designed for the key size of 448 bits and plain text of 64 bits. The code for the implementation has been written in Verilog HDL. The functional verification has been done using the ModelSim 6.1d simulation package. The synthesis of the design is done using the Xilinx Web Pack9.2i.Comparison with different implementations has been given in table no.1 and table no.2 and proved that Modified Blowfish and MBF with WDDL logic yielded the best results in delay, frequency and throughput compared to blowfish with and without WDDL logic respectively.

REFERENCES

[AM12]   **Monika Agrawal, Pradeep Mishra** - *A Modified Approach for Symmetric Key Cryptography Based on Blowfish Algorithm*, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-1, Issue-6, August 2012.

[L+12]   **Chen Liu, Rolando Duarte, Omar Granados, Jie Tang, Shaoshan Liu, Jean Andrian** - *Critical Path Based Hardware Acceleration for Cryptosystems,"* Journal of Information Processing Systems (JIPS), Vol. 8, No. 1, pp.133-144, 2012.

[PR12]   **S. Pavithra, E. Ramadevi** - *Study and Performance Analysis of Cryptography Algorithms*, International Journal of Advanced Research in Computer Engineering & Technology Volume 1, Issue 5, July 2012.

[S+12]   **Walied W. Souror, Ali E. Taki el-deen, Rasheed Mokhtar-awady Ahmed, Adel Zaghlul Mahmoud** - *An Implementation of High Security and High Throughput Triple Blowfish Cryptography Algorithm*, International Journal of Research and Reviews in Signal Acquisition and Processing (IJRRSAP) Vol. 2, No. 1, March 2012, ISSN: 2046-617X.

[SSS11]   **Gurjeevan Singh, Ashwani Kumar Singla, K. S. Sandha** - *Through Put Analysis of Various Encryption Algorithms*, IJCST Vol.2, Issue3, September 2011.

[TN08]   **Somayeh Timarchi, Keivan Navi** - *Improved Modulo 2n +1 Adder Design*, International Journal of Computer and Information Engineering 2:7 2008.

[TV04]   **K. Tiri, I. Verbauwhede** - *A logic level design methodology for a secure DPA resistant ASIC or FPGA implementation,* in Proc. Design, Automation and Test Eur. Conf. (DATE), Paris, France, 2004, pp. 246–251.

[TV06]   **Kris Tiri, Ingrid Verbauwhede** - *A Digital Design Flow for Secure Integrated Circuits,* IEEE Transaction on Computer-Aided Design of Integrated Circuits and Systems, Vol. 25, No. 7, July 2006.

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

29

[VBS09]   **V. Kumara Swamy, Prabhu G. Benakop, P. Sandeep** - *Design and Implementation of DPA Resistant Crypto-Processor using Blowfish Algorithm*, International Conference on Advanced Communication and Informatics (ICACI-2009), TPGIT, Vellore, Tamilnadu, India, January 11,12&13th, 2009, pp. 25-32.

[VBS10]   **V. Kumara Swamy, Prabhu G. Benakop, B. Sandeep** - *Implementation of digital design flow for DPA secure WDDL crypto processor using blowfish algorithm*, The Libyan Arab International Conference on Electrical and Electronic Engineering (LAICEEE-2010), Tripoli, Libya, October 23-26, 2010, pp. 565-73.

[VD12]   **Haridimos T. Vergos, Giorgos Dimitrakopoulos** - *On Modulo 2n +1 Adder Design*, IEEE Transactions on Computers, vol. 61, no. 2, february 2012.

RAMESH CHOWDARY. G
MANAGING EDITOR

01-11-2014

PAPER ID: SG-IJSETRV03IS16P3031

VISHAL ADMANE,
PG Scholar,
Department of Mechanical Engineering,
HITAM, Hyderabad, India.

Dear Author

   This is to inform you regarding the selection of your paper entitled **"Determination of Effect of Die Radius on Deep Drawing Process using FEA Technique"** after peer review in refereed International Journal of Mechanical Engineering and Advanced Automotive Technology Research, **ISSN 2348-2370, Volume No.03, Issue No.02, November-2014.** This issue published by the **SEMAR GROUPS.**

The hard copy of the journal shall be delivered to you soon after its release.

Please communicate to us for any further queries.

Regards,

Ramesh Chowdary.G
Managing Editor
SEMAR GROUPS
Hyderabad, A.P, INDIA.
Mobile: +91-8978804123
Email: ijournals@semargroup.org, ijournals@ijmeaatr.org.
Website: www.semargroup.org, www.ijmeaatr.org.

HIGH THROUGHPUT AND HIGH SPEED BLOWFISH ALGORITHM FOR SECURE INTEGRATED ECIRCUITS

2 authors:

P G BENAKOP
Methodist College of Engineering and Technology
37 PUBLICATIONS   **136** CITATIONS

SEE PROFILE

V. Kumara Swamy
Sreenidhi Institute of Science and Technology
10 PUBLICATIONS   **7** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

it is under low power VLSI View project

Speech Enhancement View project

24

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12ᵗʰ Tome 1ˢᵗ Fasc. – 2014

HIGH THROUGHPUT AND HIGH SPEED BLOWFISH ALGORITHM FOR SECURE INTEGRATED CIRCUITS

Kumara Swamy V., Dr. Prabhu Benakop

Aurora's Engineering College, JNTUH, Bhongir, Nalgonda Dist., Andhra Pradesh, India

ABSTRACT: Information Security is prime focus for current computer data communications. Insecurity in data transmission has increased cybercrimes through hacking. This paper presents four different implementations of Blowfish algorithm and analyzed the performance of it with and without Wave Dynamic Differential Logic (WDDL) style to provide security against Differential Power Analysis (DPA) attack. It compares propagation delay (T_t) and frequency (F) of Blowfish, Modified Blowfish with and without WDDL logic [VBS09, VBS10]. Throughput [S+12, SSS11] of Blowfish (BF) with modified modulo adder and WDDL Logic implementation has 840 Mbps compared to 570 Mbps of that of BF with modulo adder [VD12, TN08] and WDDL logic implementation. This paper is implemented using ModelSim6.1d, Leonardo Spectrum8.1 and Xilinx webpack9.2i with Verilog Hardware Description language.
KEYWORDS: WDDL, SIC, BF and DPA.

I. INTRODUCTION

Plaintext is encrypted to produce cipher-text for data transmission through wired or wireless means. The cipher-text message contains all the information of the plaintext, but is not in a format readable by a human or computer without the proper mechanism to decrypt it. If key length is more, number of iterations is more, the possibility of hacking is less and vice versa. At the encryption we apply plaintext and key as inputs and it produces cipher-text. At the other end, cipher-text and key are the input to decryption and the result is the recovery of original plaintext as shown in the figure no.1. It is a symmetric key algorithm.

Figure 1: Process of Encryption and Decryption with symmetric Key

Analyzing Data Encryption Standard (DES), Triple DES, Advanced Encryption Standard (AES) and BF, BF algorithm is highly secured and yields high throughput (T_p) with large key size and its chosen as choice of cryptographic algorithm to implement secure ICs [TV04, TV06].

a. Wave Dynamic Differential Logic (WDDL)

WDDL logic is a constant power consumption logic which can overcome the DPA attack by the hacker. It consists of a parallel combination of two positive complementary gates, one calculating the true output using the true inputs, the other the false output using the false inputs. A positive gate produces a zero output for an all zero input. The AND gate and the OR gate are examples of positive gates. The AND gate fed with true input signals and the OR gate fed with false input signals are two dual gates [VBS10].

During the Precharge phase (clk-signal high), the normal and complemented outputs of the digital circuit produce equal outputs. Thus the differential power analysis results in zero differential power to not to allow the hacker to gain the information from the hardware integrated circuits. During evaluation phase (clk-signal low), it generates actual outputs as per logic with correct key.
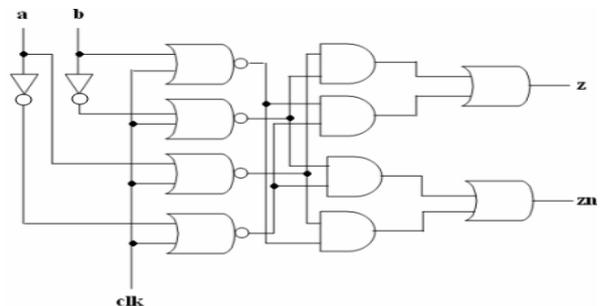

Figure 2: WDDL XOR GATE

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

25

In fig no.2, when clock is precharge mode (high), output is zero for both. When clock is evaluation mode (low), outputs are complemented and worked as XOR and XNOR.

b. Blowfish Algorithm

Blowfish is a 64-bit block cipher [AM12, PR12] is the replacement for DES (Data Encryption Standard). DES was the standard cryptographic algorithm for more than 19 years. It has a variable-length key block cipher of up to 448 bits. Although a complex initialization phase is required, the encryption of data is very efficient and highly secured. WDDL can be implemented for any logic design. Since the discussion moves around crypto processors, it would be wise to consider a cryptographic algorithm called Blowfish is a fast algorithm [S+12, VBS09].

II. ANALYSIS OF BLOWFISH ALGORITHM

Blowfish is a symmetric block cipher that encrypts and decrypts data in 8-byte (64-bit) blocks. The algorithm has two parts, key expansion and data encryption. Key expansion consists of generating the initial contents of one array (P-array), namely, eighteen 32-bit sub-keys, and four arrays (the S-boxes), each of size 256 by 32 bits, from a key of at most 448 bits (56 bytes). The data encryption and Decryption uses a 16-round Feistel Network as shown below in fig no.3 and fig no.4 [VBS09, VBS10] respectively.

Figure 3: Blowfish Encryption

The encryption algorithm can be defined by the following pseudocode equation no.1:

$$\text{For } i = 1 \text{ to } 16 \text{ do}$$
$$RE_i = LE_{i-1} \oplus P_i;$$
$$LE_i = F[RE_i] \oplus RE_{i-1};$$
$$LE_{17} = RE_{16} \oplus P_{18};$$
$$RE_{17} = LE_{16} \oplus P_{17}; \tag{1}$$

The Decryption algorithm can be defined by the following pseudo code equation no.2:

$$\text{For } i = 1 \text{ to } 16 \text{ do}$$
$$RD_i = LD_{i-1} \oplus P_i;$$
$$LD_i = F[RD_i] \oplus RD_{i-1};$$
$$LD_{17} = RD_{16} \oplus P_1;$$
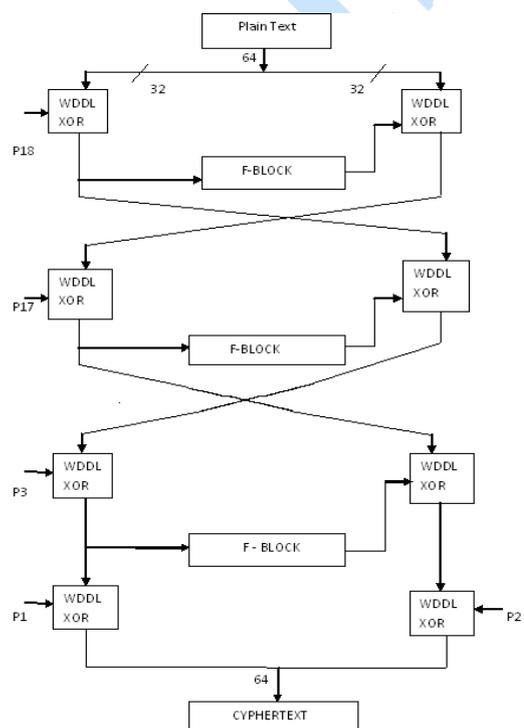$$RD_{17} = LD_{16} \oplus P2; \tag{2}$$

Figure 4: Blowfish Decryption

III. DESIGN OF BLOWFISH ALGORITHM

Encryption consists of sixteen rounds of operations. Each round-one operation consists of xor, 8-bit to 32-bit substitution, 32-bit modulo addition, xor, 32-bit modulo addition and swapping of result of Left Encryption (LE) to Right side and Right Encryption (RE) to left side of the data flow as shown in fig no.3. After performing 16 round-one operations right side output(31:0) xored with subkey p16 (31:0) and left hand side output (31:0) xored with subkey p17 (31:0) and then we get final cipher text(63:0). Decryption is same as that of encryption except we applied sub keys p0 to p17 in reverse order. Input data is the cipher text (output of encryption) and

26

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

then we get the output as Plaintext. Decryption consists of sixteen- round one operation. Each round-one operation consists of xor, 8-bit to 32-bit substitution, 32-bit modulo addition, xor, 32-bit modulo addition and swapping of result of Left Encryption (LE) to Right side and Right Encryption (RE) to left side of the data flow as shown in fig no.4. The input data ciphertext (63:0) performs 16 round-one operations with 16 subkeys (p17 to 2) and then after performing 16 round-one operations right side output (31:0) xored with subkey p1(31:0) and left hand side output (31:0) xored with subkey p0 (31:0) and then we get final plaintext. A crypto processor implementing Blowfish algorithm may be shown in fig no.5.

Figure 5: Top level module of Blowfish Crypto-processor

A. Substitution Boxes (S-boxes)

A substitution box (or S-box) is a basic component of symmetric key algorithm used to obscure the relationship between the plaintext and the cipher text In general, an S-box takes some number of input bits, 8-bit, and transforms them into some number of output bits, 32-bit: an 8×32 S-box, implemented as a lookup table [1, 3, 8].

B. Feistel Function Block

Figure 6: Function Block Internal Structure

Function 'F' is used to create 'confusion' to thwart cryptanalysis based on statistical analysis. 'Confusion' seeks to make the relationship between the statistics of the cipher text and the value of encryption key as complex as possible. One

advantage of this model is that the round function F does not have to be invertible, and can be very complex as shown in fig no.6 [AM12, S+12, VBS09].

C. Modulo 32-bit adder

To increase the speed of blowfish adders in this fig no.7 can be operated in parallel. one adder adds Two h-bit residues, X and Y to form their sum $S_1+2^h C_{out1}$ .Another one is 3-operand adder that computes "X+Y+m". Note that if $m=2^n+1$, we have h=n+1.It has been reported that if either Cout1 or Cout2 of this addition is '1' then the output is X+Y+m instead of X+Y. However, in the following we illustrate that only if the carry of "X+Y+m" is '1', it is sufficient to select it as the final output [VD12, TN08].
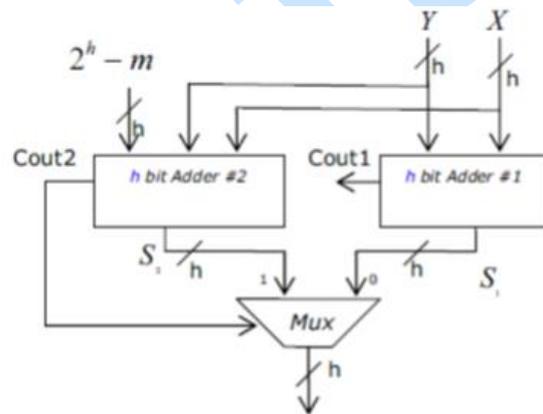

Figure 7: Modulo M –bit adder

D. Sub-key Generation Unit

The sub-key generation unit expands the given 448-bit key into 14 sub-keys and 4 more subkeys are internally generated, each of 32 bits, so that they can be used at different stages in the algorithm. The sub key generation process is designed to preserve the entire entropy of the key and to distribute that entropy uniformly throughout the sub keys. It is also designed to distribute the set of allowed sub keys randomly throughout the domain of possible sub keys. Then bit wise XOR of the P-array and K-array is performed reusing the words from K-array as needed shown in equation no.3:

$$P_1 = P_1 \wedge K \dots P_{14} = P_{14} \wedge K_{14}$$
$$P_{15} = P_{15} \wedge K_1 \dots P_{18} = P_{18} \wedge K_4 \tag{3}$$

The performance parameter throughput (TP) is defined as number of bits encrypted and decrypted per second.

$$TP = \frac{Number\ of\ bits\ encrypted}{Propagation\ delay} \tag{4}$$

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

27

IV. RESULTS AND DISCUSSION

The encryption and decryption modules are integrated in the top level module to obtain the blowfish crypto-processor and the simulation and synthesis results are analyzed. Comparison is done for four forms i.e., Blowfish (BF), Modified Blowfish (MBF), Blowfish with WDDL (BFWDDL) and Modified Blowfish with WDDL (MBFWDDL) is given below in the table no.1 and the corresponding bar charts are shown in the fig no.8, 9 and 10 for performance parameters Et, Dt and Tt respectively.

Table 1: Comparison of four implementations of Blowfish Algorithm for Et, Dt and Tt

SNo	Name of Crypt-algorithm	Performance parameters		
		Et(ns)	Dt(ns)	Tt(ns)
1	Blowfish	98.663	98.663	99.395
2	Modified Blowfish	70.08	70.08	71.067
3	Blowfish with WDDL	107.62	107.62	112.56
4	Modified Blowfish with WDDL	73.985	73.985	76.337

Et: Encrypt Time, Dt: Decrypt Time, Tt: Total Time

Figure 8: Bar Chart for Performance parameter Encryption Time of four implementations of Blowfish Algorithm

Figure 9: Bar Chart for Performance parameter Decryption Time of four implementations of Blowfish Algorithm
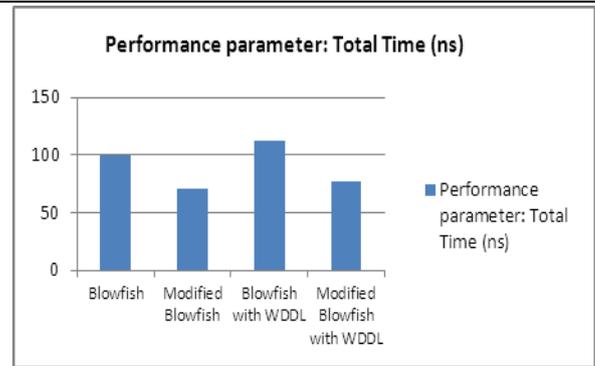

Figure 10: Bar Chart for Performance parameter Total Time (i.e., Propagation Delay) of four implementations of Blowfish Algorithm

Blowfish Algorithm is implemented in four forms and compared its performance parameters which are given below in the table no.2 and the MBF with WDDL is yielded better results in terms of propagation delay (76.337ns) and throughput (840 Mbps) compared to that of BFWDDL with 112.56ns and 570 Mbps respectively . Analysis is done for blowfish with and without WDDL logic to secure the ICs against DPA attack by the hackers.

Table 2: Comparison of four implementations of Blowfish Algorithm for propagation delay, frequency and Throughput

SNo	Name of Crypt-algorithm	Performance parameters		
		Tt(ns)	F (MHz)	TP (Mbps)
1	Blowfish	99.395	10.06	640
2	Modified Blowfish	71.067	14.07	900
3	Blowfish with WDDL	112.566	8.884	570
4	Modified Blowfish with WDDL	76.337	13.09	840

Tt: Propagation Delay, F; Frequency, TP: Throughput

Comparison is also shown below in the form of bar charts in fig no.11, 12 and 13 for performance parameters Tt, F and TP respectively.
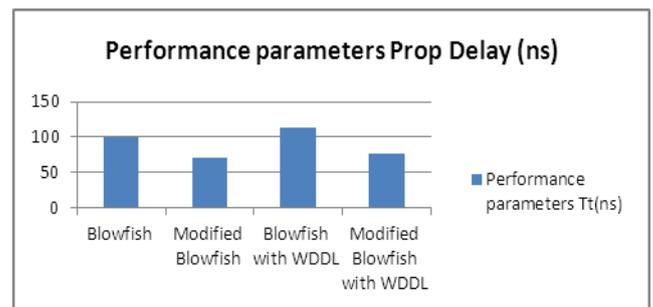

Figure 11: Bar Chart for Performance parameter propagation delay of four implementations of Blowfish Algorithm
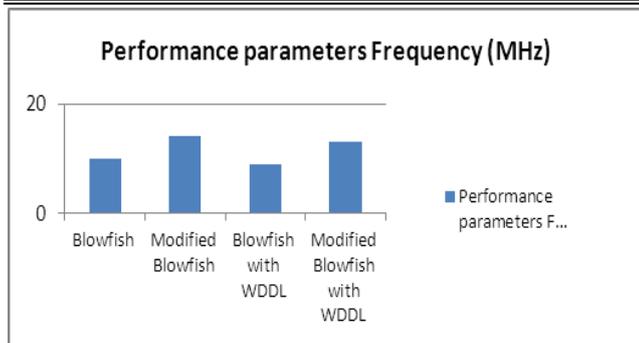
28

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

Figure 12: Bar Chart for Performance parameter Frequency of four implementations of Blowfish Algorithm
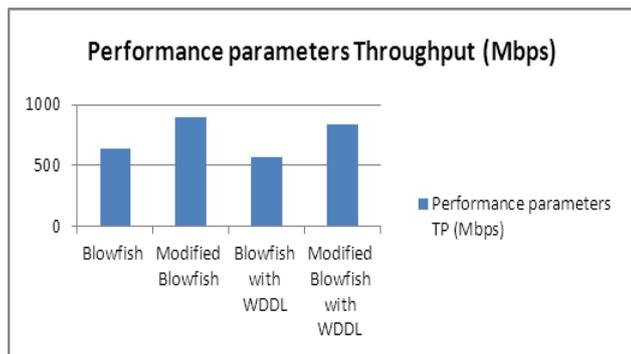

Figure 13: Bar Chart for Performance parameter Throughput of four implementations of Blowfish Algorithm

V. CONCLUSION

In this paper, an implementation of Blowfish Algorithm is designed using WDDL Logic style. In the implementation bottom-up approach is used. The sub-keys generated for a particular key can be used for the encryption of the entire data to be encrypted with that key. The sub keys are given in reverse direction of the decryption data path without changing the design for decryption. The crypto processor has been designed for the key size of 448 bits and plain text of 64 bits. The code for the implementation has been written in Verilog HDL. The functional verification has been done using the ModelSim 6.1d simulation package. The synthesis of the design is done using the Xilinx Web Pack9.2i.Comparison with different implementations has been given in table no.1 and table no.2 and proved that Modified Blowfish and MBF with WDDL logic yielded the best results in delay, frequency and throughput compared to blowfish with and without WDDL logic respectively.

REFERENCES

[AM12]   **Monika Agrawal, Pradeep Mishra** - *A Modified Approach for Symmetric Key Cryptography Based on Blowfish Algorithm*, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-1, Issue-6, August 2012.

[L+12]   **Chen Liu, Rolando Duarte, Omar Granados, Jie Tang, Shaoshan Liu, Jean Andrian** - *Critical Path Based Hardware Acceleration for Cryptosystems,"* Journal of Information Processing Systems (JIPS), Vol. 8, No. 1, pp.133-144, 2012.

[PR12]   **S. Pavithra, E. Ramadevi** - *Study and Performance Analysis of Cryptography Algorithms*, International Journal of Advanced Research in Computer Engineering & Technology Volume 1, Issue 5, July 2012.

[S+12]   **Walied W. Souror, Ali E. Taki el-deen, Rasheed Mokhtar-awady Ahmed, Adel Zaghlul Mahmoud** - *An Implementation of High Security and High Throughput Triple Blowfish Cryptography Algorithm*, International Journal of Research and Reviews in Signal Acquisition and Processing (IJRRSAP) Vol. 2, No. 1, March 2012, ISSN: 2046-617X.

[SSS11]   **Gurjeevan Singh, Ashwani Kumar Singla, K. S. Sandha** - *Through Put Analysis of Various Encryption Algorithms*, IJCST Vol.2, Issue3, September 2011.

[TN08]   **Somayeh Timarchi, Keivan Navi** - *Improved Modulo 2n +1 Adder Design*, International Journal of Computer and Information Engineering 2:7 2008.

[TV04]   **K. Tiri, I. Verbauwhede** - *A logic level design methodology for a secure DPA resistant ASIC or FPGA implementation,* in Proc. Design, Automation and Test Eur. Conf. (DATE), Paris, France, 2004, pp. 246–251.

[TV06]   **Kris Tiri, Ingrid Verbauwhede** - *A Digital Design Flow for Secure Integrated Circuits,* IEEE Transaction on Computer-Aided Design of Integrated Circuits and Systems, Vol. 25, No. 7, July 2006.

Anale. Seria Informatică. Vol. XII fasc. 1 – 2014
Annals. Computer Science Series. 12th Tome 1st Fasc. – 2014

29

[VBS09]   **V. Kumara Swamy, Prabhu G. Benakop, P. Sandeep** - *Design and Implementation of DPA Resistant Crypto-Processor using Blowfish Algorithm*, International Conference on Advanced Communication and Informatics (ICACI-2009), TPGIT, Vellore, Tamilnadu, India, January 11,12&13th, 2009, pp. 25-32.

[VBS10]   **V. Kumara Swamy, Prabhu G. Benakop, B. Sandeep** - *Implementation of digital design flow for DPA secure WDDL crypto processor using blowfish algorithm*, The Libyan Arab International Conference on Electrical and Electronic Engineering (LAICEEE-2010), Tripoli, Libya, October 23-26, 2010, pp. 565-73.

[VD12]   **Haridimos T. Vergos, Giorgos Dimitrakopoulos** - *On Modulo 2n +1 Adder Design*, IEEE Transactions on Computers, vol. 61, no. 2, february 2012.

RAMESH CHOWDARY. G
MANAGING EDITOR

01-11-2014

PAPER   ID: SG-IJSETRV03IS16P3031

R. SAI SYAM,
PG Scholar,
Department of Mechanical Engineering,
HITAM, Hyderabad, India.

Dear Author

This is to inform you regarding the selection of your paper entitled **"Optimization of High Speed Turning Parameters of Super Alloy Inconel 718 Material using Taguchi Technique"** after peer review in refereed International Journal of Mechanical Engineering and Advanced Automotive Technology Research, **ISSN 2348-2370, Volume No.03, Issue No.02, November-2014.** This issue published by the **SEMAR GROUPS.**

The hard copy of the journal shall be delivered to you soon after its release.

Please communicate to us for any further queries.

Regards,

Ramesh Chowdary.G
Managing Editor
SEMAR GROUPS
Hyderabad, A.P, INDIA.
Mobile: +91-8978804123
Email: ijournals@semargroup.org, ijournals@ijmeaatr.org.
Website: www.semargroup.org, www.ijmeaatr.org.

RAMESH CHOWDARY. G
MANAGING EDITOR

01-11-2014

PAPER   ID: SG-IJSETRV03IS16P3030

L.Rajamohan,
PG Scholar,
Department of Mechanical Engineering,
HITAM, Hyderabad, India.

Dear Author

This is to inform you regarding the selection of your paper entitled **"Comparative Analysis of Mechanical Properties of Jute Fiber Reinforced with E-Glass using Epoxy and Semi-Rigid Epoxy Material"** after peer review in refereed International Journal of Mechanical Engineering and Advanced Automotive Technology Research, **ISSN 2348-2370, Volume No.03, Issue No.02, November-2014.** This issue published by the **SEMAR GROUPS.**

The hard copy of the journal shall be delivered to you soon after its release.

Please communicate to us for any further queries.

Regards,

Ramesh Chowdary.G
Managing Editor
SEMAR GROUPS
Hyderabad, A.P, INDIA.
Mobile: +91-8978804123
Email: ijournals@semargroup.org, ijournals@ijmeaatr.org.
Website: www.semargroup.org, www.ijmeaatr.org.

RAMESH CHOWDARY. G
MANAGING EDITOR

01-11-2014

PAPER   ID: SG-IJSETRV03IS16P3029

V. Madhusudhan reddy,
PG Scholar,
Department of Mechanical Engineering,
HITAM, Hyderabad, India.

Dear Author

   This is to inform you regarding the selection of your paper entitled **"Influence of Cutting Fluids on The Carbide Tool Life in Milling Operation"** after peer review in refereed International Journal of Mechanical Engineering and Advanced Automotive Technology Research, **ISSN 2348-2370, Volume No.03, Issue No.02, November-2014.** This issue published by the **SEMAR GROUPS.**

The hard copy of the journal shall be delivered to you soon after its release.

Please communicate to us for any further queries.

Regards,

Ramesh Chowdary.G
Managing Editor
SEMAR GROUPS
Hyderabad, A.P, INDIA.
Mobile: +91-8978804123
Email: ijournals@semargroup.org, ijournals@ijmeaatr.org.
Website: www.semargroup.org, www.ijmeaatr.org.

Structural and Optical Studies of Pure and TICI Doped Poly (Vinyl Alcohol) Polymer Electrolyte Films

C. Anuradha
Department of physics
Methodist college of engineering & Technology
Hyderabad,Telangana State, India.

G. Anil Kumar
Department of physics
Osmania University
Hyderabad, Telangana State, India.

M. V. Ramana Reddy
Department of physics
Osmania University
Hyderabad, Telangana State, India.

K. Narasimha Reddy
Department of physics
Osmania University
Hyderabad, Telangana State, India

Abstract— Poly (vinyl alcohol) (PVA) is a water-soluble amorphous/crystalline polymer that is widely used in protective coating, biomedical and optical materials, orbents and membranes. In the present investigation, an attempt has been made to characterize the polymer electrolytes based on Poly(vinyl alcohol) (PVA) complexed with thallium chloride(TlCl) at different weight percentage ratio. Solid polymer electrolyte films based on poly(vinyl alcohol) complexed with TlCl were prepared using solution cast technique. The structural properties of these films were examined by XRD. The XRD results show that the amorphous domains of PVA matrix increased in the composite films. In FTIR spectra, changes are noticed in the C-H stretching vibrational mode at 2900 cm^{-1} of PVA along with disappearance of few bands and the appearance of new bands. Morphological studies show that as the percentage of TlCl concentration exceeds that of host concentration, the TlCl gets aggregates on the surface of the film, increasing the surface roughness. The optical parameters including the energy band gaps (direct and indirect) and absorption edge are investigated. It is observed that direct and indirect band gaps (Direct band gap from 5.12-4.80 eV and indirect band gap from 4.82-4.67 eV) show a decreasing trend on complexing.

Keywords— Poly vinyl alcohol, thallium chloride, XRD, FTIR, SEM, Optical absorption, Absorption edge, Energy gap.

I. INTRODUCTION

Polymers have gained much experimental attention due to their unique properties, such as low density, ability to form intricate shapes, versatile electric properties and low manufacturing cost [1]. The physical properties of these polymer materials can be enhanced by incorporating filler into its matrix, because dispersed filler will improve various physical properties of the host polymer [2]. Poly (vinyl alcohol) (PVA) is a water-soluble amorphous/crystalline polymer that is widely used in protective coatings, biomedical and optical materials, orbents and membranes [3]. In the present investigation, an attempt has been made to characterize the polymer electrolytes based on Poly (vinyl alcohol) (PVA) complexed with thallium chloride (TlCl) at different weight percentage ratio.

II. MATERIALS AND METHOD

Films of pure PVA and various compositions of complexed films of PVA with TlCl salt were prepared in weight percent ratios (80:20), (60:40) and (40:60) by solution cast technique using double distilled water as solvent. The solution was stirred for 12hrs to get homogeneous mixture and then casted on polypropylene dishes and kept in hot air oven for 12hrs at a temperature of 40°C. The films thus formed were stored in desiccators. The XRD pattern of the films was recorded with a 'X' pert x-ray diffractometer at room temperature. The FITR spectra of these films were recorded using Bruker tensor-27 spectrometer with a resolution of 4 cm^{-1}. The measurements were taken over a wave number range 400-4000 cm^{-1}. The surface morphology of these polymer electrolyte films have been observed using JEOL JSM 840A scanning electron microscope. The optical absorption spectra of the present samples were recorded at room temperature using Shimadzu UV-VIS-NIR in the wavelength range 300-900nm with a spectral width of 3nm.

III. RESULTS AND DISCUSSION

A. XRD Analysis

The X-ray diffraction pattern of pure PVA, TlCl salt and PVA complexed with TlCl are shown in Fig.1. The XRD pattern of pure PVA reveal that a broad peak is appearing at scattering angle $19^o < 2\theta < 20^o$, corresponding to a 'd' spacing of 0.457 nm. The pure PVA characteristic peak becomes less intense as the TlCl content in the composite is increased. This could be due to disruption of PVA crystalline structure by TlCl. The diffraction peaks associated with PVA has disappeared in 80:20 composite and reappeared again when TlCl present is increased in PVA films. This shows a decrease in the degree of crystallinity of the polymer after the addition of higher concentrations of TlCl. The increase in the composition of TlCl in PVA, results in increase in the amorphous nature of the composite films. Higher and broader peaks are obtained in the case of 60:40 compositions indicating greater accumulation of atoms at lattice sites, creating greater lattice distortion.
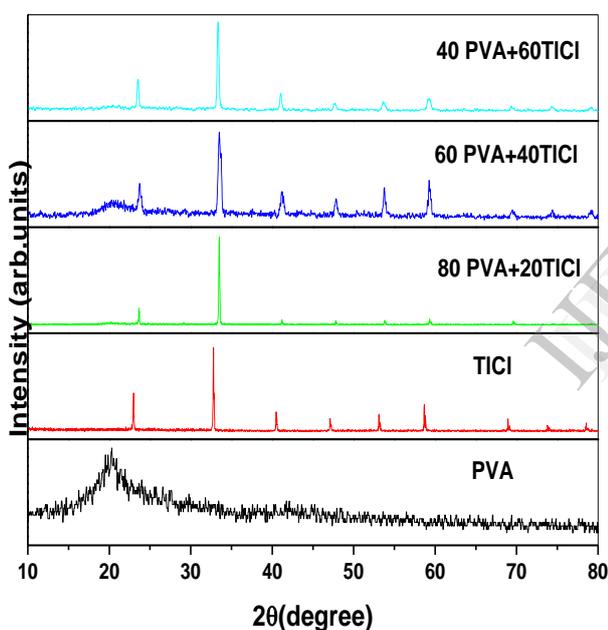

Fig. 1: XRD pattern of Pure PVA and PVA/TlCl films.

B. FTIR

The FTIR spectra for pure PVA, TlCl and PVA : TlCl composites of different compositions are shown in the fig2. The following changes in the spectral features have been observed after comparing the spectrum of PVA : TlCl composites. Changes are noticed in the C-H stretching vibrational mode at 2900 cm^{-1} of PVA along with disappearance of few bands and the appearance of new bands. The inter molecular hydrogen bonded O-H stretching frequency of PVA appearing in the range of 3590 cm^{-1} is shifted to 3507 cm^{-1}. In PVA : TlCl (60:40) composition and at higher compositions of PVA : TlCl (40:60), this band

appears at 3175 cm^{-1}. The C-H bonding of CH$_2$ in pure PVA exhibits absorption at 1474cm^{-1} and is shifted to 1418cm^{-1}and 1439^{-1} in (80:20) and (40:60) compositions respectively.

C. SEM

Fig 3 (a,b,c) shows the SEM pictures of the surface of PVA : TlCl(80:20); PVA : TlCl (60;40)and PVA : TlCl (40:60) films of different magnification respectively. These pictures show not many aggregates on the surface of the films.The increase in degree of roughness with increased TlCl concentration, indicates, the presence of the dopant which is completly complexd with the polymer. As the percentage of TlCl exceeds that of the host concentration the TlCl gets aggregates on the surface of the film increasing the surface roughness.
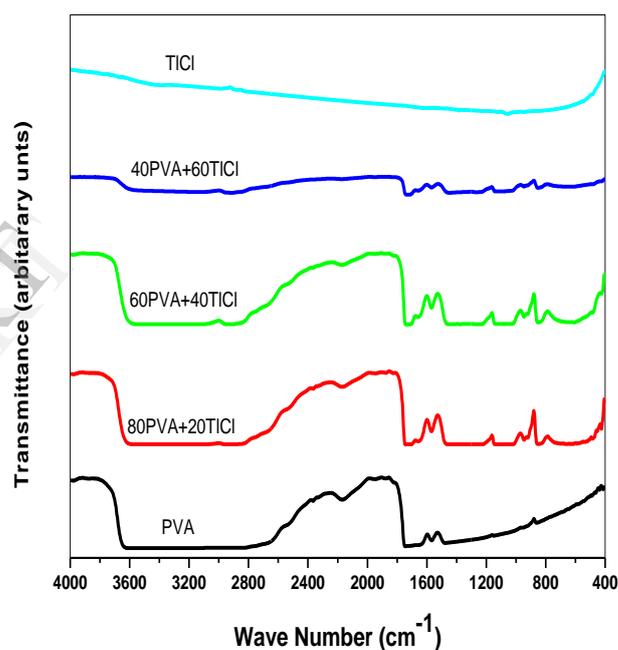

Fig. 2: FTIR spectra of Pure PVA, TlCl salt and PVA/ TlCl polymer films.

D. Optical Absorption Studies

The optical absorption (OA) studies are very interesting because it provides important information about the absorbance, transmittance and reflectance of the observed polymeric films [4].The optical absorption and especially the absorption edge presents a useful method for the investigating optically induced transitions and for getting information about the band structure, the band tail and energy gap of the polymeric materials under consideration [5]. By studying the optical absorption spectrum, one can clearly identify its band structure [6-8]. The absorption coefficient α(ν) can be estimated from the optical absorption spectrum from the following equation [9].

$$\alpha(\nu) = 2.303 \times A / d \qquad ....(1)$$

where 'd' is the film thickness in cm and 'A' is defined by log (I/I$_o$) where I$_o$ and I are the intensities of the incident and

transmitted beams respectively.

Regarding the optical transitions resulting from photons of energy $h\nu > E_{opt}$, the present optical data is studied according to the following relationship for near edge optical absorption [10].

$$\alpha(\nu)h\nu = B(h\nu - E_{opt})^r \quad ....(2)$$

where 'α' is the absorption coefficient , ν is the frequency, B is the constant, h is the Planck's constant, E_{opt} is the optical energy band gap between the valence and conduction bands and r is the power that characterizes the transition process. Here 'r' takes the values of 1/2, 3/2, 2 and 3 for transitions designated as direct allowed, direct forbidden, indirect allowed and indirect forbidden respectively [5]. The determination of the
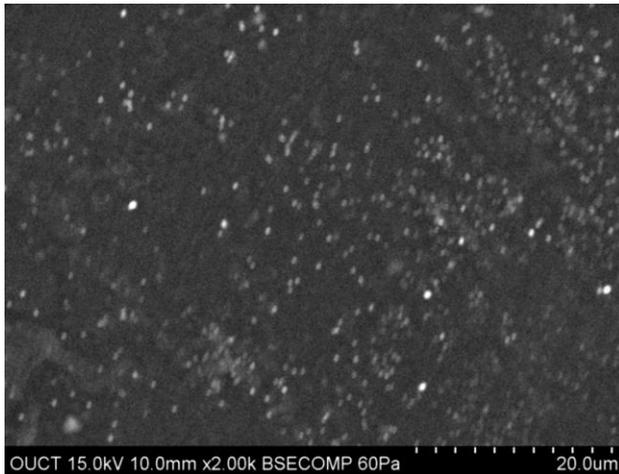

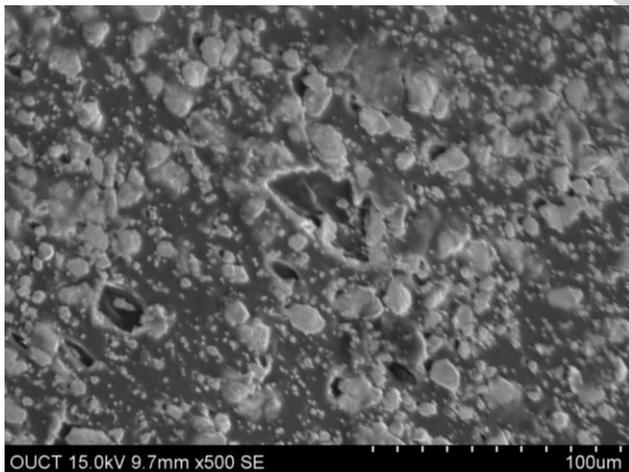Fig 3 (a): SEM picture of PVA/TlCl (80:20)

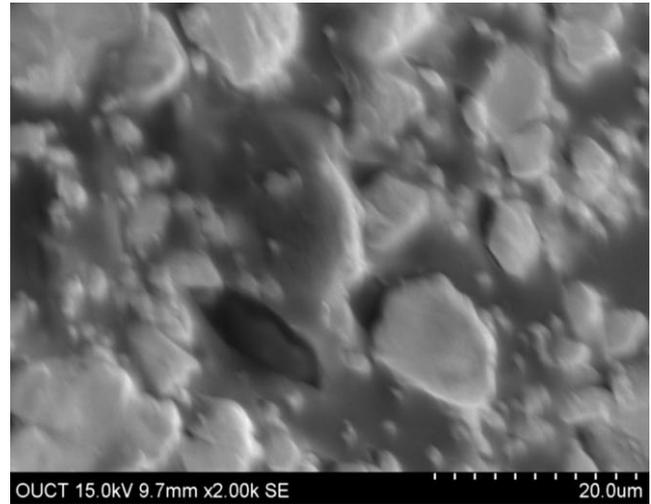

Fig 3 (b): SEM picture of PVA/TlCl (60:40)

Fig 3(c): SEM picture of PVA/TlCl (40:60)

value of the optical energy band gap E_{opt} is done by plotting $(\alpha h\nu)^{1/r}$ against $h\nu$.
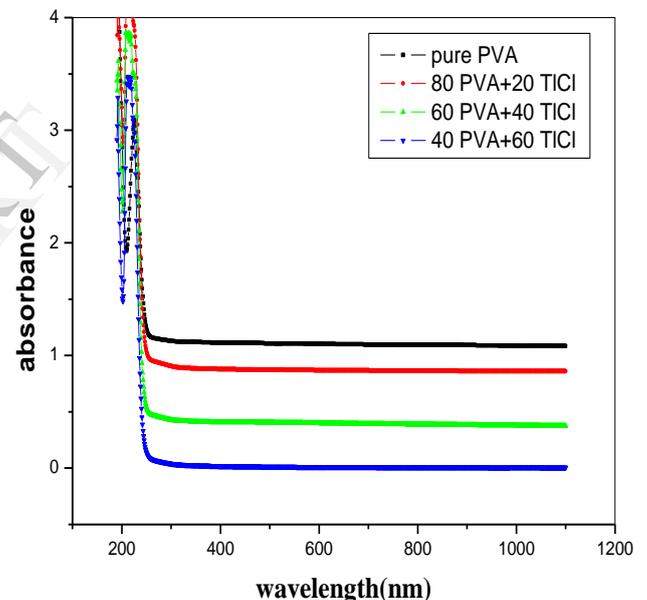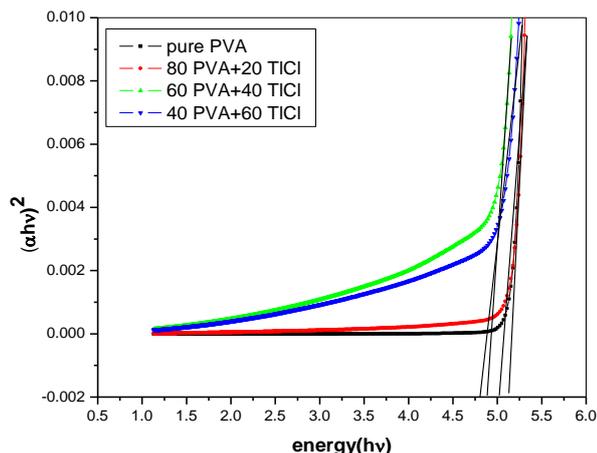

Fig. 4: OA spectra of Pure and TlCl complexed PVA films

The OA spectrum of pure PVA, PVA complexed with different concentrations of TlCl are shown in fig.4. The OA spectrum of pure PVA is characterized by an absorption peak at wavelength 283nm as well as unresolved shoulder at 330nm. No absorption peaks are noticed at higher wavelengths. The absorption peak at 283nm can be attributed to the absorption by simple carbonyl groups along the polymer chains. On the other hand shoulder can be assigned to the appearance of the $-CO-(CH=CH)_3-$groups (5).

Fig. 5(a): Plot of $(\alpha h\nu)^2$ versus photon energy (hν) for PVA:TlCl
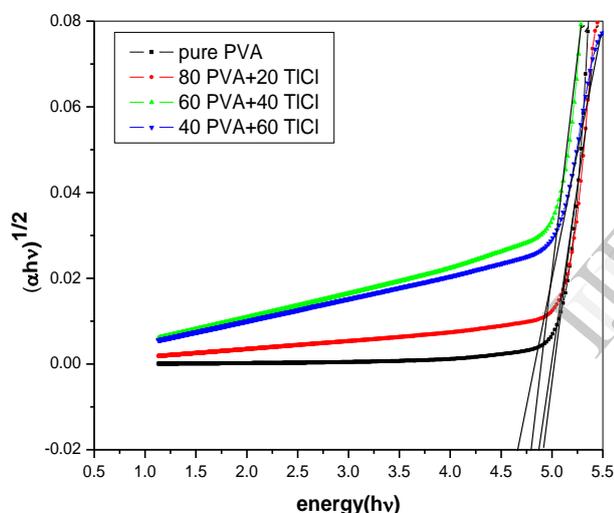
Fig. 5(b): $(\alpha h\nu)^{\frac{1}{2}}$ versus photon energy (hν) for PVA:TlCl

The addition of TlCl to PVA matrix shows no substantial change in 283 nm peak but the shoulder which appeared in pure PVA has disappeared on addition of TlCl. There is a decrease in UV absorption in the case of PVA/TlCl films. The fundamental band edge, both direct and indirect transitions can be observed by plotting $(\alpha h\nu)^2$ and $(\alpha h\nu)^{1/2}$ versus photon energy hν. These plots are shown in fig 5. These plots present experimental data near the absorption edge and give a linear fit in the high energy range. The intercept on the energy axis on extrapolating the linear portion of the curves to zero absorption value may be interpreted as the value of band gap. The values of experimental band gaps of pure PVA and PVA complexed with TlCl are listed in table 1.

TABLE 1: Absorption edge and Band Gap for PVA films complexed with TlCl.

Polymer		Absorption edge (eV)	Band gap (eV)	
			Direct	Indirect
PVA	-	5.02 (247 nm)	5.12	4.82
PVA: TlCl	90:10	4.94 (251 nm)	5.02	4.79
	80:20	4.77 (260 nm)	4.85	4.71
	70:30	4.65 (267 nm)	4.80	4.67

It is clearly evident from the table that both the direct and indirect band gap show decreasing trend on complexing. The decrease in optical band gap energies with increase in the TlCl concentrations respectively explains the fact that the addition of TlCl increases the disorder of these films. The increase in the degree of the disorder causes the band tail to increase. The decrease in band gap on increasing the TlCl content in PVA matrix also indicates that there are charge transfer complexes which arise between the PVA and TlCl molecule.

IV. CONCLUSIONS

The complexation of the salt with polymer is confirmed by XRD and FTIR studies. The morphological studies of pure PVA and (PVA:TlCl) polymer electrolyte at different weight percentage is done using SEM. The optical band gap is evaluated and its dependence on filling was investigated. The decreasing trend of the optical band gap with increase in TlCl concentration is attributed to the charge transfer complexes.

REFERENCES

[1]. A.El-Khodary, A.h.Oraby and M.M.Abdelnaby,"Characterization, electrical and magnetic properties of PVA films filled with FeCl3- MnCl$_2$ mixed fillers, Journal of magnetism and magnetic materials 320, 1739-1746 (2008).
[2]. V.Raja, A.K.Sarma and V.V.R.Narsimha Rao, "Optical properties of pure doped PMMA-Co-P4VPNO polymer films", 57 (30), 4678-4683 (2003).
[3]. M.E.Rozenberg, Polyvinyl Acetate based polymers [in Russia], Khimiya, Leningrad (1983).
[4]. P.Balaji Bhargav, V.Madhu Mohan, A.K.sharma and V.V.R.Narsimha Rao, International Journal of Polymer materials, 56, 579 (2007).
[5]. A.El.Khodary, Phsica B:Condensed Matter, 405(16) , 4301 (2010)
[6]. M.Tabata, M.Satoh, K.Kaneto and Yoshino, J.Phys.Soc.Japn, 55, 1305 (1986).
[7]. S.Proneanu, S.Torcu, M.Brie and Mihileasan, Mater.Sci.Fourum 191 (1995).
[8]. W.A.Jabbar, N.F.Habubi and S.S.Chiad, J.Arkansas Academy of Sci, 64, 101 (2010).
[9]. J.Ballato and S.Foulger, "Optical properties of Perfluocydobutyl polymers",Journal of Optical Society of America B, 20(9), 1838-1843 (2003).
[10]. J.Tauc, A.Menith and D.N.Wood, Physical review letters, 25(11), 749 (1970).

search this site

An Intelligent Way to Generate and Track Traffic Challans with the Power of ML and IoT

Abstract

Nowadays due to growing population the use of vehicles on roads has been increased randomly. Due to fast moving life violating traffic rules has become common. This paper presents an idea of automation of detecting helmet and car seat belt using machine learning with image processing and internet of things (IOT). The proposed approach first classifies the different objects passing through the junction using surveillance cameras and then verifies whether the biker is wearing helmet or the car driver is wearing seat belt or not. Based on the result the message regarding fine will be sent to the concerned object rider registered mobile number. In addition the proposed paper also classifies the different types of car number plates to have a record with RTO about the number of cars.

<< BACK

GIJET

TITLE:
GRENZE International Journal of Engineering and Technology

EDITOR IN CHIEF:
Dr. Janahanlal Stephen (Matha College of Technology, India)

ISSN:
2395-5295(Online); 2395-5287(Print)

FREQUENCY:
Twice Yearly

ASSOCIATED PUBLISHER:
GRENZE

RELATED SUBJECTS:
Computer Science & Engineering, Electrical & Electronics Engineering, Mechanical Engineering, Civil Engineering

RESEARCH GROUP:
GRENZE Engineering Group

INDEXING:

OFFICIAL WEBSITE:
http://gijet.thegrenze.com/

Research Article

Determination of the Solidification Time of Al-7%Si Alloy during Centrifugal Casting

P.Shaliesh[Á*], B. Praveen Kumar[Á], K Vijaya Kumar[c] and A Nagendra[Á]

[Á]St. Peters Engineering College,Kompally, Hyderabad, A.P, India.
[B]National Institute of Technology Warangal, A.P, India.

Abstract

The present work deals with an experimental and a theoretical investigation to determine the solidification time of cast components produced by centrifugal casting methods with different speeds. Al-7% Si alloy is considered in the present investigation at different pouring temperatures and rotational speeds. Solidification times are measured and a suitable mathematical formulation to estimate the freezing time is proposed. In the present work a horizontal axis centrifugal casting is studied both experimentally and numerically. Polar coordinate system is considered during the analysis and numerical investigation. Temperature dependent properties of aluminium alloy are taken into consideration for estimation of the solidification time. Radiative heat transfer from the outer surface of rotating cast iron mould is also taken into account along with convective heat transfer. The results are presented in both tabular and graphical from and comparisons made.

Keywords: Al-Si Alloy, Centrifugal Casting, Solidification Time.

1. Introduction

Centrifugal casting is extensively used for many applications of components made out of Aluminum alloys. The products made by centrifugal casting have better integrity than the components made by permanent mould Casting Process. A casting machine rotates the mould about a horizontal axis. Al-Si alloy at about 720°C and 780°C is fed into the mould through a pouring spout. As the liquid Al-Si alloy comes into contact with the mould it is spread centrifugally over the surface and then freezes. During this time heat is conducted between the outside surface of the mould and hot Al-Si alloy as shown in pro E-model and linear diagram in fig 1 and fig 2.
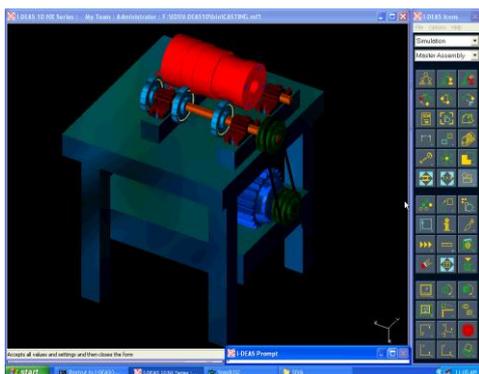

Fig 1: Horizontal Centrifugal Casting Pro-E Model

*Corresponding author: **P.Shaliesh**

The internal surfaces of the metal moulds used in horizontal centrifugal casting are usually coated with a thin layer of insulating material before they come in contact with poured liquid metal. In this study analysis was made on Al-Si (4450 of IS 617:1975) for the radial temperature distribution with in the mould and molten method are utilized in estimating the solidification time. The solidification time behavior of a tubular part for centrifugal casting is influenced by various parameters like nature of the alloy, shape and size of the casting and thermo-physical properties of metal and mould. (Roshan *et.al 1974),* (Bahadori*et.al* 1971)
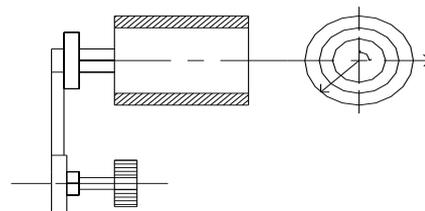
Fig: 2 Graphical diagram Horizontal Centrifugal Casting

The numerical simulation of this process is challenging, no description of its numerical simulation was found in literature. Some papers describe the less complex vertical centrifugal casting process (Kaschinitz *et.al*, 2012).
Though an exhaustive literature survey it is understood that very little work was carried on the estimating of freezing time on centrifugal casting of Aluminum alloys. There are several theoretical and experimental

investigations that involve the determination of the solidification time of aluminum alloys in casting area. Some of the important contributions in this area have been presented here to give the current state of ar (Jezierski.J *et.al* 1970) (Lazardis.A *et al*1970).

A numerical solution is obtained for the solidification of a steel casting in a thermally insulated mould. The effect of the rate of metal pouring on the motion of the solidification interface is investigated. An experimental and numerical model on the time varying heat transfer coefficient h(t) between a tube-shaped casting and metal moulds. One-dimensional treatment was adopted in analyzing the heat flows between the casting and the inner and the outer mould (Tae-Gyu Kim *et.al* 1997) (Minosyan Ya P *et.al* 1983)

2. Experimental Investigations

A mathematical model for a Horizontal Centrifugal Casting for 4450 (Al-6.5-7.5%Si) alloy has been developed using a polar co-ordinate system. The average properties of the material are taken in the appropriate temperature range. Specific heat, density and thermal conductivity values are averaged for solid and molten metals. The radial temperature distribution with in the mould and molten metal are utilized in estimating the freezing time. In the estimation of heat transfer conduction in polar coordinate system, average values of air temperature are assumed to be about 35°C which represents a typical foundry environment. A program has been developed that can take a variety of casting conditions normally prevalent in foundry practice. The output from the program that runs iteratively gives typical freezing time based on specific inputs. The mathematical formulation for a general situation is given in the following sections. The casting conditions along with the assumptions made while preparing the code are clearly stated as and when necessary. Variable temperature dependant properties like thermal conductivity, specific heat and density are appropriately taken into consideration. The program can be run for various input conditions. Change of these input conditions can be made easily through modifying the input data file. The numerical code automatically opens a file and the data generated will be stored in it, when the program terminates.

3. Mathematical Formulation

The governing equation for heat conduction in the radial direction in cylindrical polar coordinates is:

$$\rho C_p \frac{\partial T}{\partial t} = \frac{1}{r} \frac{\partial}{\partial r}\left(\lambda r \frac{\partial T}{\partial r}\right) \tag{1}$$

This equation can be applied to the mould material. In the effective specific heat methods, the same equation is applied to the liquid and solid parts of the metal also with the appropriate values of the density, specific heat and thermal conductivity, with the solid and liquid parts distinguished based on the temperature. In the mushy zone of an alloy, between the solidus and liquids

temperatures, the density, specific heat and thermal conductivity are approximated as follows:

$$\rho = \frac{\rho s + \rho l}{2} ; \quad C_p = \frac{\Delta h_{sl}}{2\Delta T} + \frac{C_{ps} + C_{pl}}{2} ; \quad \rho = \frac{\lambda_s + \lambda_l}{2} \tag{2}$$

where ρh_{sl} is the latent heat of solidification and ρt is one-half of the mushy zone temperature width. For pure metal solidification, ρT is prescribed to be a very small quantifies, say 0.5°C.

At the linear surface of the metal at r = R_3, the heat loss to the rotating mass of air will be very small and hence can be neglected. Accordingly, the boundary condition is $\partial T/\partial r=0$ at r = R_3.

At the outer surface of the mould, the boundary conditions is $-\rho_m \partial T/\partial r = \rho(T-T_{amb})$, where T_{amb} is the ambient air temperature assumed here to be 35°C.

The heat transfer coefficient ρ is the sum of a mixed convection part ρ_{mc} and a radiation part ρ_r.

The quantity ρ_{mc} is calculated using the Dropkin-Carmi relation Nu = 0 0.19(Re^2+Gr)$^{0.35}$. In this equation, the Reynolds number Re is $D_4^2\rho/\rho_{air}$ where $D_4 = 2R_4$ is the mould outer diameter, $\rho = (2\rho/N)/60$ is the angular speed of casting and ρ_{air} is the kinematic viscosity of air. The Nusselt number is defined as $\rho_{mc}D_4/\rho_{air}$. The Grashoff number is defined as Gr = $g\rho_{air}(T_{m,o}-T_{amb})$ D_4^3/ρ^2_{air}. The properties are to be calculated at the mean temperature between $T_{m,o}$ and T_{amb}. Thus, they are to be calculated often as $T_{m,o}$ will be changing. The quantity ρ_r is given by $\rho \rho(T_{m,o}+273.15)^4 - (T_{ss}+273.15)^4 / (T_{m,o}-T_{ss})$, where T_{ss} is the temperature of the surrounding surfaces in $^{\circ}$C. However, T_{ss} is assumed to be the same as T_{amb} for simplicity. The emissivity ρ of the mould outer surface is taken as 0.8. In the range of speeds 900-1440 rpm, the Reynolds number Re will be typically 70000-112000 and the Grashoff number Gr will be 2.5×10^7. The mixed convection heat transfer coefficient will be typically 70 W/(m^2.$^{\circ}$C), the radiation heat transfer coefficient will be 40 W/(m^2.C) and the total heat transfer coefficient will be about 100 W/(m^2.C). Note that radiation contributes to about 35% of the total heat transfer coefficient. Hence, radiation is not negligible.

At the interface between the metal and mould the heat flux continuity, namely, $-\rho\partial T_s/\partial r = -\rho_m\partial T_m/\partial r$, is applied, where the subscript m refers to mould and s refers to solid metal.

4. Numerical Formulation

The governing equation is discretised to yield:

$$\rho_i^{n+1,m}C_{p,i}^{n+1,m}\frac{T_i^{n+1,m+1} - T_i^N}{\Delta l}$$

$$\rho \frac{2}{r_i(\Delta r_{i-1} + \Delta r_i)}\left[\lambda_{i+1/2}^{n+1,m} r_{i+1/2}\frac{T_{i+1}^{n+1,m+1} - T_i^{n+1,m+1}}{\Delta r_i} - \lambda_{i+1/2}^{n+1,m} r_{i-1/2}\frac{T_i^{n+1,m+1} - T_{i-1}^{n+1,m+1}}{\Delta r_{i-1}}\right] \tag{3}$$

The above discretised equation can be written as:

$$A_i T_{i-1}^{n+1,m+1} + B_i T_i^{n+1,m+1} + C_i T_{i+1}^{n+1,m+1} = D_i \tag{4}$$

Where for i=2 to il (last grid point):

$A_i = -q.p_1; \quad B_i = 1 + q(p_1+p_2); \quad C_i = -q.p_2; \quad D_i = T_i^n;$

$$q = \frac{\Delta l}{0.5\rho_i^{n+1,m}C_{p,i}^{n+1,m} r_i(\Delta r_{i-1} + \Delta r_i)} ;$$

$$p_1 = \frac{0.5\left(\lambda_{i-1}^{n+1,m} + \lambda_i^{n+1,m}\right)0.5(r_{i-1} + r_i)}{\Delta r_{i-1}}$$

$$p_2 = \frac{0.5\left(\lambda_i^{n+1,m} + \lambda_{i+1}^{n+1,m}\right)0.5(r_r + r_{+1i})}{\Delta r_i} \quad (5)$$

At I = 1, i.e., the metal inner radius:

$A_i = o$; $B_i = 1.0$; $C_i = -1.0$.   (6)

At i = ii∫, i.e., the metal-mould interface radius;

$A_i = -\rho_s$, $\rho r_{ii}∫$;

$B_i = \rho_s$, $\rho r_{ii∫} + \rho_m$. $\rho r_{ii∫-1}$;

$C_i = \rho_m$. $\rho r_{ii∫-1}$;

$D_i = 0$ (7)

At I = il, i.e., the mould outer interface radius:

$A_i = -1.0$;

$$B_i = \left(1 + \frac{\alpha.\Delta r_{il-1}}{\lambda_m}\right)$$

$C_i = 0$;

$$D_i = \frac{\alpha.\Delta r_{il-1}}{\lambda_m}.T_{amb}. \quad (8)$$

The quantity ρr_i is defined as $r_{i+1} - r_i$. Here n+1 is the new time step and m+1 is the new iteration at the same time step. Sufficient number of iterations (ten) are performed at every time step for proper evaluation of the properties and non-linear boundary condition involving radiation and mixed convection. At every iteration of a time step the solution is obtained using the tridiagonal matrix algorithm.The initial temperature of the mould is assumed to be 35°C and the initial temperature of the melt is as prescribed. The solidification time is the time when the inner surface temperature of metal falls just below the solidus temperature.

5. Results and Discussion

A suitable mathematical model for a Horizontal Centrifugal Casting of 4450 (A1-6.5-7.5% Si) alloy has been developed. A detailed computer programme is written in FORTRAN 77 in cylindrical polar coordinates.
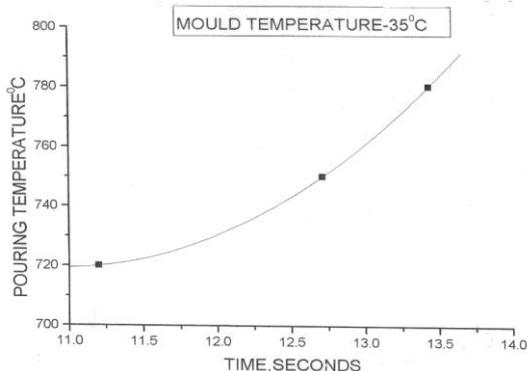

Fig. 3 shows pouring temperature Vs Time (Sec) at 35° C mould temperature

A number of numerical experiments were conducted using the developed code in a wide range of parameters and for three pouring temperatures and two different speeds. The pouring temperatures were taken as 720°C, 750°C and 780° C respectively. The two speeds at which the molten metal was poured are 900 and 1440 rpm. In the present study, cylindrical shell Horizontal Centrifugal Casting mould having an internal diameter of 50.88 mm and a wall thickness 36 mm is considered. Parameters chosen in a wide range cover the large variations in thermal properties of mould material and cast material the convective heat transfer coefficient and radiative heat transfer coefficient. The results of the numerical solution were presented in the preceding sections. A graphical representation of variation in the freezing time as a function of pouring temperature is shown in Fig.3, Fig.4, and Fig5.
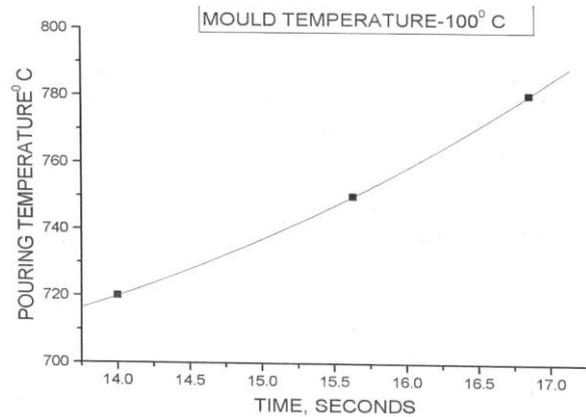
Fig. 4. Shows pouring temperature Vs Time (Sec) at 100°C mould temperature

Normally centrifugal casting process is a continuous process wherein the mould temperature will not be at room temperature. It is expected that the mould temperature will be around 100°C which would increase the freezing time considerably. The solidification time typically is of the order of 15 seconds. When the mould reaches the working temperature.

Fig. 5 Shows pouring temperature Vs Time (Sec) at 200° C mould temperature

The time temperature variation in the mould wall and solidification time for horizontal centrifugal casting of 4450 Al-7% Si Alloy were arrived at

- When the pouring temperature is at 720°C and the mould temperature is 35°C the freezing time is less i.e., at the solidus point. Whereas when the pouring temperature is increased to 780°C and the mould

temperature is 35°C there is a obvious rise in the solidification time.
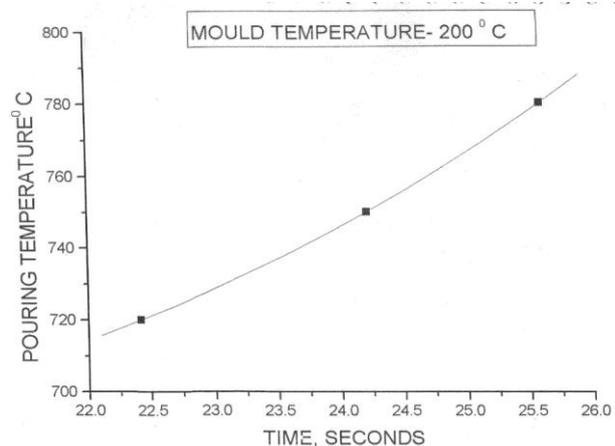
- When the mould temperature is at 35°C and the pouring temperature is 720°C. the freezing time is 11.2 seconds at the solidus point. When the mould temperature is increased to 100°C while the pouring temperature is maintained at 720°C the freezing time increases to 15 seconds. Similarly when the mould temperature reaches 200°C for the pouring temperature of 720°C the freezing time further increases to 22.42 seconds.
- It has been observed that there is no rise in the solidification time when the rotation speed of the mould increases from 900 rpm to 1440 rpm.
- There is a good agreement between the numerical results and the experimentally observed values.
- The rate of heat extracted at any instant of time will be less in thin walled moulds than in thick walled moulds due to the heat capacity associated with the mould materials.
- The freezing time is found to be independent of the rotational speed of the Mould in the range considered in the present investigation.
- As the rotational speed of the mould increases the convective heat transfer coefficient on the External surface also increases, because the Reynolds number increases. As a consequence the cooling rates increases as a function of Reynolds number. This results in the reduced solidification time of the Molten Metal. The speed of the Mould as such will not have a great influence on the freezing time for the reason that the density of the molten metal does not change considerably. There may be a perceivable change in the freezing time at very high speeds such that the centrifugal force causes a change in the density of the molten metal. As these speeds are beyond the scope of present investigations the data is insufficient to make a firm conclusion in this regard.

6. Conclusions

Heat transfer analysis is carried out through FORTRAN programme indicated that

1. With increase in the preheat temperature of the die cast mould the thickness of the solidification layer is get reduced while preheating is desirable to remove the hot cracking tendency of the alloy. The same is not desirable from the mechanical strength point of view.
2. Freezing time of molten metal in centrifugal casting is a strong function of mould temperature as well as the pouring temperature.
3. The freezing time is completely independent of the rotational speed of the mould in the range considered in the present investigation.
4. The predictive capabilities of the numerical code developed for the present work is established by comparing numerical results with that of experimental values.

References

H.Md. Roshan, (1947), Analytical Solution to the Heat Transfer in Mould walls during solidification of metals, AFS *Cast Metals Research Journal*, pp 39-47.

Bahadori M.N (1971), Control of Solidification Rate by Application of Heat Pipe Principle,*Cast Metals Research Journal*, pp.62-66.

E Kaschnitz (2012) Numerical simulation of centrifugal casting of pipes IOP Conf. Series: Materials Science and Engineering33012031.

Jezierski J(1970), Analysis of the State of Thermal Stress in Moulds during Centrifugal Casting, *AFS Cast Metals Research Journal*, pp.75-79.\

LazardisA (1970), Thermal Analysis of Centrifugal Casting Moulds, *AFS Cast Metals Research Journal*, pp.153-160.

Tae-Gyu Kim (1997), Time Varying Heat Transfer Coefficients between Tube Shaped Casting and Metal Mould, *Pergamon*, pp.3513-3525.

Minosyan Ya P (1983), Mathematical Simulation of Centrifugal Casting of Pipes, *Heat Transfer Soviet Research Journal*, pp.134-140.

A NEAR-DUPLICATE DETECTION ALGORITHM TO FACILITATE DOCUMENT CLUSTERING

Lavanya Pamulaparty[1], Dr. C.V Guru Rao[2] and Dr. M. Sreenivasa Rao[3]

[1]Department of CSE, Methodist college of Engg. & Tech., OU, Hyderabad
[2]Department of CSE, S R Engineering College, JNT University, Warangal
[3]Department of CSE, School of IT, JNT University, Hyderabad

ABSTRACT

Web Ming faces huge problems due to Duplicate and Near Duplicate Web pages. Detecting Near Duplicates is very difficult in large collection of data like "internet". The presence of these web pages plays an important role in the performance degradation while integrating data from heterogeneous sources. These pages either increase the index storage space or increase the serving costs. Detecting these pages has many potential applications for example may indicate plagiarism or copyright infringement. This paper concerns detecting, and optionally removing duplicate and near duplicate documents which are used to perform clustering of documents .We demonstrated our approach in web news articles domain. The experimental results show that our algorithm outperforms in terms of similarity measures. The near duplicate and duplicate document identification has resulted reduced memory in repositories.

KEYWORDS

Web Content Mining, Information Retrieval, document clustering, duplicate, near-duplicate detection, similarity, web documents

1. INTRODUCTION

The WWW is a popular and interactive medium to disseminate information today. Holocene epoch has detected the enormous emergence of Internet document in the World Wide Web. The Web is huge, diverse, and dynamic and thus raises the scalability, multimedia data, and temporal issues respectively. Due to these situations, we are currently drowning in information and facing information overload [1]. In addition to this, the presence of duplicate and near duplicate web documents has created an additional overhead for the search engines critically affecting their performance [2]. The demand for integrating data from heterogeneous sources leads to the problem of near duplicate web pages. Near duplicate data bear high similarity to each other, yet they are not bitwise identical [3] [4] but strikingly similar. They are pages with minute differences and are not regarded as exactly similar pages. Two documents that are identical in content but differ in small portion of the document such as advertisement, counters and timestamps. These differences are irrelevant for web search. So if a newly-crawled page Pduplicate is deemed a near-duplicate of an already-crawled page P, the crawl engine should ignore Pduplicate and its entire out-going links (intuition suggests that these are probably near-duplicates of pages reachable from P) [4, 35]. Near Duplicate web pages from different mirrored sites may only differ in the header or footnote zones that denote the site URL and update time [5].

Duplicates and Near Duplicate Web pages are creating large problems for web search engines like they increase the space needed to store the index, either slow down or increase the COST of saving results and annoy the users [34]. Elimination of near-duplicates saves network bandwidth, reduces storage costs and improves the quality of search indexes. It also reduces the load on the remote host that is serving such web pages [10].

The determination of the near duplicate web pages [28-29] [21] aids the focused crawling, enhanced quality and diversity of the query results and identification on spam. The near duplicate and duplicate web page identification helps in Web mining applications for instance, community mining in a social network site [20], plagiarism detection [24], document clustering [29], collaborative filtering [30], detection of replicated web collections [31] and discovering large dense graphs [34]. NDD removal is required in Data Cleaning, Data integration, Digital libraries and electronic published collections of news archives. So in this paper, we propose a novel idea for finding near duplicate web pages from a huge repository.

2. RELATED WORK

The proposed research has been motivated by numerous existing works on and near duplicate documents detection. Duplicate and near-duplicate web pages are creating large problems for web search engines: they increase the space needed to store the index, either slow down or increase the cost of serving results, and annoy the users. This requires the creation of efficient algorithms for computing clusters of duplicates [4, 6, 7, 16, 21, 22, 29, 30]. The first algorithms for detecting near-duplicate documents with a reduced number of comparisons were proposed by Manber [25] and Heintze [17]. Both algorithms work on sequences of adjacent characters. Brin [40] started to use word sequences to detect copyright violations. Shiva Kumar and Garcia-Molina [31] continued this research and focused on scaling it up to multi-gigabyte databases. Broder et al [5] defined two concepts resemblance and containment to measure the similarity of degree of two documents. He used word sequences to efficiently find near-duplicate web pages.

The dimensionality reduction technique proposed by Charikar's Simhash [34] is to identify near duplicate documents which maps high dimensional vectors to small-sized fingerprints. They developed an approach based on random projections of the words in a document. Henzinger [9] compared Broder et al.'s [7] shingling algorithm and Charikar's [34] random projection based approach on a very large scale, specifically on a set of 1.6B distinct web pages.

In the syntactical approach we define binary attributes that correspond to each fixed length substring of words (or characters). These substrings are a framework for near-duplicate detection called shingles. We can say that a shingle is a sequence of words. A shingle has two parameters: the length and the offset. The length of the shingle is the number of the words in a shingle and the offset is the distance between the beginnings of the shingles. We assign a hash code to each shingle, so equal shingles have the same hash code and it is improbable that different shingles would have the same hash codes (this depends on the hashing algorithm we use). After this we randomly choose a subset of shingles for a concise image of the document [6, 8, and 9]. M. Henzinger [32] uses like this approach AltaVista search engine .There are several methods for selecting the shingles for the image: a fixed number of shingles, a logarithmic number of shingles, a linear number of shingle (every nth shingle), etc. In lexical methods, representative words are chosen according to their significance. Usually these values are based on frequencies. Those words whose frequencies are in an interval (except for stop- words from a special list of

about 30 stop-words with articles, prepositions and pronouns) are taken. The words with high frequency can be non informative and words with low frequencies can be misprints or occasional words.

In lexical methods, like I-Match [11], a large text corpus is used for generating the lexicon. The words that appear in the lexicon represent the document. When the lexicon is generated the words with the lowest and highest frequencies are deleted. I-Match generates a signature and a hash code of the document. If two documents get the same hash code it is likely that the similarity measures of these documents are equal as well. I-Match is sometimes instable to changes in texts [22]. Jun Fan et al. [16] introduced the idea of fusing algorithms (shingling, I-Match, simhash) and presented the experiments. The random lexicons based multi fingerprints generations are imported into shingling based simhash algorithm and named it "shingling based multi fingerprints simhash algorithm". The combination performance was much better than original Simhash.

3. ARCHITECTURE OF PROPOSED WORK

The paper proposed the novel task for detecting and eliminating near duplicate and duplicate web pages to increase the efficiency of web crawling. So, the technique proposed aims at helping document classification in web content mining by eliminating the near-duplicate documents and in document clustering. For this, a novel Algorithm has been proposed to evaluate the similarity content of two documents.
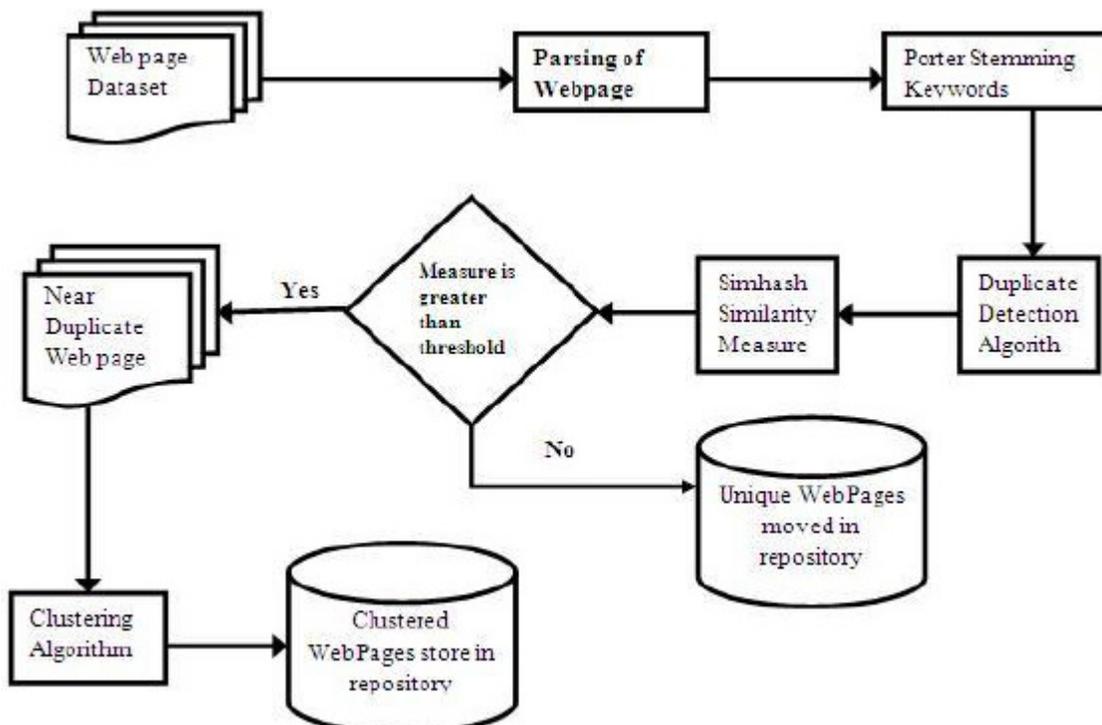

Figure 1. Proposed Architecture

3.1. Architectural Steps

Architectural steps which includes:(i)Web page Dataset Collection (ii) Pre-processing (iii)Store in database (iv) Rendering DD Algorithm (v)Verifying the similarity content (vi) Filtering Near Duplicates (vii) Refined Results

3.1.1. Dataset Collection

We have collected data using Wget, a software program that retrieves content from webservers and have gathered our data sets. Here, we have collected by giving some URLs of the news websites which usually have replicas, so we can get more number of web documents with relevant information. Wget can optionally work like a web crawler by extracting resources linked from HTML pages and downloading them in sequence, repeating the process recursively until all the pages have been downloaded or a maximum recursion depth specified by the user has been reached. The downloaded pages are saved in a directory structure resembling that on the remote server.

3.1.2. Parsing of Web Pages

Once a page has been crawled, we need to parse its content to extract information that will feed and possibly guide the future path of the crawler. Parsing might also involve steps to convert the extracted URL to a canonical form, remove stop words from the page's content and stem the remaining words [33]. HTML Parsers are freely available for many different languages. They provide the functionality to easily identify HTML tags and associated attribute-value pairs in a given HTML document.

3.1.3. Stop-listing

When parsing a Web page to extract content information or in order to score new URLs suggested by the page, it is often helpful to remove commonly used words or stop words such as "it" and "can". This process of removing stop-words from text is called stop-listing [26].

3.1.4. Stemming Algorithm

Stemming algorithms, or stemmers, are used to group words based on semantic similarity. Stemming algorithms are used in many types of language processing and text analysis systems, and are also widely used in information retrieval and database search systems [25]. A stemming algorithm is an algorithm that converts a word to a related form. One of the simplest such transformations is conversion of plurals to singulars, another would be the derivation of a verb from the gerund form (the "-ing" word). A number of stemming or conflation algorithms have been developed for IR (Information Retrieval) in order to reduce morphological variants to their root form. A stemming algorithm would normally be used for document matching and classification by using it to convert all likely forms of a word in the input document to the form in a reference document [22]. Stemming is usually done by removing any attached suffixes, and prefixes from index terms before the assignment of the term. Since the stem of a term represents a broader concept than the original term, the stemming process eventually increases the number of retrieved documents [23].

3.1.5. Duplicate Detection (DD) Algorithm

Step 1: Consider the Stemmed keywords of the web page.

Step 2: Based on the starting character i.e. A-Z we here by assumed the hash values should start with1-26.

Step 3: Scan every word from the sample and compare with DB (data base) (initially DB Contains NO key values. Once the New keyword is found then generate respective hash value. Store that key value in temporary DB.

Step 4: Repeat the step 3 until all the keywords get completes.

Step 5: Store all Hash values for a given sample in local DB (i.e. here we used array list)

Step 6: Repeat step 1 to step 6 for N no. of samples.

Step 7: Once the selected samples were over then calculate similarity measure on the samples hash values which we stored in local DB with respective to webpages in repository.

Step 8: From similarity measure, we can generate a report on the samples in the score of % forms. Pages that are 80% similar are considered to be near duplicates.
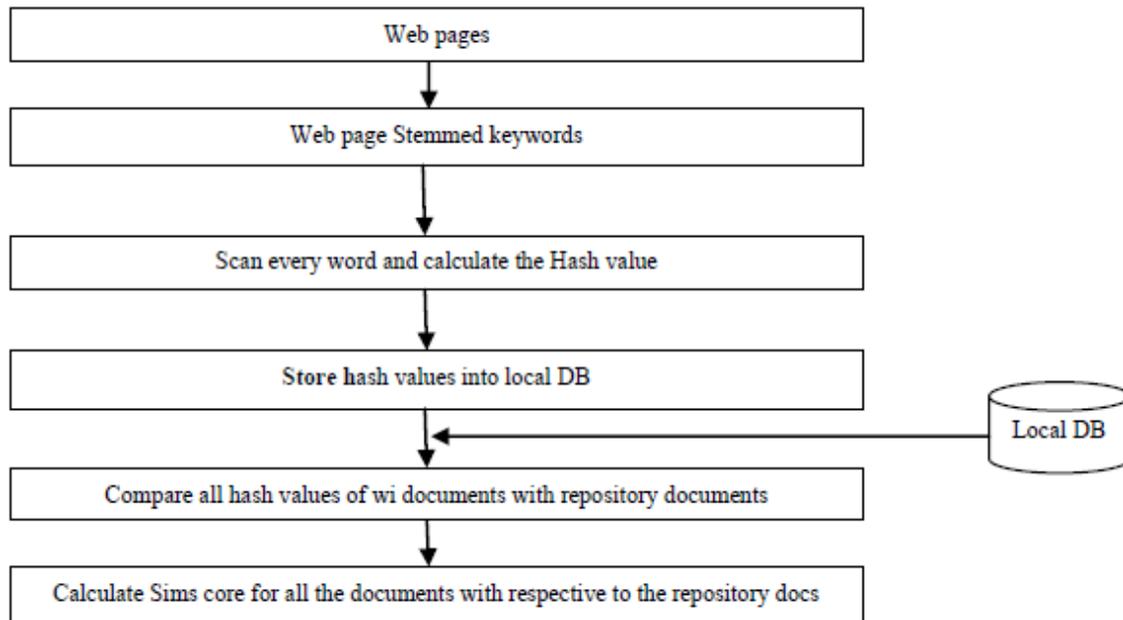

Figure 2. DD algorithm Work flow

This algorithm consists of three major steps. The first step is to calculate the hash vales of the each keyword in a web page w_1. Then in the second step they are stored in a temporary data base. This procedure is repeated for all the samples collected. The third step is to calculate the similarity of the pages on the hash values generated which are stored in a local DB (data base). If the threshold is above 80% then it is considered as a near duplicate web page. Whenever a new page w_n is coming and needs to be stored in the repository, its similarity with the web pages already existing in the repository needs to be compared. Similarity is calculated using the following formula.

$$\text{SimScore} = \frac{\text{Number of hash values in } w_1, w_2 \ldots w_n}{\text{Total } w_1, w_2 \ldots w_n \text{ under consideration in Repository}} \times 100$$

4. EXPERIMENTAL ENVIRONMENT AND SETUP

The proposed near duplicate document detection system is programmed using Java (jdk 1.6) and the backend used is MS Access. The experimentation has been carried out on a 2.9 GHz, i5 PC machine with 4 GB main memory running a 32-bit version of Windows XP. The Web pages are collected using Wget computer program.

Table 1. Web pages dataset details

S. No	Documents data set	Number of Documents
1	Current Affairs	14
2	Technical articles	10
3	Shopping sites articles	15
4	Raw files	20
	Total	59

Figure 3. Data Collection using Wget tool.

Figure 4. Data Collection Sample-1.

Figure 5. Data Collection Sample-2.

5. RESULTS

Every dataset mentioned in the above section undergoes web page parsing, stop word removal and stemming process. It is observed that after applying the above mentioned steps the no. of keywords are reduced to an extent. The final output that is stemmed keywords are provided to the DD algorithm. The results are obtained by executing the DD program on the datasets which are shown in Table 2 and Table 3. These are representing the outcome obtained by checking every page of the dataset with all web pages from the database. As shown in Fig. 4 and Fig. 5, SimScore range is divided into 4 categories that <60%, 60% to 70%, 70% to 80% and >80%.

Table 2. Samples outcomes

Sample 1	Sample 2
Para 1: 23519 5125 31513 20158 31597 5245 14215 16119 12118 14215 16155 6125 15169 20154 1997 13513 21144 1315 3185 10155 16184 31514 14215 16155 16121 1195 12421 3120 12013 18524 5145 71522 2154 51912 45223 11220 5145 19153 19191 11812	**Para 1:** 20146 19572 20158 31597 23519 5125 31513 5245 14215 16119 12118 14215 16155 6125 15169 20154 1997 13513 21144 1315 3185 10155 16184 31514 14215 16155 16121 1195 12421 3120 12013 18524 5145 71522 2154 51912 45223 11220 5145 19153 19191 11812
Para 2 : 20158 23519 16189 23159 12514 14215 52416 18531 14221 18514 16189 15165 11915 19519 16171	**Para 2 :** 20158 23519 16189 23159 12514 14215 52416 18531 14221 18514 16189 15165 11915 19519 16171

Table 3: DD results for selected dataset

Dataset	Number of documents	< 60 %	60% to 70%	70% to 80%	>80%
Technical	w1	w10,w9,w8	w4,w6,w7	w3,w5	w2
	w2	w10,w8,w9	w4,w6,w7	w3,w5	w1
	w3	w4,w8,w9,w10	w6,w7	w1,w2,w5	--
	w4	w3,w5,w8,w9,w10	w1,w2,w6,w7	--	--
	w5	w4,w8,w9,w10	w6,w7	w1,w2,w3	--
	w6	w7,w8,w9,w10	w1,w2,w4,w3	w5	--
	w7	w6,w8,w9,w10	w1,w2,w3,w4,w5		--
	w8	w1,w2,w3,w4,w5,w6,w7,w9,w10			--
	w9	w1,w2,w3,w4,w5,w6,w7,w8,w10			--
	w10	w1,w2,w3,w4,w5,w6,w7,w8,w9			--
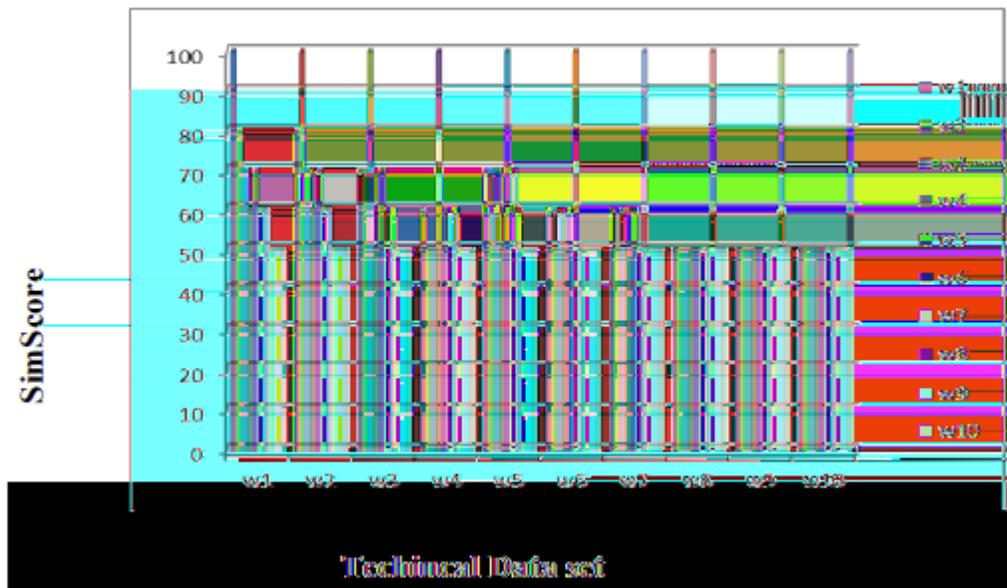
Figure 5. Simscore Illustrations for the datasets

6. CONCLUSIONS AND FUTURE WORK

Web pages with similarity score of 0% represent totally unique documents. Web pages with similarity score of <60% are not similar and needs to be maintained in the database for future reference. Web pages with similarity score of 60% to 70% are suspicious near duplicates and needs to be maintained in the database for future reference. Web pages with similarity score of more than 70% are almost near duplicates.

Furthermore only top N pages are stored in the repository for each datasets instead of all documents which reduces memory space for the repository. Since web pages having SimScore greater than 60% are not stored in the repository, by detecting them as near duplicate web pages. The search efficiency and effectiveness will be achieved and document clustering can be facilitated.

Web pages which are near duplicates may appear closer to each other in search results, but provide very little benefit to the user. The future work will be research for more robust and accurate methods for near duplicate detection and elimination on basis of the detection. To increase the accuracy and effectiveness of the DD Algorithm a clustering mechanisms can also be applied to perform the effective document clustering.

REFERENCES

[1] P. Maes. Agents that reduce work and information overload. Communications of the ACM, 37(7):30–40, 1994.

[2] Fetterly D, Manasse M, Najork M, On the evolution of clusters of near duplicate Web pages, In Proceedings of the First Latin American Web Congress, pp.37- 45 Nov. 2003.

[3] Chuan Xiao, Wei Wang, Xuemin Lin, Efficient Similarity Joins for Near Duplicate Detection, Proceeding of the 17th international conference on World Wide Web, pp 131 – 140. April 2008. SimScore Techincal Data set

[4] Gurmeet Singh Manku, Arvind Jain and Anish Das Sarma, Detecting near duplicates for web crawling, In Proceedings of the 16th international conference on World Wide Web, pp. 141 - 150, Banff, Alberta, Canada, 2007.

[5] Dennis Fetterly, Mark Manasse and Marc Najork, Detecting phrase-level duplication on the World Wide Web, In Proceedings of the 28th annual international ACM SIGIR conference on Research and development in information retrieval, pp.170 - 177, Salvador, Brazil, 2005

[6] A. Broder, on the resemblance and containment of documents, Proc. Compression and Complexity of Sequences (SEQS: Sequences97). pp. 21–29.

[7] A. Broder, S. Glassman, M. Manasse, G. Zweig, Syntactic clustering of the web, 6th International World Wide Web Conference, Apr. 1997, pp.393–404.

[8] A. Broder, M. Charikar, A.M. Frieze, M. Mitzenmacher, Min-wise independent permutations, Proc. STOC, 1998, pp. 327–336.)

[9] A. Broder, Identifying and filtering near-duplicate documents, Proc. Annual Symposium on Combinatorial Pattern Matching, Lecture Notes in Computer Science (eds. R. Giancarlo and D. Sankoff) 1848, 2000, pp.(1–10.)

[10] Broder, A. Z., Najork, M., and Wiener, J. L., 2003. "Efficient URL caching for World Wide Web crawling", In International conference on World Wide Web.

[11] A. Chowdhury, O. Frieder, D.A. Grossman, M.C. McCabe, Collection statistics for fast duplicate document detection, ACM Transactions on Information Systems, 20, 2 (2002) 171–191.)

[12] B. Ganter, R. Wille, Formal concept analysis: mathematical foundations, Springer, Berlin, 1999.

[13] Lavanya Pamulaparty, C.V. Guru Rao, A Novel Approach to Perform Document Clustering Using Effectiveness and Efficiency of Simhash, ,International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249 – 8958, Volume-2, Issue-3, February 2013

[14] J. Cho, N. Shiva Kumar, H. Garcia-Molina, Finding replicated web collections, Proc. SIGMOD Conference, (2000) 355–366.) 216

[15] S. Brin, J. Davis, H. Garcia-Molina, Copy detection mechanisms for digital documents, 1995 ACM SIGMOD International Conference on Management of Data 1995, pp. 398–409.

[16] Jun Fan, Tiejun Huang "A fusion of algorithms in near duplicate document detection".

[17] N. Heintze, Scalable document fingerprinting, Proc. of the 2nd USENIX Workshop on Electronic Commerce, 1996, pp. 191–200.) 216

[18] M. Henzinger, Finding near-duplicate web pages: a largeccale evaluation of algorithms, Annual ACM Conference on Research and Development in Information Retrieval, 2006, pp. 284–291.) 216

[19] T. C. Hoad, J. Zobel, Methods for identifying versioned and plagiarized documents, Journal of the American Society for Information Science and Technology, 54, 3 (2003) 203–215.) 216 232 D. Ignatov, K. J´anosi-Rancz, S. Kuznetsov

[20] Spertus, E., Sahami, M., and Buyukkokten, O., (2005) "Evaluating similarity measures: a large-scale study in the orkut social network", In KDD (2003), pp. 678-684.

[21] Henzinger, M., (2006) "Finding near-duplicate web pages: a large-scale evaluation of algorithms," Proceedings of the 29th annual international ACM SIGIR conference on Research and development in information retrieval, pp. 284-291.

[22] A. Kolcz, A. Chowdhury, J. Alspector, Improved robustness of signature-based near-replica detection via lexicon randomization, Proc. KDD'04(eds. W. Kim, R. Kohavi, J. Gehrke, W. DuMouchel) Seattle, 2004, pp.605–610.) 216, 217

[23] S.O. Kuznetzov, S.A. Obiedkov, Comparing performance of algorithms for generating concept lattices, Journal of Experimental and Theoretical Artificial Intelligence, 14 (2002) 189–216.) 221

[24] Hoad, T. C., and Zobel, J., (2003) "Methods for identifying versioned and plagiarized documents", JASIST, vol. 54, no. 3, pp.203-215

[25] U. Manber. Finding similar files in a large file system, Proc. of the USENIX Winter 1994 Technical Conference, 1994, pp. 1–10.) 216

[26] Gibson, D., Kumar, R., and Tomkins, A., (2005) "Discovering large dense sub graphs in massive graphs", Proceedings of the 31st international conference on Very large data bases, Trondheim, Norway, pp. 721-732.

[27] Lavanya Pamulaparty, Dr. M. Sreenivasa Rao, Dr. C. V. Guru Rao, A Survey on Near Duplicate Web Pages for Web Crawling, International Journal of Engineering Research & Technology (IJERT),ISSN: 2278-0181,Vol. 2 Issue 9, September – 2013

[28] Fetterly, D., Manasseh, M., and Najork, M., (2003) "On the evolution of clusters of near-duplicate web pages", Proceedings of the First Conference on Latin American Web Congress, pp. 37.

[29] Conrad, J. G., Guo, X. S., and Schreiber, C. P., (2003) "Online duplicate document detection: signature reliability in a dynamic retrieval environment", Proceedings of the twelfth international conference on Information and knowledge management, New Orleans, LA, USA, pp. 443-452.

[30] Bayardo, R. J., Ma, Y., and Srikant, R., (2007) "Scaling up all pairs similarity search", In Proceedings of the 16th International Conference on WorldWideWeb, pp.131-140.

[31] Cho, J., Shiva Kumar, N., and Garcia-Molina, H., (2000) "Finding replicated web collections", ACM SIGMOD Record, Vol. 29, no. 2,pp. 355-366.

[32] W. Pugh, M. Henzinger, Detecting duplicate and near-duplicate files, United States Patent 6658423 (December 2, 2003).) 216, 217

[33] N. Pasquier, Y. Bastide, R. Taouil, L. Lakhal, Efficient mining of association rules using closed item set lattices, Inform. Syst., 24, 1 (1999) 25–46) 220

[34] Charikar's M., 2002. "Similarity estimation techniques from rounding algorithms", In Proc. 34th Annual Symposium on Theory of Computing (STOC 2002), pp. 380-388.

[35] Y. Bernstein, J. Zobel ―Accurate discovery of co-derivative documents via duplicate text detection‖ Information Systems 31(2006) 595–609 Elsevier. doi:10.1016/j.is.2005.11.006.

AUTHORS

Lavanya Pamulaparty, Associate Professor and Head of the Dept. Dept of CSE, MCET, Osmania University, Hyderabad, obtained her Bachelor's degree in computer science from Nagpur University of KITS, Nagpur, India, and Masters Degree in Software Engineering from School of Informatics from JNT University Hyderabad, India, and Pursuing the PhD degree in computer science and engineering from JNT University. Her research interests include information storage and retrieval, Web Mining, Clustering technology and computing, performance evaluation and information security. She is a senior member of the ACM, IEEE and Computer Society of India.

Dr. Guru Rao C. V received his Bachelor's Degree in Electronics &Communications Engineering from VR Siddhartha Engineering College, Vijayawada, India. He is a double post graduate, with specializations in Electronic Instrumentation and Information Science & Engineering. He is a Doctorate holder in Computer Science & Engineering from Indian Institute of Technology, Kharagpur, India. With 24 years of teaching experience, currently he is the Professor & Principal, SR Engineering College Warangal, India. He has more

than 25 publications to his credit. He is a life member of Indian Society for Technical Education, Instrumentation Society of India and member of Institution of Engineers, Institution of Electronics & Telecommunications Engineers and Institution of Electrical & Electronics Engineers (USA).

Dr. M Sreenivasa Rao, Professor, School of Information Technology, JNT University, Hyderabad, obtained his Graduation and Post-graduation in Engineering from JNT University, Hyderabad and Ph D from University of Hyderabad. Over 28 Years of IT Experience in the Academia& industry. As a Dean of the MS IT Program, in association with Carnegie Melon University, USA. De- signed and conducted post graduations level MSIT program. Guided more than 10 research students in JNTU, and continuing the research in IT.

An Approach to Identify Dishonest Nodes Using MAC Protocol in Multihop Cellular Networks

Mr. P.Vijaya Babu Varma[1], Mrs. Lavanya Pamulaparty[2],
Mr. T. Praveen Kumar[3]
[1](CSE, Methodist College of Engineering & Technology/Osmania University, India)
[2](CSE, Methodist College of Engineering & Technology/Osmania University, India)
[3] (CSE, Methodist College of Engineering & Technology/Osmania University, India)

Abstract: In mobility based networks, the mobile nodes usually relay on other node packets rather than their own rightful packet for enhancing network performance. It happens due to the availability of some selfish or malicious nodes which do not cooperate in transmission of received packets to honest nodes, which totally reduces the network performance. A fairness issue arises when a selfish/malicious node access the advantage of the honest nodes without providing their contributions to honest nodes which significantly degrades the performance of network and May results in failure of entire communication. In this paper, we are analyzing network performance by using Message Authentication Code (MAC) Based protocol which can identify misbehaving/malicious nodes.MAC uses only fast symmetric cryptographic operations, making it suitable for multicast networks, where latency is an important factor. For its construction, we used an efficient key assignment based on Blom's scheme, and a Merkle tree to provide authenticity during our identification routine. Further, this scheme support addition of new nodes in to the existing network only after proper authentication is done.
Keyword: Mobile networks, honest nodes, Symmetric cryptography, node authentication.

I. Introduction

Mobile cellular network (MCN) [1], [2], [3], [4] follows the architecture which incorporates the ad hoc characteristics into the cellular system. A node's traffic is usually relayed through other nodes to the destination. The mobile nodes commit bandwidth, data storage, CPU cycles, battery power, etc., forming as group of resources that can be shared among them. A privilege that all nodes can obtain from the group of resources is more than they can obtain on their own. The considered MCN is used for many common life applications where the network has long life and the mobile nodes are supposed to have long-term relations with the network. Multihop packet relay can reduce the dead areas by extending the communication range of the base stations without extra costs. It can also reduce the energy consumption because packets are transmitted over shorter distances, and improve the area spectral efficiency and the network throughput and capacity [5], [6], [7]. However, due to involvement of autonomous devices in packet relay, the packet routing process suffers from new security challenges that endanger the practical implementation of MCN. The assumption that the network nodes are willing to relay other nodes' packets may not hold for common life applications where the nodes are autonomous and selfish or malicious in the sense that they aim to maximal own benefits and shows minimal contributions towards network. Although the proper network operation requires the nodes to collaborate, collaboration consumes the nodes' resources such as energy and computing power, and does not provide direct benefits. Selfish nodes are not interested in cooperation without incentive and make use of the cooperative nodes to relay their packets, which has a negative effect on the network fairness and performance. A fairness issue arises when selfish nodes take advantage of the cooperative nodes without any contribution to them. The selfish behavior also significantly degrades the network performance, which may result in failure of the total communications [8], [9]. In this article we present a mechanism that allows honest nodes to exclude misbehaving nodes, by not forwarding packets coming from these nodes in the future. To achieve detection, we base our scheme on the security properties of systems aimed at detecting pollution in network coding. To provide authentication, we present a fast authentication scheme based on Blom's key distribution scheme [10]. Our construction guarantees either that the sender of a packet is identified or an honest node does not waste significant resources checking a packet whose sender cannot be identified.

Unlike other constructions in the literature [11], [12], where a central authority is needed to exclude a misbehaving node; our construction allows any honest node to take proper action against attackers, without contacting the network's central authority; since it is based on cryptographic primitives with provable security properties, its security is high. Our proposal is also reasonable in terms of assumptions; we do not require knowledge of the topology beyond neighboring nodes, making it suitable for dynamic networks. The price we pay is: linear transmission overhead in the number of neighbors a given node has another not so significant

drawback is that, the proposal becomes vulnerable when more than c attackers collude; however, this does not represent a significant challenge, since the collusion bound can be set arbitrarily large without significant impact in performance.

II.   Related Work

In tamper-proof device (TPD)-based incentive mechanisms [17], [18], [19], a TPD is installed in each node to manage its credit account and secure its operation. In Nuglets [17], [18], the self-generated and forwarding packets are passed to the TPD to decrease and increase the node's credit account, respectively. The packet purse and the packet trade models have been proposed. In the packet purse model, only the source node pays by loading some credits in each packet before sending it. Each intermediate node acquires the amount of credits that cover the packet's relaying cost. In the packet trade model, each intermediate node runs an auction to sell the packets to the following node in the route. In this way, each intermediate node earns some credits and the destination node pays the total packet relaying cost. In SIP [19], after receiving a data packet, the destination node sends a payment RECEIPT packet to the source node to issue a REWARD packet to increment the credit accounts of the intermediate nodes. In CASHnet [20], [21], the source node's traffic credit account is charged and a signature is attached for each data packet. Upon receiving the packet, the destination node's traffic credit account is also charged and a digitally signed ACK packet is sent back to increase the helper credit accounts of the intermediate nodes. Users regularly visit service points to buy traffic credits with real money and/or transfer helper credits to traffic credits. The TPD-based incentive mechanisms suffer from the following problems. First, the assumption that the TPD cannot be tampered is neither secure nor practical for MCNs. That is because the nodes are autonomous and self-interested and the attackers can communicate freely in an undetectable way if they could compromise the TPDs [22]. Moreover, since the security protection of these mechanisms completely fails if the TPDs are tampered, only a small number of manufacturers can be trusted to make the network nodes, which is too restrictive for common life networks. Second, a node cannot communicate if it does not have sufficient credits at the communication time. The nodes at the network edge cannot earn as many credits as the nodes at other locations because they are less frequently selected by the routing protocol. Furthermore, the credit distribution has direct impact on the network performance, e.g., if a small number of nodes have a large ratio of the network credits, the network performance significantly degrades because the rich nodes are not motivated to cooperate and the poor nodes cannot initiate communications. Finally, since credits are cleared in real time, the network performance degrades if the network does not have enough credits circulating around. In [23], it is shown that the overall credits in the network decline gradually because the total charges are not necessarily equal to the total rewards. That is because the source node is fully charged after sending a packet but some intermediate nodes may not be rewarded when the route is broken. Although CASHnet can alleviate this problem by buying credits with real money, it is shown in [23] that in spite of having helper credits, some nodes starve because they cannot find a service point to convert them to traffic credits. In order to eliminate the need for TPDs, a central bank called the AC (Accounting Center) can be used to store and manage the nodes' accounts. In [24], the source node appends a payment token to each transmitted packet, and each intermediate node uses its secret key to check whether the token corresponds to a winning ticket. Winning tickets are submitted to the AC to reward the winning nodes. The source and destination nodes are charged per packet but the intermediate nodes are rewarded per winning ticket. In a security flaw, the colluding nodes can exchange tokens to be checked in each node to steal credits. However, due to the nature of the reputation systems, some honest nodes may be falsely identified as cheaters and the colluding nodes may manage to steal credits. Each node in a route buys packets from the previous node and sells them to the next node. The packets' buyers contact the AC to get deposited coins and the packets' sellers submit the coins to the AC to claim their payment. However, the interactive involvement of the AC in each communication session is not efficient and creates a bottleneck at the AC. So AC has to properly authenticate every node which is joining to the network.

III.   Identifying Malicious Nodes

In this section we will present some existing authentication mechanisms, along with a key assignment needed for our proposal.

3.1 Digital Signatures

Digital signatures allow any node in possession of a public key P, check that a node in possession of the corresponding private key S generated a message m; however, the knowledge of P does not allow nodes to produce valid digital signatures. To achieve this property, some kind of asymmetry is needed. In the RSA signature scheme [13], asymmetry comes from number theory. Compute $n = pq$ (public key), where p, q are prime numbers of a suitable size; then, compute $\varphi(n) = (p-1)(q-1)$. Select a number e relatively prime to $\varphi(n)$ and find its inverse modulo $\varphi(n)$. To sign $0 < m < n$, compute $\sigma = md \bmod n$; to verify the signature, check if $m = (\sigma e \bmod n)$. Another source of asymmetry to create digital signatures comes from time. This idea is exploited

by the Tesla [14] protocol. The construction assumes nodes are loosely synchronized; using this; nodes can generate signatures that can be checked at a future time:

- Assume there is a one way function h; this is given a value s, computing $h(s)$ is easy; but given $h(s)$ is not possible for an adversary to find s.
- Invoke h, t times using the output of the previous invocation as input for the next one; the value for the first invocation will be s. In mathematical terms, this is: $h0 = h(s)$, $hi = h (hi-1)$. Publish ht as the "public key".
- During the first period of time, compute a MAC involving the message m using $ht-1$ as a key to the fast symmetric cryptographic function (e.g. HMAC). Finally, publish the result of the MAC along with ht. In general, use $hi-1$ as a secret input to a function and publish hi.
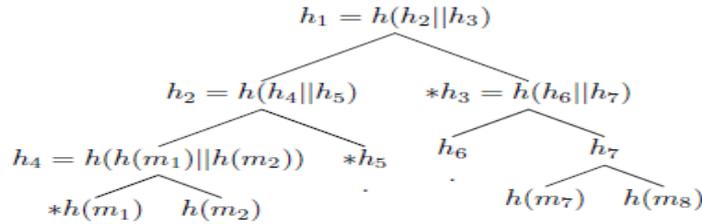

Figure 1. Example of a signature for $m2$ using a Merkle tree, appended nodes are marked with ($*$).

- Nodes cannot check a signature for the current period, but once the period expires, the information is revealed. Security comes from the fact that it is computationally impossible for an adversary to simulate the chain, unless they actually know s. Since no expensive number theory functions are used, this scheme is very efficient, but incurs in an initial delay. A real time authentication function can be achieved if the source can perform initial packet buffering [15].

In the multicast authentication literature, the Wong and Lam scheme [16] provides fast stream authentication using a binary tree. In this scheme, the root of the tree is delivered reliably. To verify a particular message mi; $h (mi)$ and the siblings of its ancestors are appended to the message (h is a cryptographic hash function). Figure 1 contains an example of signature for message $m2$, where the nodes of the tree appended to the message have an asterisk ($*$). To verify the signature, the verifier simply recomputes the tree using the given information; then if the root matches the digitally signed data, received at a previous stage or from a trustworthy entity, the node can conclude the message is authentic.

3.2. Blom's Scheme

Blom's scheme [3] allows every user in a network, to share a secret with any other user in an efficient way. Let D be a secret random $c \times c$ symmetric matrix and G be a public $c \times n$ generator matrix of a Maximum Distance Separable (MDS) code; this is a code that meets the Singleton bound: for a $(n, k, d)q$ then $k = n-d+1$; Reed-Solomon codes have this property. All elements from both matrices and operations are carried in the field Fq. The set of secrets of the system is given by $A = (DG) TG$, where $(DG) T$ denotes the transpose of (DG). The following derivation shows that A is symmetric:

$$A = (DG) TG = GTDTG = GT (DG) = AT$$

The shared secret between users i and j is $Aij = Aji$; to compute this value, the i-th user receives the i-th row from the matrix $Ki = (DG) T$. To get the shared secret Aij ; i computes $KiG*j$, where $G*j$ is the $j-$th column of G; similarly j computes $Aji = KjG*i$. If $x \le c$ attackers collude, they get no information about secrets not in the collusion.

3.3 HMAC

HMAC [25] is a cryptographic MAC, based on a hash function h and a random key k (// denotes the concatenation operator). Given information m to be authenticated as

$$HMAC (k, m) = h ((k \oplus opad) //h ((k \oplus ipad) //m))$$

Where opad=$0x36$// . . . //$0x36$ and ipad=$0x5c$// . . . //$0x5c$ are fixed values padded to match the key length. If a node wishes to verify that a node in possession of k created a message, it must recompute the function from the received message and then check if the output matches what was received. Proofs of securities for HMAC are found in [26].

IV.   Work Model

As our proposal relies on an existing selfish/dishonest node prevention scheme, which we will denote as a Source Message Authentication Codes (SMAC). MACs introduced by our proposal will be denoted as Relay MACs (RMACs). The key idea of the protocol is that it guarantees authentication for all messages using a fast function, before the slow SMAC verifying routine is applied.
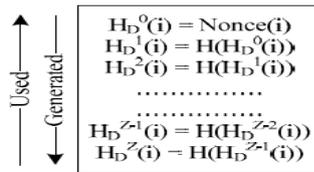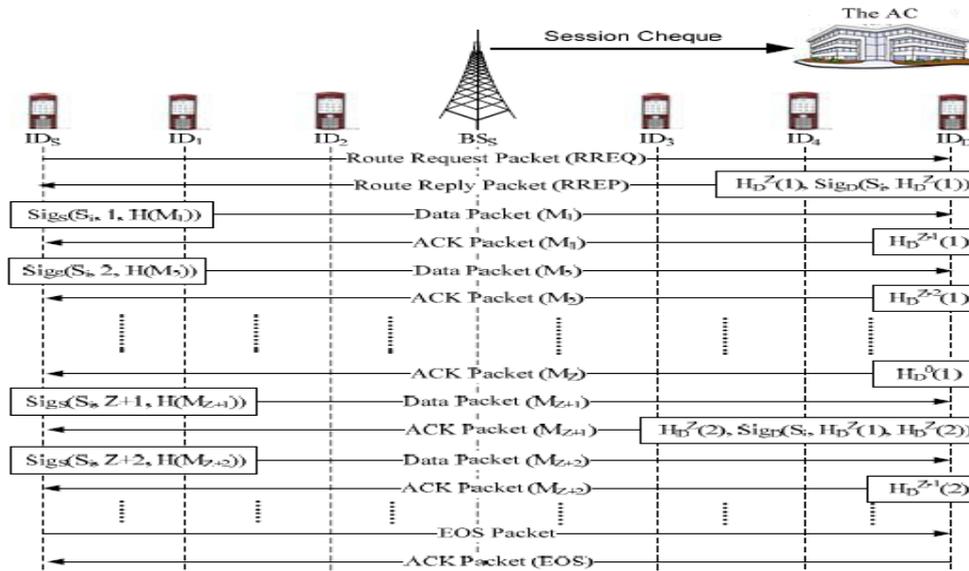
Figure 2. Hash Chain generation by receiving node

Figure 3. The exchange of keys between nodes.

4.1 Initialization

The sources initialize every node in the network and themselves, with two sets of secret values S_i and R_i. The purpose of S_i is to give the node the ability to authenticate information sent by the sources; this information will be modified using network coding operations. R_i is given according to Blom's scheme; its purpose is to generate shared keys k_{ij} to authenticate messages among neighbors. Recall from Blom's scheme that these values correspond to the i−th row of the matrix $(DG)\, T$; in addition, the identifier i is also provided to the node. A digital signature of all the keys in the system is given to each node, along with information to produce a proof that one key was assigned by the source to a particular node. We will now explain how these are generated. To avoid the use of digital signatures based on number theory at the nodes; we will use the tree construction to sign the whole square matrix of mutual secrets A. The idea is to embed A in the tree, as a set of row vectors appended one after another. Recall from Blom's scheme that the secrets given to node i, are represented by the i−th row of matrix A, that will be denoted by A_{i*}. The first step taken by the source is to produce a hash of each row in A independently, by using each coordinate of A_{i*} as a separate message for a Merkle tree, whose root for each row will be denoted by $h1,i$.
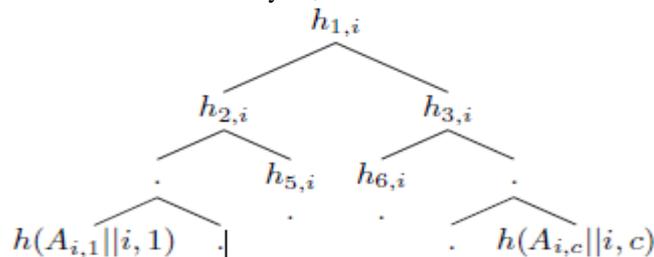
Figure 4. Computing the hash of i-th row in A.

The above figure shows this procedure; the reason we concatenate the actual coordinates of the secret to the invocation of the hash function is to guarantee the secret was in that given position in matrix A. Next, create a vector $v = (h1,\, 1,\ h1,\, 2 \ldots h1,\, c-1,\ h1,\, c)$ where each component is the root of the tree computed from each row. Now we use this vector as an input to another tree whose root will be named σA; σA is the signature for the whole matrix A. In this computation, the additional string is not needed.

id	r	m	SMACS	RMACS

Figure 5. Packet structure

The only remaining thing to give the nodes, is information to prove other nodes, one secret was assigned to them by the sources. To accomplish this, nodes receive the siblings of their ancestors in the Merkle tree created from v. The reasoning behind this, is that only node i is able to replicate the path for any of its secrets until $h1, i$; then, by using the information from the siblings from his ancestors, any node can verify the result without contacting the source.

4.2 Transmission

When any node i (including the source) want to transmit a message, it creates a packet with the following format:

- id: Id of the the last relay that processed the message; for this case i.
- r: Increasing value used to derive a different key for computing RMACs.
- m: Data to be sent.
- SMACs: A suitable pollution prevention scheme.
- RMACs: One RMAC for each one of its neighbors j; first, a master key is derived for each neighbor $κij$ = HMAC (salt, kij), where salt is a random public system parameter; kij is derived using Blom's scheme. The key used to generate a RMAC for node j is:
- k_ij = HMAC ($κij, r$). Next, let $m\_$ = (id, r, m, SMACS); the output of one RMAC function is (id$j$ //HMAC ($k\_ij, m\_$//id$j$)).

4.3 Relay Processing

When node j receives a packet, it verifies the RMAC intended for it. If the RMAC is not authentic, the packet is discarded immediately; otherwise, the node stores the packet until the SMAC in the packet can be verified (buffering is common in Tesla-based protocols).If the verification for SMACs is successful, the packet is coded with other packets by generating a linear combination of them; otherwise, the node increases a "bad events counter" for the sender and calls the decision routine (section-D); this counter is set to 0 periodically. If the decision routine returns "true", packets from sender i are not relayed anymore.

To inform other nodes of the discovery of a misbehaving node i, entry $Aji = Aij$ is sent to the neighborhood, along with information from the internal part of the Merkle tree only known to node i. We want to point out that the whole internal tree needs to be computed only once, so it can be queried later to accelerate the procedure, the total amount of information stored is twice the number of nodes in the network, times the size of the output of the hash function As it was stated in the initialization stage, nodes complement their part of the tree with the message received, if the result of the tree computation equals $σA$, the secret is considered legitimate. Note that the number of hash invocations is 2 log2 (n), where n is the number of nodes in the network. Consider now node l who receives the new secret and who still considers i as honest; then, l uses that key to check the RMAC authenticity of packets coming from i, whose SMACs have not been authenticated yet. Every time a RMAC is verified successfully and the corresponding SMAC is invalid, we increment the counter for "Bad events" proportional to the number of valid RMACs we can check. If the number of bad events from node i exceeds threshold x, l labels i as compromised and reveals $Ail = Ali$ to his neighbors.

4.4 Decision Routine

This routine is only called when either:

1. A node presents a valid RMAC for another node; 2. The message authenticated by the SMAC is not authentic. Assuming there are c (or less) compromised nodes, an attacker can cause the first event by either, forging the SMACs for one node and letting an honest node forward the packet (attack I); or forging the RMAC himself (attack II). In attack I, we assume the attacker can forge a valid SMAC with probability $1/p$; thus, the probability in succeeding in this attack v times is:

$$(1/p)^v .1 \qquad (1)$$

Here, the first term is the probability of an attacker forging the SMAC v times. The second term is the probability of the second event happening; the value is 1 because an honest node will always forward packets that pass the verification routine for SMACs.

In attack II, the first event occurs with probability $1/|RMAC|$; hence the probability of the first event happening v times is given by $1/|RMAC|v$. If both events happen v times, the probability of labeling an honest node as compromised is given by:

$$1/|RMAC|v. (1-1/p)^v \qquad (2)$$

Which is the probability of submitting a valid RMAC, times the probability of the validated message to be wrong by chance. Both events are considered independent because the RMAC and SMAC routines are completely unrelated due to their construction. The system administrator can determine a threshold that is reasonable for false positives depending on the system parameters and equations (1) and (2).

V.   Conclusion

Our Analysis work shows a fair and secure cooperation mechanism for MCN, In order to fairly and efficiently charge the source and destination nodes, the lightweight hashing operations are used to reduce the number of public-key-cryptography operations. Our extensive analyses have demonstrated that our incentive mechanism can secure the payment and significantly reduce the overhead of storing, submitting, and processing the checks. Node non repudiation can be achieved using a hash chain at the source node side to efficiently verify the message integrity at each intermediate node. By using our analytical procedure AC can process the identity of selfish/dishonest node that involves themselves in sessions with the intention of dropping the data packets to launch Denial of- Service attacks. By using our method the AC can process the checks to identify the irrational nodes which improves reliable, efficient and secure transfer of packet and which enhance the network performance.

References

[1]   Y. Lin and Y. Hsu, "Multihop Cellular: A New Architecture for Wireless Communications," Proc. IEEE INFOCOM, vol. 3, pp. 1273-1282, Mar. 2000.

[2]   X. Li, B. Seet, and P. Chong, "Multihop Cellular Networks: Technology and Economics," Computer Networks, vol. 52, no. 9, pp. 1825-1837, June 2008.

[3]   C. Gomes and J. Galtier, "Optimal and Fair Transmission Rate Allocation Problem in Multi-Hop Cellular Networks," Proc. Int'l Conf. Ad-Hoc, Mobile and Wireless Networks, Aug. 2009.

[4]   H. Wu, C. Qios, S. De, and O. Tonguz, "Integrated Cellular and Ad Hoc Relaying Systems: iCAR," IEEE J. Selected Areas in Comm., vol. 19, no. 10, pp. 2105-2115, Oct. 2001.

[5]   G. Shen, J. Liu, D. Wang, J. Wang, and S. Jin, "Multi-Hop Relay for Next-Generation Wireless Access Networks," Bell Labs Technical J., vol. 13, no. 4, pp. 175-193, 2009.

[6]   R. Schoenen, R. Halfmann, and B. Walke, "MAC Performance of a 3GPP-LTE Multihop Cellular Network," Proc. IEEE Int'l Conf. Comm. (ICC), pp. 4819-4824, May 2008.

[7]   Third Generation Partnership Project, Technical Specification Group Radio Access Network, "Opportunity Driven Multiple Access," 3G Technical Report 25.924, Version 1.0.0, Dec. 1999.

[8]   S. Marti, T. Giuli, K. Lai, and M. Baker, "Mitigating Routing Misbehavior in Mobile Ad Hoc Networks," Proc. ACM MobiCom, pp. 255-265, Aug. 2000.

[9]   P. Michiardi and R. Molva, "Simulation-Based Analysis of Security Exposures in Mobile Ad Hoc Networks," Proc. European Wireless Conf., Feb. 2002.

[10]   R. Blom, "Non-public key distribution." in Advances in Cryptology: Proceedings of CRYPTO '82, 1982, pp. 231–236.

[11]   A. Le and A. Markopoulou, "Cooperative defense against pollution attacks in network coding using spacemac," CoRR, vol. abs/1102.3504, 2011.

[12]   Q. Wang, L. Vu, K. Nahrstedt, and H. Khurana, "Mis: Malicious nodes identification scheme in network-coding-based peer-to-peer streaming," in INFOCOM, 2010 Proceedings IEEE, 2010.

[13]   R. L. Rivest, A. Shamir, and L. Adleman, "A method for obtaining digital signatures and public-key cryptosystems," Common. ACM, vol. 26, pp. 96–99, January 1983. 35:50–52.

[14]   A. Perrig, R. Canetti, J. D. Tygar, and D. Song, "The tesla broadcast authentication protocol," RSA CryptoBytes, pp. 2–13, 2002.

[15]   A. Perrig, R. Canetti, D. Song, and J. D. Tygar, "Efficient and securesource authentication for multicast," in In Network and Distributed System Security Symposium, NDSS '01, 2001, pp. 35–46.

[16]   C. K. Wong and S. Lam, "Digital signatures for flows and multicasts," in Network Protocols. Proceedings. Sixth International Conference on, Oct 1998, pp. 198 –209.

[17]   L. Buttyan and J. Hubaux, "Enforcing Service Availability in Mobile Ad-Hoc WANs," Proc. ACM MobiHoc, pp. 87-96, Aug. 2000.

[18]   L. Buttyan and J. Hubaux, "Stimulating Cooperation in Self- Organizing Mobile Ad Hoc Networks," Mobile Networks and Applications, vol. 8, no. 5, pp. 579-592, Oct. 2004.

[19]   [19] Y. Zhang, W. Lou, and Y. Fang, "A Secure Incentive Protocol for Mobile Ad Hoc Networks," ACM Wireless Networks, vol. 13, no. 5, pp. 569-582, Oct. 2007.

[20]   A. Weyland and T. Braun, "Cooperation and Accounting Strategy for Multi-Hop Cellular Networks," Proc. IEEE Local and Metropolitan Area Networks (LANMAN '04), pp. 193-198.

[21]   A. Weyland, "Cooperation and Accounting in Multi-Hop Cellular Network," PhD thesis, Univ. of Bern, Nov. 2005.

[22]   J. Hubaux, L. Buttya´n, and S. Capkun, "The Quest for Security in Mobile Ad Hoc Networks," Proc. ACM Symp. Mobile Ad Hoc Networking and Computing, Oct. 2001.

[23]   A. Weyland, T. Staub, and T. Braun, "Comparison of Motivation- Based Cooperation Mechanisms for Hybrid Wireless Networks,"J. Computer Comm., vol. 29, pp. 2661-2670, 2006.

[24]   M. Jakobsson, J. Hubaux, and L. Buttyan, "A Micro-Payment Scheme Encouraging Collaboration in Multi-Hop Cellular Networks," Proc. Seventh Financial Cryptography (FC '03), pp. 15-33.

[25]   M. Bellare, R. Canetti, and H. Krawczyk, "Keying hash functions for message authentication," in Proceedings of the 16th Annual International Cryptology Conference on Advances in Cryptology, CRYPTO '96. London, UK: Springer-Verlag, 1996, pp. 1–15.

[26]   New proofs for NMAC and HMAC: Security without collision-resistance, Lecture Notes in Computer Science, vol. 4117. Springer, 2006.

P Vijaya Babu Varma received his Bachelor's degree in computer science from and received Master's degree in Information Technology from Jawaharlal Nehru Technological University of Hyderabad, India. Presently, he is a professor in the Department of Computer Science and Engineering at Methodist College of Engineering and Technology, Osmania University, Hyderabad. His research interests include Adhoc and mobile networks, information storage and retrieval, Web Mining, Clustering technology and computing, and information security. He is a senior member of Computer Society of India.

Lavanya Pamulaparty, Associate Professor and Head of the Dept. of CSE, MCET, Osmania University, Hyderabad, obtained her Bachelor's degree in computer science from Nagpur University of KITS, Nagpur, India, and Masters Degree in Software Engineering from School of Informatics from JNT University Hyderabad, India, and Pursuing the PhD degree in computer science and engineering from JNT University Hyderabad. Her research interests include information storage and retrieval, Web Mining, Clustering technology and computing, performance evaluation and information security. She is a senior member of the ACM, IEEE and Computer Society of India.

T. Praveen Kumar received his Bachelor's Degree in Computer Science and Engineering from JNTUH and Master's Degree in Software Engineering from JNTUH. He is presently working as Assistant Professor in MCET, Osmania University. His research interests include Data Mining, Information Security and Databases. He is the life member of Indian Society for Technical Education
.

Modeling and Experimental Validation of Combustion in DI Diesel Engine through CFD Simulation

Dr.P.Manoj Kumar[1], Dr.S.L.V.Prasad[2], Ananda Mohan Vemula[3], Prof. R.V. Prasad[4]

Professor & HOD[1], Professor & HOD[2], Assoc.Professor[3], Professor[4],

Department of Mechanical Engineering

[1,3]Guru Nanak Institutions Technical Campus,   Hyderabad, Telangana State, India

[2]Sri Venkateswara Institute of Technology, Anantapur,   A.P., India

[4]Methodist College of Engineering and Technology, Hyderabad, Telangana State, India

Martinmanoj07@gmail.com, s.l.v.prasad@gmail.com, happymohan@yahoo.com, prof.rvprasad@gmail.com

Abstract: This paper describes the combustion analysis in direct injection (DI) diesel engine. In the present study the Computational Fluid dynamics (CFD) code STAR-CD is used to model complex combustion phenomenon in compression ignition (CI) engine [1]. The experiments were accomplished on single cylinder and DI engine, with full load condition at constant speed of 1600 rpm. Combustion parameters such as cylinder pressure, heat release rate and mass of NO emission with crank angle were obtained from experiment [2]. The results obtained from modeling were compared with experimental investigation. Consequences in terms of pressure, heat release rate and mass of NO are presented. The modeling outcome is discussed in detail with combustion parameters. The results presented in this paper demonstrate that, the CFD modeling can be the reliable tool for modeling combustion of internal combustion engine.

Keywords: *CFD, DI, combustion modeling, pressure, heat release rate, NO, simulation.*

1. Validation of CFD Code

The purpose of the validation of the CFD code is being used in this work. It is proposed to compare the results predicted through CFD simulation with experimental results.

Since, the experimental facilities available are not enough to measure in-cylinder fluid parameters, the experimental results available in literature has been used. The experimental results of a four stroke single cylinder DI diesel engine with Mexican Hat Bowl piston is being used for validation of the predicted capability of the CFD code [3]. CFD simulations were performed for the same engine and injection details are compared with experimental engine. And the injection details used in the simulation study are given in table 1 Fuel and Injection details are given in table 2

Comparisons are drawn between the experimental and predicted results based on the global parameters such as Pressure vs. Crank angle, Heat Release Rate vs. Crank Angle, and Mass of NO vs. Crank Angle formations.

TABLE: 1 Engine Details

Bore	137.19 mm
Stroke	165.10 mm
Connecting rod length	261.62 mm
Piston bowl	Mexican Hat Bowl(MHB)
Engine speed	1600 rpm

TABLE: 2 Fuel And Injection Details

Fuel	Diesel
Number of nozzle holes	6
Nozzle hole diameter	0.259 mm
Fuel injected (g/cycle)	0.1622
Injection duration (CA)	21.5
Start of injection (CA)	9 bTDC

2. Presentation of Results

It is important to study the in-cylinder fluid dynamics during the later part of combustion and initial part of expansion strokes in a diesel engine as the fuel injection, fuel-air mixing, combustion and pollutant formation takes place during this period only. Hence the present analysis is considered from 40^0 before TDC during compression stroke to 80^0 after TDC during the expansion stroke so as to include fuel injection, combustion and subsequent emission formation stages, as these are the crucial stages of DI diesel engine operation [5].

3. Comparison between Experimental and Predicted In-Cylinder Pressure with Crank Angle

The comparison of experimental and predicted pressure as shown in figure.6.1.The variation of in-cylinder pressure with crank angle is presented during compression stroke and expansion strokes. Pressure variation may be due to the greater ignition delay during combustion. The increase in ignition delay causes the combustion to continue even after the piston crosses TDC towards expansion stroke, resulting in lower difference in peak pressures, may be by blow-by and crevice flows. The pressure variation is studied from 40° before TDC in compression stroke to 80° after TDC in expansion stroke. In predicted curve a smooth rise is due to compression is noticed from 40° before TDC to 30° before TDC during compression stroke [6].

Figure: 1 shows the pressure rise with experimental model is noticed to be almost same 20 bar to be 38 bar. A rapid pressure rise in the predicted curve after TDC for a short span is noticed. The experimental peak pressure is slightly lower than that of a predicted model.
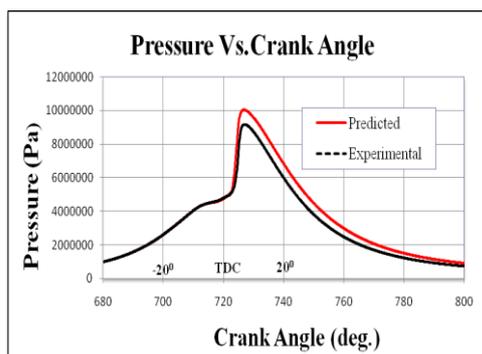

Fig: 1   Comparison of experimental and Predicted In-Cylinder Pressures

However they are comparable to the peak pressures which are noticed 99.7 bar in the case of predicted and 90 bar in the case of experimental. 20° after TDC in the expansion stroke the peak pressures are noticed. In both predicted and experimental the peak pressures are gradually decreased, but they are not following in the same path. The predictions made with this model are found to be closer to the experimental values [7].

4. Comparison between   Experimental Predicted Heat Release Rate Variations   with Crank Angle

Variation of heat release rate with crank angle predicted with experimental results are shown in figure: 2

The heat release in the combustion chamber is due to the combustion of fuel. Heat releases are noticed to be similar between 35° before TDC to 20° before TDC. And it is also observed that in the case of predicted model it is 47.9 J/Ca at about 5° after TDC [8]. Whereas in the experimental heat release rate 39 J/Ca is noticed. From the above discussions it is concluded that the predicted model is better than the experimental values in the case of experimental heat release rates are almost 20% lower than that of predicted model [9].
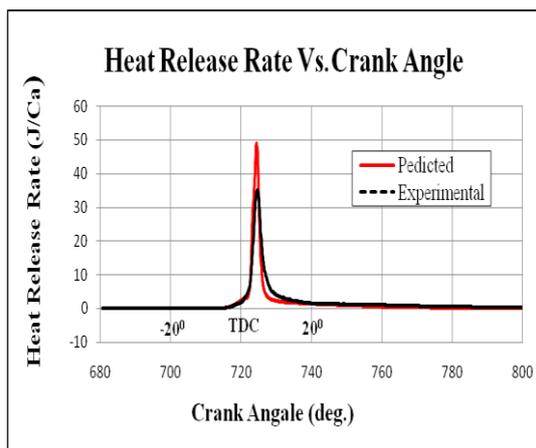

Fig: 2   Comparison of Predicted and Experimental Heat Release Rate

Accordingly it can be concluded that rapid-combustion phase is suppressed and mixing-controlled combustion phase is enhanced [10].

5. Comparison between Experimental and Predicted Model No Emissions

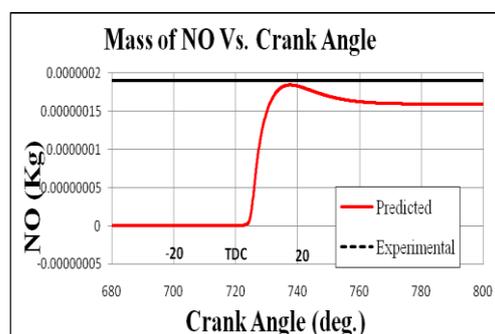Figure: 3 present the predicted model and experimental Mass of NO emission vs. crank angle.

Fig: 3   Comparison of Predicted and Experimental NO Emission

The experimental value of mass of NO emission is 1.85 mg and the predicted value of mass of NO emission is 1.72mg. It is clear that the predicted results are comparable to the experimental

results [11]. There is higher experimental value of NO emission may be due to the oxidation of nitrogen which is present in the fuel. This is used for future predictions.

6. Conclusion

To simulate Diesel injection and combustion the CFD code STAR-CD has been used for diesel spray. The model implemented in STAR-CD code for spray orientation was validated by comparison to publish experimental data. A good agreement between the predicted and experimental values ensures the accuracy of the numerical predictions collected with the present work. The results reported in this paper illustrate that the numerical simulation can be one of the most powerful and beneficial tools for the internal combustion engine design, optimization and performance analysis.

REFERENCES

[1] Reitz, R.D. and Bracco, F.V.: "On the dependence of Spray Angle and Other Spray Parameters on Nozzle Design and Operating Conditions", SAE paper 790494, 1979.

[2] Naber, J.D., Reitz, R.D.: Modeling Engine Spray/Wall- Impingement; SAE Paper 880107, 1988

[3] T. Bo, D. Clerides, A. D. Gosman and P. Theodossopoulos "Prediction of the Flow and Spray Processes in an Automobile DI Diesel Engine" S.A.E. paper 970882.

[4] G.M. Bianchi and P. Pelloni "Modeling the Diesel Fuel Spray Breakup by Using
a Hybrid Model" S.A.E. paper 1999-01-0226.

[5] A.D. Gosmen "State of the art of multi-dimensional modeling of engine reacting flows" oil and gas science technology, Vol.54 (1999).

[6] Trigui, N., Affects, H. and Kent, J. C., "Use of Experimentally Measured In-Cylinder Flow Field Data at IVC as Initial Conditions to CFD Simulations of Compression Stroke in C. I. Engines – A Feasible Study" S.A.E Technical Paper. 940280,1994.

[7] Trigui, N., Affects, H. and Kent, J. C., "Use of Experimentally Measured In-Cylinder Flow Field Data at IVC as Initial Conditions to CFD Simulations of Compression Stroke in C. I. Engines – A Feasible Study" S.A.E Technical Paper. 940280, 1994.

[8] Holger Peters, Ralph Worret, Ulrich Spicher "Numerical Analyses of the Combustion Process in a Spark-Ignition Engine." The Fifth International Symposium on Diagnostics and Modeling of Combustion in Internal Combustion Engines (COMODIA 2001), July 1-4, 2001, Nagoya.

[9] Chen A., Wallace S. and Veshagh A., "Intake Flow Predictions of a Transparent DI Diesel Engine" S.A.E. Technical Paper 981020.

[10] Bianchi G.M., Richards K. and Reitz R.D., "Effects of Initial Conditions in Multidimensional Combustion Simulations of HSDI Diesel Engines" S.A.E. Technical Paper 1999-01-1180.

[11] Marc Zellat, Driss Abouri, Thierry Conte and Bharat Raghunathan, "Advanced modeling of GDI and DI Diesel Engines: Investigations on Combustion and High EGR level" 15th International Multidimensional Engine User's Meeting at the S.A.E Congress 2005, April, 10, 2005 Detroit, MI.

Micro Genetic Algorithm Based on Pricing of Reactive Power Service in Deregulated Electricity Markets

Ramesh Babu Jarapala
Abhinav Hi-tech college of Engg
Hyderabad, Telangana-India
babu.ramesh444@gmail.com

Bhumaiah Jula
Abhinav Hi-tech college of Engg
Hyderabad Telangana-India
bhumeshjula@gmail.com

Ramesh Jatoth
Methodist College Of Engg & Tech
Hyderabad, Telangana-India
ramesh.jatoth@gmail.com

Abstract—**This study presents a new evolutionary method for reactive power pricing based on optimal power flow. Adequate reactive power is one of the most important parameters for secure operation of power system. In restructured electricity market, power system is operated near its secure boundaries in order to maximize social welfare. So Appropriate and accurate pricing of this service, can be very considerable in this environment. The main purpose of this paper is usage of Micro Genetic Algorithm method for determination active and reactive power prices produced by generators, based on Locational Marginal Price (LMP). The proposed method has been applied on IEEE 14 bus system and compared with GA**

Index Terms— **Reactive power pricing, Micro genetic algorithm, genetic algorithm, locational marginal price, restructured power market.**

I. INTRODUCTION

II. Because of competitive structure of energy markets, reduction of regulations in load area and more motivation for using available transmission systems facilities, power system is utilized near its secure boundaries. Considerably ancillary services that provide reliability and voltage security become very important in deregulated environment. Reactive power is one of the most important ancillary services in power system because during normal operations, it is required to maintain the necessary balance between generation and load in real time, to maintain voltages within the required ranges and to transmit active power. Therefore Reactive power value and its influence on system stability, especially during hard and congested conditions, can be very high [1]. Lack of reactive power can make voltage collapse that it is the main reason of recent widespread power outages worldwide such as one occurred in the United States and Canada in 2003 [2].

III. Appropriate and accurate pricing of this service not only covers the costs of reactive power supplying and provides incentives for investment of reactive power equipment so as to maximize overall social welfare, but also gives useful information about necessity of reactive power supporting and voltage control to system operator.

IV. Until now different pricing methods is proposed for pricing this service but some of the proposed methods are usually difficult and hard in practice. Reference [3] presents the analysis of the dominant component determined from the opportunity costs of a generator in the real power markets in

the cost structure of this service. Reference [4] suggests a new approach for reactive power pricing that is especially suitable for a power market using pool model. Reference [5] devises a scheme enforced capital investment on the needed services. In that scheme reactive support of generators is divided into two functions: reactive power delivery and voltage control. reactive power costs [6]. Reactive power pricing is principally based on the costs of reactive power providing that it can be achieved directly by determining marginal cost of reactive power or from market by using supply and demand curve [1]. In mentioned paper the combined reactive power market model is proposed for reactive power pricing. Spot pricing theory which its purpose is maximizing social welfare is proposed by F. C. Shewepp and et al. [7].In that paper for the first time marginal price concept from microeconomics introduced in power systems and used in electricity spot pricing. Nodal pricing among the other schemes based on locational marginal costs of system is most considerable. With nodal pricing of reactive power, prices at each node on a network reflect the marginal cost of generating that power. To estimate these costs, Optimal Power Flow (OPF) which its goal is minimization system operational costs subject to system operational constrains, is used. Two algorithms for solving optimal power flow (OPF) have been presented by [8]: genetic algorithm and ant colony algorithm.

V. In this study, a new approach based on Locational Marginal Price (LMP) for solving OPF in order to minimize objective function and therefore maximize social welfare is presented which results LMP of those powers in each node of system. The objective function is including cost of active and reactive powers produced by generators. The mentioned method is studied on 14-bus IEEE standard network and the results are compared to Genetic algorithm to approve these results are reasonable and practical.

II. MICRO GENETIC ALGORITHM

Genetic algorithms are simple, robust, flexible, and able to find the global optimal solution. They are especially useful in finding solution to problems for which other optimization techniques encounter difficulties [112]. A basic genetic algorithm is constituted by a random creation of an initial population and a cycle of three stages, namely:

• evaluation of each chromosome;

• chromosomes selection for reproduction;

• genetic manipulation to create a new population, which includes crossover and mutation. Each time, this cycle is completed, it is said that a generation has occurred.

A. Standard Micro genetic algorithm

The disadvantage of GAs is the high processing time associated. That is due to their evolutionary concept, based on random processes that make the algorithm quite slow. However, different methods for reducing processing time have already been proposed, such as more appropriate choice of solution coding and reduction of search space using the specialist knowledge. One alternative method known as microgenetic algorithms, whose processing time is considerably smaller, is shown in [12] .

Most GAs produce poor results when populations are small, because insufficient information is processed about the problem and, as a consequence, premature convergence to a local optimum occurs. Population size generally varies from 30 to 300 individuals. In contrast, MGAs explore the possibility to work with small populations (from five to 20 individuals usually) in order to reduce the processing time. From a genetic point of view, it is known that frequent reproductions inside a small population may disseminate hereditary diseases rarely found in large populations. On the other hand, small populations can act as natural laboratories where desirable genetic characteristics quickly can emerge. In MGAs, mutations are unnecessary because after a certain number of generations, the best chromosome is maintained and the rest are substituted by randomly generated ones. On the other hand, it requires adoption of some preventive strategy against loss of diversity in population.

The MGA implemented in the present work is reported in the following algorithm:

1) Select a population of n randomly generated individuals. Alternatively, n-1 individuals may be generated randomly together with one good individual obtained from previous search

2) Evaluate fitness and determine the best individual which is always transferred to the next generation. This "elitist" strategy guarantees against the loss of good information embedded in the best individual produced thus far

3) Select individuals for reproduction with the tournament selection strategy (for example with k=2)

4) Apply crossover with probability equal to 1 to favor exchange of genetic information among the population

5) Check for convergence by measuring the amount of diversity left in the population (by counting the total number of bits which are unlike those possessed by the best individual). If population diversity has fallen under a preselected threshold, go to Step 1; otherwise, go to Step 2.

OPF problem is a nonlinear optimization problem whichits goal is minimizing objective function subject to equality and inequality constrains. There are many methods to optimize non linear problems. In this study Micro genetic algorithm(MGA) is applied in solving the OPF problem.

B. Objective Function

As presented in (1), objective function used in this case consists of active and reactive power production cost produced by generators. Consider a network that in it N and Ng are number of buses and number of generator buses respectively.

$$C = \sum_{i=Ng}(c_{gpi}(P_{Gi}) + c_{gqi}(Q_{Gi})) \dots\dots\dots\dots(1)$$

Subject to power flow equality and inequality constrains:

$$P_{Gi} - P_{Di} = \sum_{q=2}^{n} |v_i| |v_i| |Y_{ij}| \, Cos \, (\theta_{ij} + \delta_i - \delta_j) = 0 \dots\dots(2)$$

$$Q_{Gi} - Q_{Di} = \sum_{q=2}^{n} |v_i| |v_i| |Y_{ij}| \, Sin \, (\theta_{ij} + \delta_i - \delta_j) = 0 \dots\dots(3)$$

$$P_{Gi}{}^{min} \leq P_{Gi} \leq P_{Gi}{}^{max} \quad\dots\dots\dots(4)$$

$$Q_{Gi}{}^{min} \leq Q_{Gi} \leq Q_{Gi}{}^{max} \quad\dots\dots(5)$$

$$V_{Gi}{}^{min} \leq V_{Gi} \leq V_{Gi}{}^{max} \quad\dots\dots(6)$$

$$P_{ij} \leq P_{ij}{}^{max}$$

$$\dots\dots\dots\dots(7)$$

Where

P_{Gi}, Q_{Gi} real and reactive power generation at i^{th} bus

P_{Di}, Q_{Di} real and reactive power demand at i^{th} bus

$c_{gpi}(P_{Gi})$ active power cost function in i^{th} bus

$c_{gqi}(Q_{Gi})$ reactive power cost function in i^{th} bus

For computing Cost function of active power (8) is regarded.

$$c_{gpi}(P_{Gi}) = aP^n{}_{Gi} + bP + c \dots\dots\dots\dots(8)$$
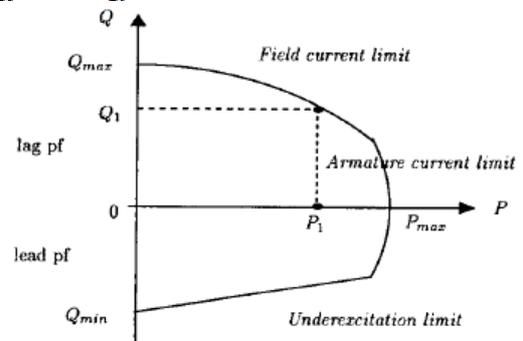
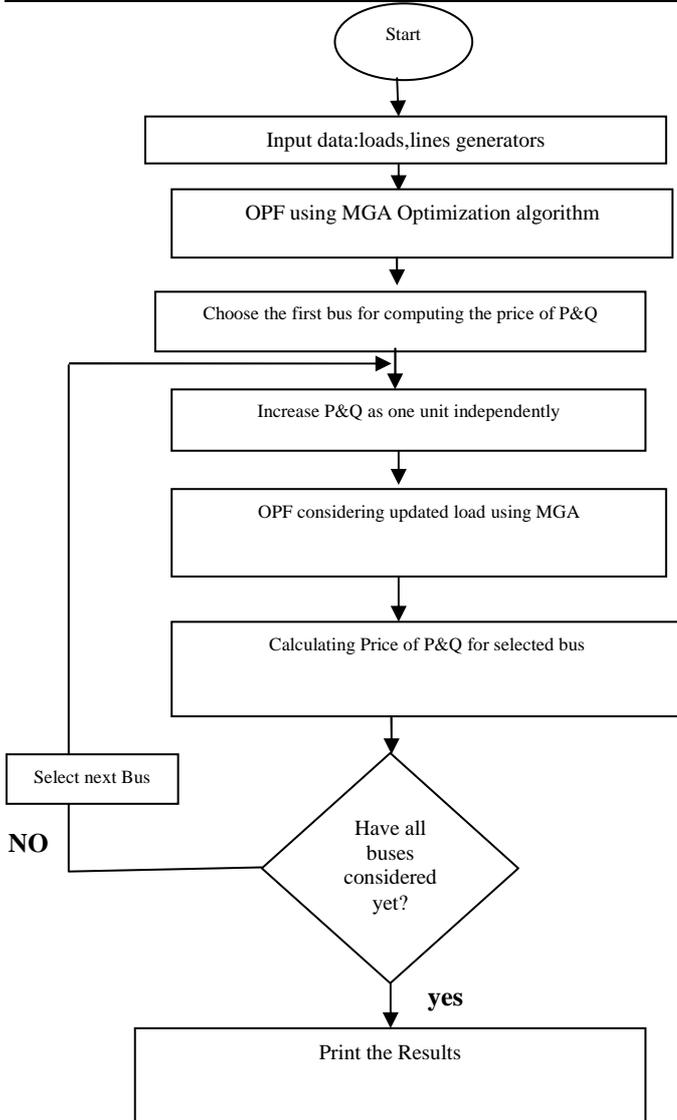

Fig. 1. Loading capability diagram.

Fig. 2. The flow chart of active and reactive power pricing

Cost function for reactive power produced by generator is based on opportunity cost deduced via loading capability diagram shown in Fig. 1. Essentially opportunity cost is based on market process, but since it is hard to determine its precise and exact value, in this paper its simplest form is used where Q_{Gi} and $S_{Gi,max}$ are reactive power of generator in ith bus and maximum apparent power in ith bus, respectively. K is reactive power efficiency rate which is usually between 5-10% which in this paper $K = 5\%$ is considered

$$C_{gq}(Q_{Gi}) = [C_{gpi}(S_{Gi,max}) - C_{gpi} \, sqrroot \, (S_{Gi,max}2 - (Q_{Gi})2)$$

..9

C. Flowchart and methodology

In this paper Locational marginal price (LMP) method is used for active and reactive power pricing. As illustrated in Fig. 2 Active power prices in each bus is determined from difference between optimum cost while constant loading and optimum cost while active power demand increases 1MW in subjected bus. Reactive power prices in each bus is determined from difference between optimum cost while constant loading and optimum cost while reactive power demand increases 1MVAr in subjected bus.

III. TEST RESULTS

MGA optimization method has been applied on IEEE14 bus system which its single lines diagram shown in Fig. 3.Table I and Table II list the line parameters of network and characteristics of the network loads, respectively. Cost function coefficients of active power production by generators are in Table III. In this study mentioned objective function is calculated for 3 cases:

1) By the system base load that totally is 259 MW and 73.5 MVAr.

2) 40 MVAr reactive powers in bus 2, 3, 4 and 50MVAr in bus 5 are injected. These buses are selected because they consume more VAr in respect of others.

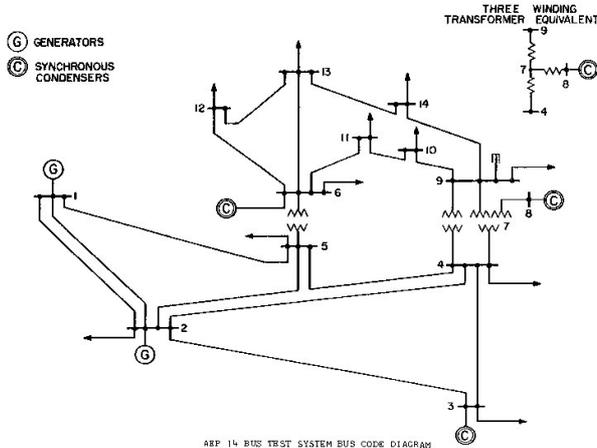*3)* Active demand loads in all buses are increased by 1.2.
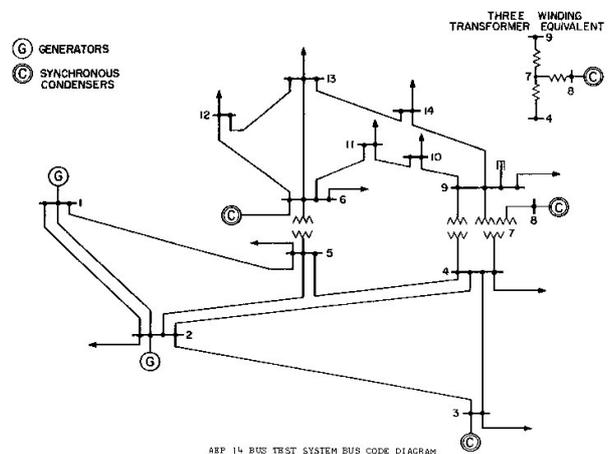

Fig. 3. IEEE14-Bus system

Fig. 3. IEEE 14-bus system.

Then the determined prices by MGA optimization method are compared with those are calculated by Genetic (GA) method in Table IV where parameter λ presents the price of active and reactive power produced by generators. Case 2 declares when reactive power is injected to system in critical buses the price of active power is reduced but in this system the prices of reactive power is nearly constant in respect of case 1. Case 3 shows that, in this network, when active demands are increased, the prices of generator active power are increased too. As can be seen the result determined by MGA optimization method are reasonable and approximately equal to ones determined by GA

TABLE I INE PARAMETERS OF 14 BUS IEEE NETWORK

Line no.	From node	To node	R(pu)	X(pu)	Yc(S)
L1	1	2	0.01938	0.05917	0.0528
L2	2	3	0.04699	0.19797	0.0492
L3	2	4	0.05811	0.17632	0.0438
L4	1	5	0.05403	0.22304	0.034
L5	2	5	0.05695	0.17388	0.0346
L6	3	4	0.01335	0.04211	0.0128
L7	4	5	0.0.01335	0.04211	0
L8	5	6	0.0	0.25202	0
L9	4	7	0.0	0.20912	0
L10	7	8	0.0	0.17615	0
L11	4	9	0.0	0.55618	0
L12	7	9	0.0	0.11001	0
L13	9	10	0.03181	0.08450	0
L14	6	11	0.09498	0.19890	0
L15	6	12	0.12291	0.25581	0
L16	6	13	0.06615	0.13027	0
L17	9	14	0.12711	0.27038	0
L18	10	11	0.08205	0.19207	0
L19	12	13	0.22092	0.19988	0
L20	13	14	0.17093	0.34802	0

TABLE II LOAD CHARACTERISTICS

Bus	Active Power(MW)	Reactive Power(MVAr)
1	0	0
2	21.7	0
3	94.2	0
4	47.8	0
5	7.6	0
6	11.2	0
7	0	0
8	0	0
9	29.5	0
10	9	0
11	3.5	0
12	6.1	0
13	13.5	0
14	14.9	0

TABLE II GENERATORS CHARACTERISTICS

Generator	A($/H)	b($/H)	c($/H)	Pmax(MW)	Pmin(Mw)
1	0.11	2	150	332.4	0
2	0.25	5	225	140	0
3	0.09	1.2	600	100	0
6	0.04	1	335	100	0
8	0.10	3	400	100	0

TABLE IV RESULT AND COMPARISON

	Case-I		Case-II		Case-III	
Mincost($/H)	MGA	GA	MGA	GA	MGA	GA
λ($/HMW)	3441.9	3440.1	3446.1	3435.9	4137.7	4136.01
λ($/HMW)	11.6	11.62	10.13	11.71	14.50	15.48
λ($/HMW)	11.66	11.75	10.27	11.68	14.78	14.77
λ($/HMW)	11.86	12.03	10.29	11.93	15.07	15.14
λ($/HMW)	11.32	11.41	10.02	11.48	14.41	14.40
λ($/HMWr)	12	11.91	10.39	11.97	14.95	14.99
λ($/HMWr)	0.18	0.334	1.52	0.17	0.13	0.31
λ($/HMWr)	0.08	0.325	1.96	0.38	0.15	0.33
λ($/HMWr)	0.12	0.268	1.84	0.22	0.13	0.27
λ($/HMWr)	0.18	0.012	1.61	0.093	0.16	0.021
λ($/HMWr)	0.02	0.213	1.68	0.095	0.287	0.2414

IV. CONCLUSION

This paper use Micro genetic algorithm method for solving Optimal Power Flow (OPF) in order to minimize the objective function which consists of active and reactive power costs produced by generators. Particle swarm optimization is a very simple algorithm that appears to be effective for optimizing a wide range of functions [9]. This approach has been applied on IEEE 14 bus system. The simulation results of this work in comparison with Genetic algorithm show that the method is physically reasonable and its implementation is simpler than other optimization methods such as GA. The presented technique can also be applied to manage and set the price of the reactive power supplied by other sources than generators and in different market types

REFERENCES

[1]. M. Sedighizadeh, A. Rezazadeh and M. Seyed Yazdi"Pricing of Reactive Power Service in Deregulated Electricity Markets Based on Particle Swarm Optimization, International Journal of Computer and Electrical Engineering,Vol.2, No.6, December, 2010 1793-8163.

[2]. G R. Deksnys, R. Staniulis, "Pricing of Reactive Power Service," Oil Shale, Estonian Academy Publishers, Vol. 24, No. 2 Special, pp. 363–376, April 1955.

[3]. Principle for Efficient and Reliable Reactive Power Supply and Consumption. FEDERAL ENERGY REGULATORY COMMISSION, STAFF REPORT, Feb. 2005.

[4]. S.N. Khalid, M.W. Mustafa, H. Shareef, A. Khairuddin, "Unbundled Reactive Support Service: Key Characteristics and Dominant Cost Component," Universities Power Engineering Conference, Australasian 9-12, pp.1 – 6, Dec. 2007.

[5]. Y. Zhao, M.R. Irving, Y. Song, "A cost allocation and pricing method for reactive power service in the new deregulated electricity market environment," IEEE/PES transmission and Distribution Conference & Exhibition: Asia and Pacific, pp. 1-6, 2005.

[6]. G. M. Huang, H. Zhang, "Pricing of generators reactive power delivery and voltage control in the unbundled environment," IEEE, Transactions on Power Systems, Vol. 15, pp. 1226-1231, 1998

[7]. J. W. Lamont and J. Fu, "Cost analysis of Reactive Power Support," IEEE Transactions on Power Systems, Vol. 14, pp. 890-898, 1999.

[8]. F. C. Schwepp.e, M. C. Caramanis, R. D. Tabors, R. E. Bohn, "Spot Pricing of Electricity," Kluwer Academic Publishers, 1988

[9]. T. Niknam, H. Arabian and M. Mirjafari, "Reactive Power Pricing in Deregulated Environments Using Novel Search Method," Proceedings of the Third International Conference on Machine Learning and Cybernetics, Shanghai, 26-29 August 2004.

[10]. J. Kennedy, R. C. Eberhart, and Y. Shi, "Swarm intelligence," San Francisco, CA, USA: Morgan Kaufmann Publishers Inc., Mar. 2001.

[11]. G.K. Venayagamoorthy, R.G. Harley, "Swarm intelligence for transmission system control," Power Engineering Society General Meeting, IEEE, pp. 1-4, 2007.

[12]. V. Kranthi Kumar1, J. Ramesh Babu2 and M. Ramesh3 "Micro Genetic Algorithm Based Electrical Power Dispatch for Deregulated Electricity Market," Advance in Electronic and Electric Engineering.ISSN 2231-1297, Volume 3, Number 6 (2013), pp. 739-746.

About the Authors:

Ramesh babu Jarapala received his B.Tech degree in Electrical and Electronics Engineering and M.E in Power system from University College of Engineering, Osmania University , Hyderabad, Telangana, India, in 2007 To 2009 respectively. 2009 to 2012, he is Assistant Professor in KSIT Engineering college, since 2012 to Till date AHTC and PBIT engineering college in Hyderabad Telangana.

Bhumaiah Jula received his B.Tech degree in Electrical and Electronics Engineering and M.Tech in Power Electronic from Vardhaman College of Engineering, JNT University , Hyderabad, Telangana, India, in 2010 to 2012 respectively. since 2012 he is Assistant Professor AHTC and PBIT engineering college in Hyderabad Telangana.

Ramesh Jatoth received his B.Tech degree in Electrical and Electronics Engineering and M.Tech in Power System from NIT calicut, Kerala, India, in 2008 to 2010 respectively. since 2014 he is Assistant Professor Methodist College Of Engineering &Tech Hyderabad, Telangana-India

LAGRANGIAN MODEL FOR SIMULATING TURBULENT DISPERSION AND AGGLOMERATION OF DROPLETS WITHIN A SPRAY

Dr. P. Manoj Kumar[1], Ananda Mohan Vemula[2], M. Prakash Babu[3], Prof. R.V. Prasad[4]

[1]*Department of Mechanical Engineering, Professor & HOD, Guru Nanak Institutions Technical Campus, Hyderabad, Telangana State, (India)*

[2]*Department of Mechanical Engineering, Associate Professor, Guru Nanak Institutions Technical Campus, Hyderabad, Telangana State, (India)*

[3]*Department of Mechanical Engineering, Associate Professor, Vignana Bharathi Institute of Technology, Hyderabad, Telangana State, (India)*

[4]*Department of Mechanical Engineering, Professor, Methodist College of Engineering and Technology, Hyderabad, Telangana State, (India)*

ABSTRACT

Lagrangian modeling approach is for simulating turbulent dispersion and agglomeration of droplets within a spray. This model (Lagrangian) predicts droplet dispersion rate and shift in droplet size distribution due to agglomeration within the spray, over a wide range of droplet and gas flows, and for sprays with different size distribution at the nozzle exit. The computer time required for simulating agglomeration within a steady axisymmetric spray is of a similar order of magnitude regardless of which formulation, Lagrangian, is adopted. However the Lagrangian formulation is more practical in terms of the range of applicability and ease of implementation.

Keywords: Lagrangian, Dispersion, Agglomeration, Droplets, Turbulent, CFD, Spray

I. INTRODUCTION

Spray dryers are used to produce dried powder products by atomising liquid suspensions that contain solids into a stream of hot gas where the   moisture is evaporated. Particle agglomeration is an important phenomenon in this process because it affects the size distribution of the particles, and hence the properties of the dry powder. Agglomeration kinetics are determined to a certain extent by the turbulent nature of the flow, which influences the dispersion rate of practices and hence the development of relative velocities between particles, a prerequisite for successful particle collisions. No fundamental theory has yet been applied to model turbulent dispersion and agglomeration simultaneously within a spray dryer, and this lack of fundamental understandings is the reason, that spray dryers are so difficult to design. In fact, dryer manufactures and users of spray dryers typically rely on simple empirical models or a trial and error approach to improve their designs and operating conditions. The aim of this work to address this gap in fundamental understanding and to develop a Computational Fluid Dynamics

(CFD) model to predict the turbulent dispersion and agglomeration of droplets within a spray. In the Lagrangian model, the spray is represented by a flow of gas, treated mathematically as a continuum, which carries numerous discrete droplet parcels, each parcel consisting of a group of physical droplets of similar size. The trajectory of each droplet parcel within the airflow is predicted by solving the Lagrangian equations of mass and momentum. The Monte-Carlo method is used to model the turbulent dispersion of droplets by effectively sampling the fluctuating velocities of the droplets randomly. Ruger at al. (2000) [10] and Berlemont et al. (1990) [1] have used Lagrangian calculations in their analyses.

Mostafa and Mongia (1987) [7] have been that Larangian approach is able to predict the main features of a turbulent spray, such as the decay of the entire line axial velocity and the turbulent dispersion of droplets. The Lagrangian method may have Fourier transport equations to solve numerically, but the trade off is the necessity of a three-dimensional, transient solution to properly model the effect of collisions and turbulence interactions on the trajectories of individual droplets. In this paper, the Lagrantian predicts of droplet turbulent dispersion and agglomeration within a spray are compared over a wide range of gas and droplet flows, and for sprays with different droplet size (1) to validate the numerical aspects of each mathematical formulation so that the models can be applied with more confidence in future simulations. (2) To determine whether each approach predicts similar droplet turbulent dispersion and agglomeration rates, and (3) To ascertain the weaknesses and strengths of each approach in terms of the case of application and subsequent computational effort required. The ultimate aim of the work is to develop a validated CFD model to predict the extent of particle agglomeration within a spray dryer, and the flow patterns and drying of particles, and to use this predictive tool to design more efficient spray dryer that produce higher throughputs.

II. MODEL DISCRIPTION

Lagrangian method is for calculating the velocity and turbulence fields, and the turbulent dispersion of droplets, are described in detail by Ruger et al.(2000)[10] and Nijdam et al.(2003)[8], respectively. Here, we provide only a description of the agglomeration models used in each approach. This model has been incorporated into a commercially available Computational Fluid Dynamics (CFD) program called CFX4 (AEA Technology). The Lagrangian approach requires a transient, three dimensional calculations.

2.1 Lagrangian Agglomeration Model

The Lagrangian agglomeration model is a modification of the O'Rourke model (1981)[9], for which parcels of droplets are tracked simultaneously in three-dimensional space and with time. The turbulent effect is included within the droplet transport model using the eddy-lifetime method of Gosman and loannides (1983)[2]. When considering a collision between two parcels, the parcel containing the larger number of droplets (N_i) is called the 'contributor" While the parcel containing fewer droplets (N_i) is called the 'collector'. Ruger et al. (2000) [10] have shown that the collision frequency v between the collector and contributor parcels is proportional to the mean number density, a collision cross-sectional area, and a relative velocity, as follows:

$$v = \frac{N_j}{V} \frac{\Pi}{4} (D_i + D_j)^2 u_r \qquad \dots\dots (1)$$

Where V is the volume within which both parcels are located. This volume V is related to the cube of the distance l between parcels, so that eqn. (1) becomes

$$v = \frac{N_j}{b_1 l^3}(D_i + D_j)^2 u_r \quad \ldots\ldots (2)$$

Where b_1 is an empirical constant A "proximity" function is derived from Equation (2), as follows

$$P = \frac{N_j}{l^3}\Delta t (D_i + D_j)^2 u_r \quad \ldots\ldots\ldots (3)$$

Which effectively represents the probability of collision between two parcels over a given time interval Δt. At the end of each time-step in the simulation, the proximity function is evaluated for every combination of parcel pairs. Collision of a pair of parcels is allowed when the proximity function P exceeds a critical value P_c,

$$P \ge P_c \equiv -\frac{b_1 \log 0.5}{1.5} \quad \ldots\ldots (4)$$

for any acceptable collision, the collector parcel absorbs a part of the colliding contributor parcel, so that every droplet in the collector parcel coalesces with a droplet in the contributor parcel on a one-to-one basis to form the group of agglomerates. The remaining diminished contributor parcel, which contains any excess droplets, is tracked further in the next time-step. The velocities of the parcels after collision are determined by conservation of momentum. The size of the droplets in the collector increases according to conservation of volume, as follows.

$$D^3 = D^3_i + D^3_j \quad \ldots\ldots (5)$$

A more detailed description of the model can be found in Guo et al. (2003)[3].

III. RESULTS AND DISCUSSION

3.1 No Agglomeration Case

Figure 1 shows the Lagrangian predicts of the axial mean velocity profiles of the droplets at various axial locations downstream of the nozzle clearly, it predicts decay rate for the. axial mean velocity at the centre-line.
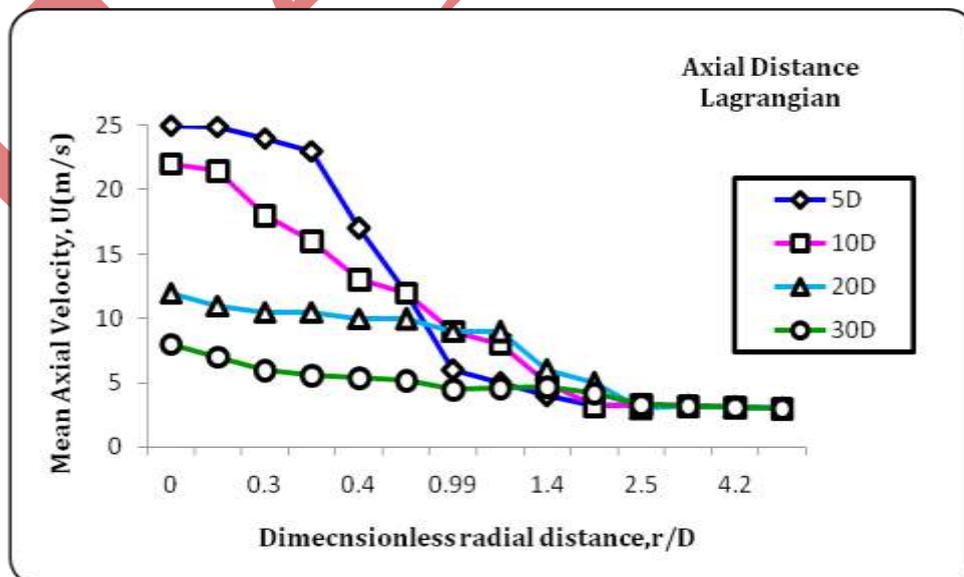

Fig1: Mean axial velocity U (mean of all droplet size classes) verses dimensionless radial distance at various axial locations from the nozzle exit.

Figure 2: shows that the spreading rate of droplets of different size is also similarly predicted in this model. . and implies that smaller droplets disperse radially more rapidly than larger droplets. This is physically reasonable because small droplets have relatively low inertia and therefore they readily follow the turbulent fluctuations   of the carrier gas, whereas large droplets have relatively high inertia so that they are less affected by gas-flow turbulent fluctuations. The Lagrangian approach is able to predict the main features of a turbulent spray, including the decay of centerline velocity and the radial dispersion of droplets with axial distance from the nozzle.
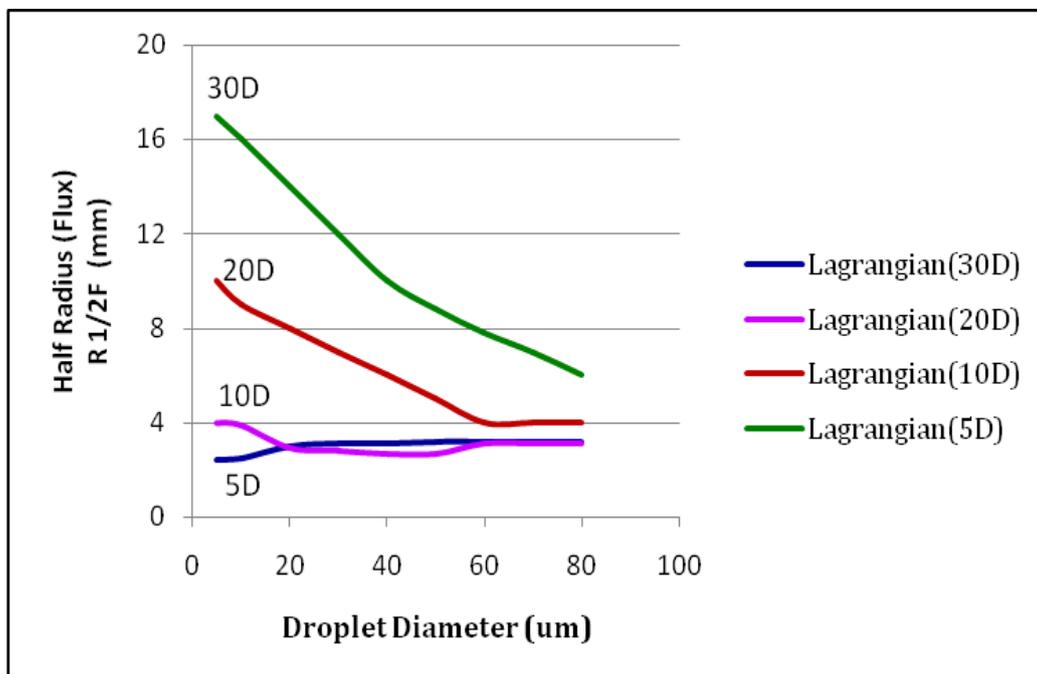

Fig 2: The half-radio $R_{1/2F}$ **of the radial profiles of droplet volume flux for different droplet size classes at various axial locations from the nozzle exit.**

3.2   Agglomeration Case

The Lagrangian model is first fitted to one set of spray conditions by arbitrarily choosing a value of 3.2 for the Lagrangian parameter b_1. A second set of parameters – double the Lagrangian parameter (b_1=6.4) is also tested over a range of droplet flows. This test gives an indication of the compatibility for predicting droplet – droplet interactions with different agglomeration efficiencies. Here, the critical agglomeration probability (eq. 4), and accounts for the reduced probability of collision and subsequent coalescence due to 1) unsuccessful wake capture of a portion of droplets as they are accelerated within the wakes of other droplets, and 2) insufficient contact times for the film separating collided droplet pairs to drain and rupture. Figure 3 shows the Lagrangian predicts of the Sauter-mean diameter D_{32} for sprays having the same normalized droplet volume distribution, and air velocity and turbulence profiles at the nozzle exit, but having different total droplet flows   in this   model predicts similar increases in D_{32} with droplet flow for two different sets of agglomeration parameters (b_1 and β_o).

Firstly, this verifies to a certain extent of the Lagrangian numerical code, so that it can be used with confidence in future agglomeration calculations. Secondly, this result implies that a sufficient number of droplet size classes (15 droplet size classes) and parcels (about 20000 parcels are tracked at any given time) have been chosen for the Lagrangian approach, to ensure that the solution is independent of these quantities.
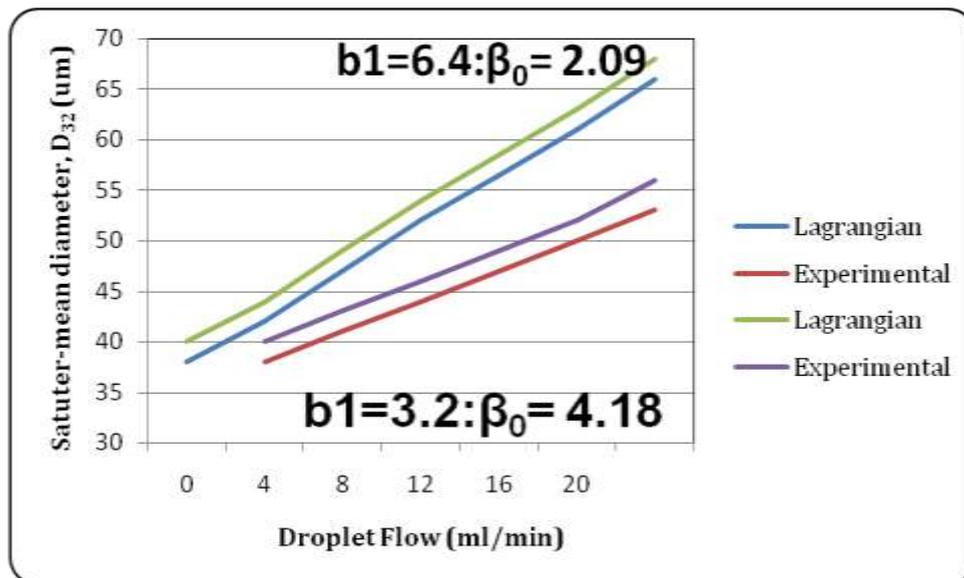
Fig:3 Lagrangian predictions of the integral Sauter-mean diameter D_{32} at an axial location of 30D for sprays with different droplet flows, and with different agglomeration efficiencies
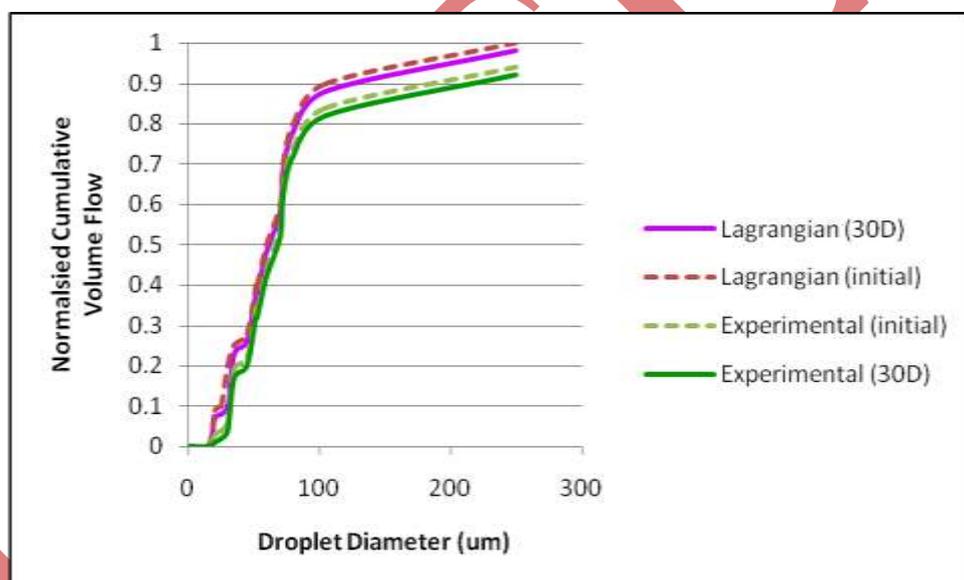

Fig: 4 Lagrangian predictions of the droplet size distribution at an axial location of 30D for a spray with a poly – disperse droplet size distribution (droplet flow is 10ml/min b_1 is 3.2).

Additionally, the discretisation of the droplet size distribution used in Lagrangian model is small enough so that further refinement would not effect the solution significantly. Finally, this result shows that this method predicts agglomeration rate, over a wide range of droplet flows and for different agglomeration efficiencies. The development of a poly-disperse droplet size distribution downstream of the nozzle is for the Lagrangian model, as shown in Figure 4. This agreement is also found when simulating the downstream development of a mono-size (36μm) droplet dispersion, as shown in Figure 5. Thus, this model predicts agglomeration of droplets in sprays with different droplet-size distributions at the nozzle exit.
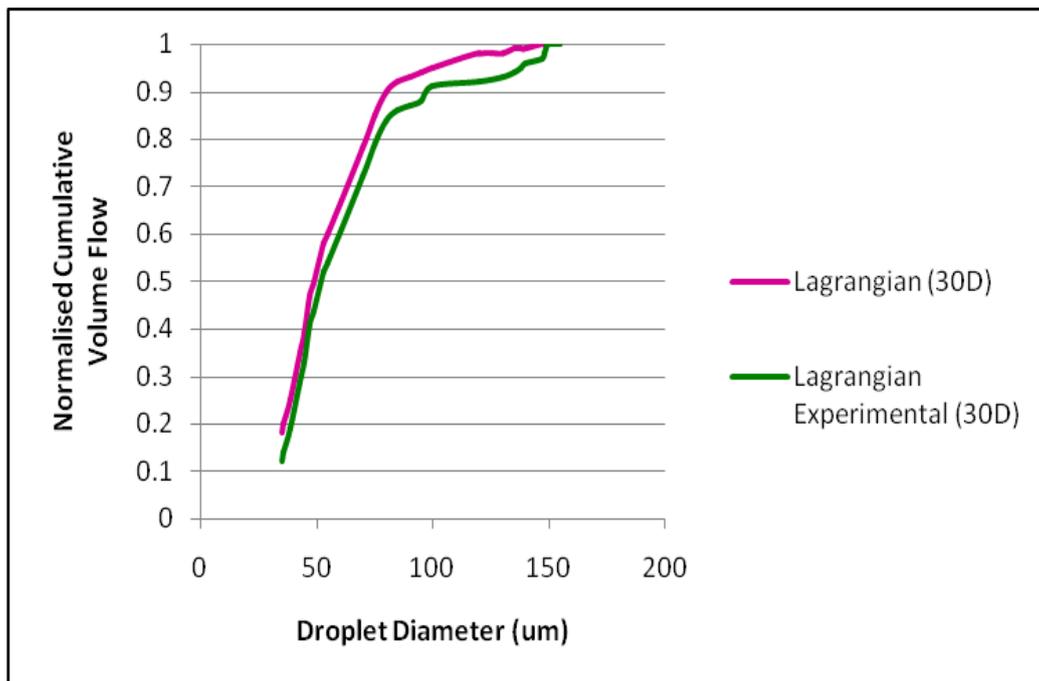
Fig 5: The Lagrangian predictions of the droplet size distribution at an axial location of 30D for a spray with an initial mono-sized distribution with 36 µm droplets (droplet flow is 10ml / min, b_1 is 3.2).

The effect of the gas-flow velocity and turbulence on the extent of agglomeration is shown in Table 1. In this part of the investigation, the velocity of the carrier gas at the nozzle exit is doubled and the turbulence kinetic energy is quadrupled (in order to retain the same turbulence intensity), while keeping the droplet flow constant at 10 m1/min. This effectively halves the number density of droplets at the nozzle exit, and hence reduces the extent of agglomeration within the spray, so that D_{32} at 30 nozzle diameters reduces from 52 µm to 45 µm. When the droplet flow is doubled from 10ml/min to 20 ml/min, while keeping the gas velocity and turbulence kinetic energy constant at the higher values, the number density at the nozzle exit increases back to the original value, and consequently D_{32} at 30 nozzle diameters, increases from 45µm to 53 µm. According to the Lagrangian predictions, D_{32} at 30 nozzle diameters only increases marginally from 51.8 µm to 52.5 µm when the gas velocity is doubled while keeping the droplet number density constant. Thus, the extent of agglomeration within a single spray is relatively insensitive to the carrier gas velocity and turbulence levels generated within the shear layer of the spray, and reasonably sensitive to the number density of droplets at the nozzle exit. In practice, it is considerably easier to change the number density of droplets over a wide range of values than the gas-flow velocity, which suggests that droplet number concentration is a particularly effective variable for controlling agglomeration.

Table 1 shows that Lagrangian model predicts the above mentioned trends. We have found that the computation time required to complete an agglomeration simulation is of a particular order of magnitude in its approach. The Lagrangian approach as a three dimensional calculation is realistically possible, so that it is more applicable for a wider range of   different flows.

TABLE 1: Sauter-mean diameter D at an axial location of 30D for poly-disperse sprays with different air velocities and droplet flows: Lagrangian predictions (b_1 is 3.2).

Droplet Flow (ml/min)	Velocity	D_{32} @ 30D (µm) Lagrangian
10	1x	51.8
10	2x	45.4
0	2x	52.5

The Lagrangian approach is not limited in this manner, so that droplets of similar size originating from different nozzles that point towards each other can cross-over the central axis of the impinging spray system, provided they have sufficient inertia.

IV. CONCLUSIONS

The Lagrangian approach is able to simulate droplet turbulent dispersion and agglomeration for a wide range of droplet and gas flows, and for sprays from nozzles that produce different droplet size distributions. Moreover, the time required for simulating agglomeration within a steady axisymmetric spray is of the given

magnitude for this approach. The Lagrangian approach has a wide range with regard to the range of applicability and ease of implementation.

REFERENCES

[1] ERLEMONT. A., DESJONQUERES. P., GOUESBET. G. (1990) "Particle Lagrangian simultation in turbulent flows" *Int.J.Multiphase Flow.* 16(1) 19 34.

[2] GOSMAN, A.D. IOANNIDES, E., (1983), "Aspects of computer simulation of liquid-fuelled combustors", *J.Energy ,* 7(6) 482-490.

[3] GUO, B.FLETCHER, D.F. LANGRISH, T.A.G., (2003), "Simulation of the agglomeration in a spray using Lagrangian particle tracking". *Applied Mathematical Modelling* (accepted).

[4] HOUNSLOW, M.J. RYALL, R.L. Marshall, V.R.(1988), "A discretised population balance for nucleation growth, and aggregation". *AICHEJ.* **34(11),** 1821-1832.

[5] ISSA, R.I., OLIVEIRA, P.J. (1994), "Numerical prediction of phase separation in two-phase flows through T-junctions". *Computers Fluids* 23(2), 347-372.

[6] KHAIN, A.P., PINSKY, M.B. (1997), "Turbulence effects on the collision Kernel. II. Increase of the swept volume of colliding drops", Q *J.R. Meteorol* Soc.123, 1543 – 1560.

[7] MOSTAFA, A.A. and MONOGIA, H.C.(1987), "On the modeling of turbulent evaporating sprays, Eulerian verses Lagrangian approach", Int. *J.Heat Mass Transfer.* 30 (12), 2583-2593.

[8] NIJDAM J.J. SIMONIN, O.,LANORISH, T.A.G., FLETCHER, D.F. (2003), "Experimental and theoretical investigations of droplet dispersion in a turbulent jet", manuscript in preparation.

[9] O'ROURKE. P.J. (1981), "Collective drop effects on vaporizing liquid sprays", PhD thesis, Los Alamos Nat Lab, Los Alamos, NM.

[10] RUGER, M. HOHMANN, S. SOMMERFELD. M. KOHNEN, G.(2000), "Euler/Lagrange calculations of turbulent sprays: the effect of droplet collisions and coalescence", *Atomisation and Spray,* 10.47-81.

[11] SIMONIN, O., (1991), "Prediction of the dispersed phase turbulence in particle-laden jets", in 4th *Int. symposium on Gas-solid Flows, ASME FED,* 121, 197-206.

HEAT TRANSFER ANALYSIS OF AUTOMOTIVE DISC BRAKES

Y Madhu Maheswara Reddy[1], Dr. P Usha Sri[2]

[1]Asst. Professor, Mechanical Engineering Department,
Methodist College of Engineering & Technology, Abids, Hyderabad.(India).
[2]Assoc. Professor, Mechanical Engineering Department, Osmania University, Hyderabad.(India).

ABSTRACT

The braking system plays the crucial role in the safety of a vehicle and its design poses a critical challenge. The heat dissipation and thermal performance of ventilated brake discs strongly depends on the aerodynamic characteristics of the air flow through the rotor passages. In this paper, the 3D CAD models for Solid disc and discs with different fin configurations namely, Straight Elliptical fins, Backward curved fins and Forward curved fins are designed. Each finned model disc with 12, 24 and 36 number of fins were developed using catia V5R20. The 3D FE models have been developed for the above disc configurations using Hypermesh V11 and the heat transfer analysis was carried out using ansys fluent13 at two different velocities at 40 mph and 50 mph. It was found that the Forward curved fins are having superior thermal performance characteristics both at 40 and 50 mph, namely at 40 mph and with 36 fins, show surface Heat Transfer coefficient 278.2 w/m^2k, Nusselt number 11000, Reynolds number 1930.

Keywords: Brake rotor, C.F.D., Heat transfer, Numerical Simulation, Velocity.

I. INTRODUCTION

The disc brake is a wheel brake which slows rotation of the wheel by the friction caused by pushing brake pads against a brake disc with a set of calipers. The brake disc (or *rotor* in American English) is usually made of cast iron, but may in some cases be made of composites such as reinforced carbon–carbon or ceramic matrix composites. This is connected to the wheel and/or the axle. To stop the wheel, friction material in the form of brake pads, mounted on a device called a brake caliper, is forced mechanically, hydraulically, pneumatically or electro magnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop. Brakes convert motion to heat, and if the brakes get too hot, they become less effective, a phenomenon known as brake fade.

For solid rotors, the highest temperature occurs on the surfaces of the rotors. To decrease the maximum temperature, the most effective way is to increase the thickness of the rotors. However, the increase is limited by the pistons. Materials also have effects on the rotor's temperature. From this research, steel is a better alloy to dissipate heat from the rotors. But in practical design problems, the thermal performance is not the only requirement. From the perspective of stiffness, friction resistance and cost, the cast iron material is common used in industry.

The objective of current paper is

- To estimate heat flux generated in solid discs
- The combinations of various fin configurations namely Straight Elliptical, Backward Curved, Forward curved and the various numbers of fins (12, 24 and 36) at two different speeds (40 and 50 mph) will be studied.
- To predict the effect of these variables on the heat transfer performance of disc brakes.

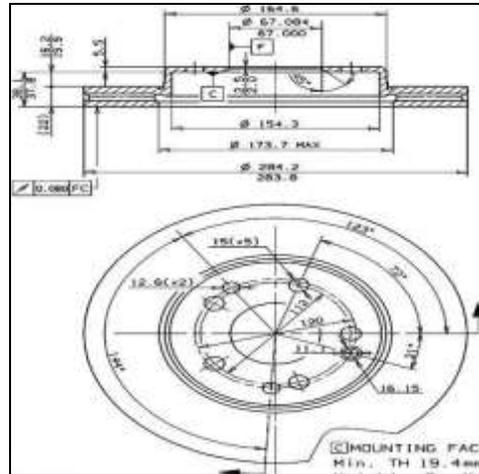The technical drawing of rotor is as shown in Fig1.

Fig.1 Drawing of OEM XYZ Rotor

II. METHODOLOGY

The 3D CAD models were developed for various disc configurations, namely Solid disc, discs with Straight elliptical fins, Backward curved fins and Forward curved fins with 12, 24 and 36 fins were created using CATIA V5R20. The 3D FE models were created for the above mentioned disc configurations using HYPERMESH V11. The conjugate heat transfer analysis was carried for each disc model using ANSYS-FLUENT13 at a disc speed of 40 mph and 50mph. The result plots were taken using ENSIGHT post processor. The cad models of rotors are shown in Fig2,3,4 and 5.

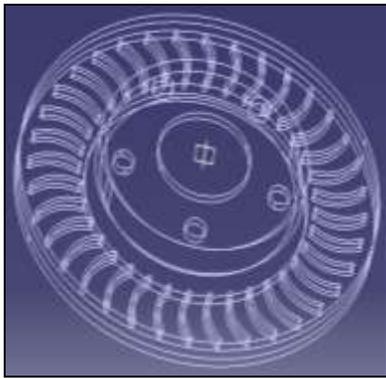**Fig.2 Solid Rotor**

Fig.3 Rotor with Straight Elliptical Fins

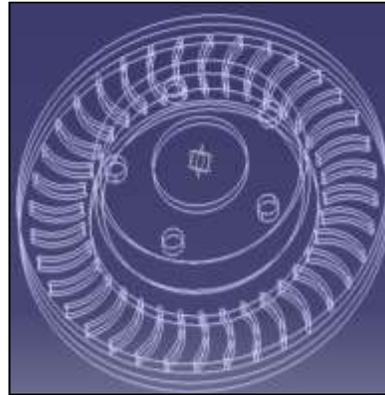**Fig.4 Rotor with   Backward Curved Fins**   **Fig.5 Rotor with Forward   Curved Fins**

III. PROPERTIES OF MEDIUM

In this section the various thermal and mechanical properties of the brake material and air medium will be presented.

Cast Iron Properties	Air Properties
Thermal conductivity, k = 27-46 w/m-K	Heat transfer coefficient, h = 5-25 w/m^{2}K (Free Convection)
Density, ρ = 6800-7800 kg/m^3	25-200 w/m^{2}K (Forced Convection)
Specific heat, c = 460 J/Kg-K	

Table.1 Properties of Medium

The vehicle and brake disc specifications considered for the analysis will be tabulated.

Vehicle Specifications	Disc Brake Specifications
Manufacturer = OEM	Brake Disc Thickness (mm): 21.9
Model = OEM XYZ	Brake Disc Type: Vented Disc
Year of Manufacture = 1998	Centering Diameter (mm): 67.0
Curb weight = 1600 Kg	Fitting Position: Front Axle
	Height (mm): 48.2
	Minimum Thickness (mm): 20.0
	Number of Holes: 5
	Outer Diameter (mm): 262.4

Table.2 Vehicle specifications

IV. BOUNDARY CONDITIONS

Inlet: Pressure at atmospheric condition (101325 Pa)

Outlet: Pressure at slightly above atmospheric condition (101525 Pa)

Ambient Temperature: 300 K

Convergence Tolerance: Default

Velocity of Rotor: 40 and 50 mph

For this problem, the model is based on the following assumptions:

- Continuum flow
- Newtonian fluid
- Steady state
- Laminar flow
- Constant properties (density, conductivity, specific heat, and viscosity
- Uniform surface heat flux
- Gravitational effect is considered.

The following commands/options were used in ANSYS-FLUENT to do the flow analysis.

- Pressure based solver
- Velocity formulation - Absolute
- Gravity is applied
- Second-Order upwind scheme for flow
- Convergence checks for continuity, energy and Momentum are taken as default values (1e-6)
- Energy equation is on.
- K-e (K-epsilon) model with standard wall functions
- Coupled (Pressure-velocity coupling) solver

V. VARIOUS PLOTS FOR ALL GEOMETRIES

In this Chapter, the results for 1 model of Solid disc and 3 models of discs with different fin shapes, namely Straight Elliptical fins, Backward curved fins, and Forward curved fins at different speeds, namely 40 mph and 50 mph with 12, 24 and 36 number of fins are presented.

The variation of Heat Transfer Coefficient with respect to number of fins, for various fin shapes at 40mph is shown in Fig.6
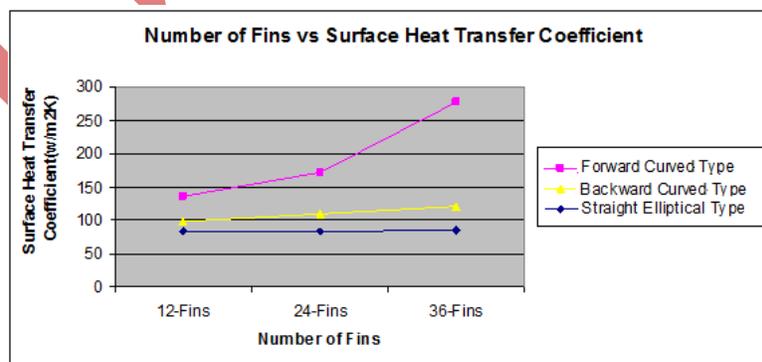

Fig.6 Number of Fins vs. Surface Heat Transfer Coefficient

From Fig.6 it is observed that the Heat Transfer Coefficient is increasing as the numbers of fins are increasing from 12 to 24 and 24 to 36. From Fig.6 it is clear that the Forward curved fins with 36 numbers of fins are having highest Heat transfer coefficient compared to the rest.

The values of Heat Transfer coefficient for Solid disc and discs with different fin shapes namely Straight elliptical fins, Backward curved fins and Forward curved fins for 12 fins, 24 fins and 36 fins at 40mph and 50 mph are shown in the Table 3.

Fin Shape	Number of Fins	Surface Heat Transfer Coefficient (w/m2-K) at 40mph	Surface Heat Transfer Coefficient (w/m2-K) at 50 mph
Solid		78.2	97.75
Straight Elliptical Fins	12-Fins	82.6	103.25
	24-Fins	83.96	104.95
	36-Fins	85.49	106.86
Backward Curved Fins	12-Fins	97.98	122.48
	24-Fins	108.66	135.83
	36-Fins	120.24	150.3
Forward Curved Fins	12-Fins	136.29	170.36
	24-Fins	171.73	214.66
	36-Fins	278.2	347.74

Table.3 Values of Heat Transfer Coefficient at 40mph and 50 mph

The variation of Surface Nusselt Number with respect to number of fins, for various fin shapes at 40mph is shown in Fig.7
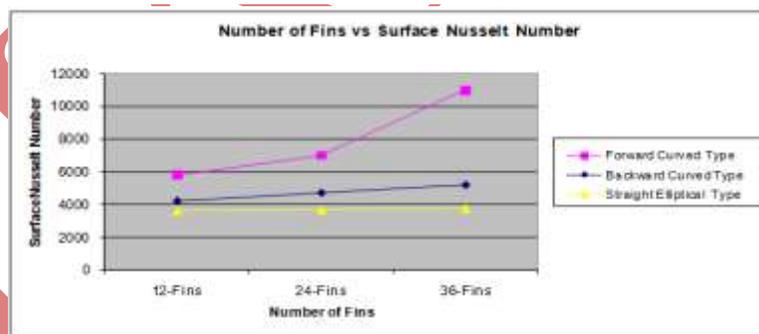

Fig.7. Number of Fins vs. Nusselt Number

From Fig.7 it is observed that the Nusselt Number is increasing as the numbers of fins are increasing from 12 to 24 and 24 to 36. From Fig.7 it is clear that the Forward curved fins with 36 numbers of fins are having highest Nusselt Number compared to the rest.

The values of Nusselt Number for Solid disc and discs with different fin shapes namely Straight elliptical fins, Backward curved fins and Forward curved fins for 12 fins, 24 fins and 36 fins at 40mph and 50 mph are shown in the Table 4

	Number of Fins	Surface Nusselt Number at 40mph	Surface Nusselt Number at 50 mph
Solid		3230	4038
Straight Elliptical Fins	12-Fins	3620	4525
	24-Fins	3680	4600
	36-Fins	3752	4690
Backward Curved Fins	12-Fins	4215	5269
	24-Fins	4712	5890
	36-Fins	5213	6516
Forward Curved Fins	12-Fins	5814	7268
	24-Fins	7000	11640
	36-Fins	11000	15784

Table.4 Values of Nusselt Number at 40mph and 50 mph

The variation of Reynolds Number with respect to number of fins, for various fin shapes at 40mph is shown in Fig.8
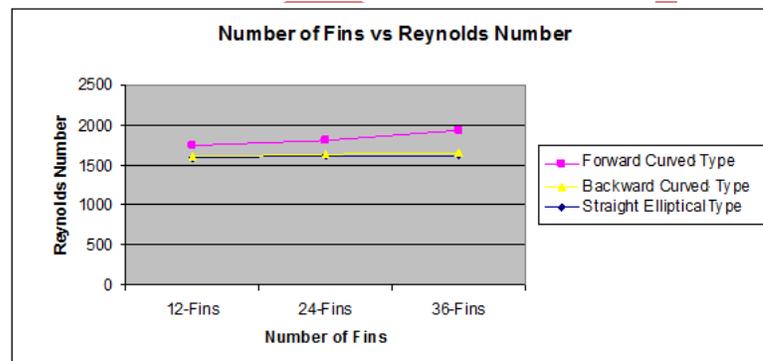

Fig.8 Number of Fins vs. Reynolds Number

From Fig.8 it is observed that the Reynolds Number is increasing as the numbers of fins are increasing from 12 to 24 and 24 to 36. From Fig.8 it is clear that the Forward curved fins with 36 numbers of fins are having highest Reynolds Number compared to the other.

The values of Reynolds Number for Solid disc and discs with different fin shapes namely Straight elliptical fins, Backward curved fins and Forward curved fins for 12 fins, 24 fins and 36 fins at 40mph and 50 mph are shown in the Table 5

Fin Shape	Number of Fins	Reynolds Number at 40mph	Reynolds Number at 50 mph
Solid		1422	1582
Straight Elliptical Fins	12-Fins	1602	1730
	24-Fins	1628	1742
	36-Fins	1656	1787

Backward Curved Fins	12-Fins	1602	1826
	24-Fins	1628	1859
	36-Fins	1656	1902
Forward Curved Fins	12-Fins	1739	1915
	24-Fins	1812	2095
	36-Fins	1930	2313

Table.5 Values of Reynolds Number at 40mph and 50 mph

Tables 3,4 and 5 shows the results of heat transfer analysis for 1 model of Solid disc and 3 models of discs with different fin shapes, namely Straight Elliptical fins, Backward curved fins, and Forward curved fins at different speeds, namely 40 mph and 50 mph with 12, 24 and 36 number of fins.

From the tables 3,4 and 5 it is observed that as the number of fins are increased for curved rotors the heat transfer parameters like Heat transfer coefficient, Nusselt number, and Reynolds number are increasing.

It is also observed that these heat transfer parameters are changing with the change of curvature of fins. These parameters are increasing from Straight elliptical fins to Backward curved fins and Backward curved fins to Forward curved fins.

VI. CONCLUSION

The following conclusions have been drawn from the analysis performed on the various fin configurations at 40 and 50 mph. The most important variables affecting thermal performance are fin numbers and curvature. From the result the disc with Forward type fins is superior in terms of heat transfer performance when compared to all other fin types, namely Solid disc, Backward curved fins and Straight elliptical fins. It is found that at 40mph and 50mph the disc with Forward curved fins is having the better heat transfer characteristics. Forward disc has the following values at 40mph with 36 numbers of fins Surface Heat Transfer Coefficient 278.2 (w/m^2-K), Nusselt Number 11000, and Reynolds Number 1930.Forward disc has the following values at 50mph with 36 numbers of fins Surface Heat Transfer Coefficient 347.74 (w/m^2-K), Nusselt Number 15784, and Reynolds Number 2313.From the results it is observed that as the speed of the rotor increases Reynolds number increases, Nusselt number improved and Heat transfer coefficient increased.

REFERENCES

[1].   D. A. Johnson, B. A. Sperandei, R. Gilbert, Analysis of the Flow Through Vented Automotive Brake Rotor, Journal of Fluids Engineering, ASME, Nov. 2003,Vol. 125/979

[2].   J. H. Choi, I. Lee, Finite Element Analysis of Transient Thermo elastic Behaviors in Disk Brakes, Science Direct, Wear 257 (2004) 47-58.

[3].   D. G. Grieve, D. C. Barton, D. A. Crolla, J. T. Buckingham, Design of a lightweight Automotive Brake Disc Using Finite Element and Taguchi Techniques, Institution of Mechanical Engineers; 1998; 212, 4; ProQuest Science Journal.

[4].   Z. Chi, Y. He and G. F. Naterer, Geometrical Optimization of Vented Brake Discs of Automotive Vehicles, submitted to CATS 2008, Toronto, Canada, 2008

[5].   Z. Chi, G. F. Naterer and Y. He, Thermal Performance Analysis of Vented Automotive Brake Discs, CSME Forum 2008, University of Ottawa, Ottawa,Canada, 2008.

[6].   D. G. Grieve, D. C. Barton, D. A. Crolla, J. T. Buckingham, Design of a lightweight Automotive Brake Disc Using Finite Element and Taguchi Techniques, Institution of Mechanical Engineers; 1998; 212, 4; ProQuest Science Journal.

[7].   S. Aus Der Wiesche, Heat Transfer from a Rotating Disk in a Parallel Air Cross flow, International Journal of Thermal Sciences 46(2007) 745-754.

[8].   Z. Chi, G. F. Naterer and Y. He (2008) Effects of Brake Disc Geometrical Parameters and Configurations on Automotive Braking Thermal Performance, CSME Transactions 2008, University of Ottawa, Ottawa, Canada, 2008

[9].   A. D. Mcphee and D. A. Johnson, Experimental Heat Transfer and Flow Analysis of a Vented Braked Brake Rotor, International Journal of Thermal Sciences, Vol. 3, No. 6, 2007.

[10].   M. Naji, M. Al-Ninr, S.Masoud, Transient thermal behavior of a cylindrical brake system, Heat and Mass Transfer 36 (2000) 45-49, Springer-Verlag 2000.

[11].   Bejan, Adrian, Convection heat transfer, 3rd edition. Hoboken, N.J.:Wiley,c2004.

[12].   Latif M. Jiji, Heat Convection, Berlin ; New York : Springer, c2006

[13].   Brake Design and Safety, 2E, Rudolf Limpert

Effect of Induced Turbulence in a C.I Engine by Varying Compression Ratio and Injection Timing on the Performance of the Engine

K. Srinivasa Raghavan
Mechanical engineering department
JNTUA College of engineering
Anantapuramu, A.P. India

Dr. V. Pandurangadu
Professor, Mechanical engineering department
JNTUA College of engineering
Anantapuramu, A.P. India

Abstract- **The depletion of world petroleum reserves results in, two crises that are rising of fuel prices and global warming problems. The energy security can be maintained by improving the efficiency of energy producing components. Efforts are being made to find the alternatives. In the present work the modification of C I engine, for inducing turbulence to improve the combustible mixture, a rotating blade has been provided in the cavity (bowl) of the reciprocating piston in the main combustion chamber. The oscillation of the connecting rod causes the blade to rotate by an angle of 60°. This arrangement induces the turbulence in combustible mixture during engine operation, through which better combustion can be achieved. The effects of induced turbulence, injection pressure, compression ratio, injection timing on combustion, performance and emission characteristics of diesel fuelled compression ignition engine are studied.**

Key words- Turbulence, rotating blades, modified piston

INTRODUCTION

Internal combustion engines have been a relatively inexpensive and reliable source of power for applications ranging from domestic use to large scale industrial and transportation applications for most of the twentieth century. DI Diesel engines, having the evident benefit of a higher thermal efficiency than all other engines, have served for both light- duty and heavy- duty vehicles. The in-cylinder fluid motion in internal combustion engines is one of the most important factors controlling the combustion process. It governs the fuel-air mixing and burning rates in diesel engines. The fluid flow prior to combustion in internal combustion engines is generated during the induction process and developed during the compression stroke. Therefore, a better understanding of fluid motion during the induction process is critical for developing engine designs with the most desirable operating and emission characteristics. To obtain a better combustion with lesser emissions in direct injection diesel engines, it is necessary to achieve a good spatial distribution of the injected fuel throughout the entire space. This requires matching of the fuel sprays with combustion chamber geometry to effectively make use of the gas flows. In other words, matching the combustion chamber geometry, fuel injection and gas flows is the most crucial

factor for attaining a better combustion. In DI diesel engines, swirl can increase the rate of fuel-air mixing, reducing the combustion duration for re-entrant chambers at retarded injection timings. Swirl interaction with compression induced squish flow increases turbulence levels in the combustion bowl, promoting mixing. Since the flow in the combustion Chamber develops from interaction of the intake flow with the in-cylinder geometry, the goal of this work is to characterize the role of combustion chamber geometry on in-cylinder flow. It is evident that the effect of geometry has a negligible effect on the airflow during the intake stroke and early part of the compression stroke. But when the piston moves towards Top Dead Centre (TDC), the bowl geometry has a significant effect on air flow thereby resulting in better atomization, better mixing and better combustion. The re-entrant chamber without central projection and with sharp edges provides higher swirl number than all other chambers. Turbulence plays a very vital role in combustion phenomenon. The flame speed is very low in non-turbulent mixtures. A turbulent motion of the mixture intensifies the processes of heat transfer and mixing of the burned and unburned portions in the flame front (diffusion). These two factors cause the velocity of turbulent flame to increase practically in proportion to the turbulence velocity. The turbulence of the mixture is due to admission of fuel-air mixture through comparatively narrow sections of the intake pipe, valves, etc. in the suction stroke. The turbulence can be increased at the end of the compression by suitable design of combustion chamber, which involves the geometry of cylinder head and piston crown. The degree of turbulence increases directly with the piston speed. If there is no turbulence the time occupied by each explosion would be so great as to make the high speed internal combustion engines impracticable. Insufficient turbulence lowers the efficiency due to incomplete combustion of the fuel. However, excessive turbulence is also undesirable.

The effects of turbulence can be summarized as follows:
Turbulence accelerates chemical action by intimate mixing of fuel and oxygen. Hence Turbulence allows the ignition,

advance to be reduced and therefore weak mixtures can be burnt. The increase of flame speed due to turbulence reduces the combustion time and hence minimizes the tendency to detonate. Turbulence increases the heat flow to the cylinder wall and in the limit excessive turbulence may extinguish the flame. Excessive turbulence results in the more rapid pressure rise (though maximum pressure may be lowered) and the high rate of pressure rise causes the crankshaft to spring and rest of the engine to vibrate With high periodicity, resulting in rough and noisy running of the engine.

MODIFICATION OF ENGINE

Base piston is having simple bowl shaped structure on the crown of it. In the present work modified piston is made with three rotating blades at 120^0 to each other in piston bowl. The blades used for this work should be of same material which piston have. Aluminum alloy material is used in fabrication of blades. The modified piston is arranged in the combustion chamber.

Fig 1: Piston with the rotating blades inside the bowl.

Fig 2 : Arrangement of modified piston inside the engine cylinder

EXPERIEMENTAL DETAILS

Experiments are conducted on a 4-stroke single cylinder 3.68 Kw Kirlosker water cooled Diesel engine. All these tests are conducted at a rated speed of 1500 RPM . The experimental set up is shown in fig.

Fig 3 : View across the engine side

From the experiments observed that combustibility of the fuel is very important in order get a good power output and good thermal efficiencies. The turbulence was played an important role here. In the present work it can be obtained by arranging the rotating blades inside the piston bowl of the engine.

RESULTS ANS DISCUSSIONS

A variable load test is conducted on Diesel engine by arranging the modified piston inside the cylinder. The better combustibility of fuel is obtain by better turbulence due to the modified piston. The performance and emission characteristics are explained below in detail.

BRAKE THERMAL EFFICIENCY

The variation of break thermal efficiency with respect to load applied for 17.5 and 20.1 compression ratios and advanced, standard and retard injection timings for normal and modified pistons are shown in exhibits 1&2. Turbulence is caused by modified piston. Turbulence enhances mixing and probably produces a leaning effect. The turbulence in the combustion chamber makes the charge into homogeneous and increases the combustibility of fuel. So brake thermal efficiency of modified piston is 2% more than the normal piston. Brake thermal efficiency is increasing with load applied. Compared to normal piston the efficiency increased by 2.2% for modified piston with 17.5 compression ratio. For 20.1 compression ratio the improvement in brake thermal efficiency is less than 17.5 and is up to 2% only. Thus we can get better improvement in brake thermal efficiency at 17.5 compression ratio. Brake thermal efficiency is got max. for the advanced injection timing compared to standard and retard timings. So that the brake thermal efficiency can be increased by more than 2% for modified piston of 17.5 compression ratio and advanced injection timing.

VOLUMETRIC EFFICIENCY

The variation of volumetric efficiency with respect to load applied for 17.5 and 20.1 compression ratios and advanced, standard and retard injection timings for normal and modified pistons are shown in exhibits 3&4. Volumetric efficiency depends up on the intake air into the combustion chamber. As the intake air into cylinder is more then we get better volumetric efficiency. By Turbulence we get better results. The volumetric efficiency of modified piston

is 2-3 % more than the normal piston. Compared to normal piston the efficiency increased by 2.6% for modified piston with 17.5 compression ratio. For 20.1 compression ratio the improvement in volumetric efficiency is almost same as 17.5 and is also varies between 2-3% only. Volumetric efficiency is got maximum at 17.5 compression ratio, 200 bar pressure and standard injection timing, for 20.1 compression ratio it is 250 bar pressure and advance timing. So that the brake thermal efficiency can be increased by more than 2% for modified piston of 17.5 compression ratio and advanced injection timing.

CARBON MONOXIDE (CO) EMISSIONS

The amount of Carbon monoxide (CO) emissions present in the exhaust with respect to load applied for 17.5 and 20.1 compression ratios and advanced, standard and retard injection timings for normal and modified pistons are shown in exhibits 5&6. As more amount of oxygen is available in cylinder results the reduction in CO emissions. Due to the turbulence there will be a good amount of oxygen supply to cylinder. Turbulence is caused by modified piston. So that carbon monoxide emissions are reduced by 15% vol with modified piston. Carbon monoxide emissions are reduced with load applied. Compared to normal piston the CO emissions are reduced by 14% vol for modified piston with 17.5 compression ratio. For 20.1 compression ratio the reduction in CO emissions is 17% vol for modified piston. Thus we can get good reduction in CO emissions at 17.5 compression ratio. CO emissions are got min. at 250 bar pressure and the standard injection timing for 20.1 compression ratio. So that the CO emissions are reduced by 15 % with modified piston.

HYDRO CARBON (HC) EMISSIONS

The amount of Hydrocarbon (HC) emissions present in the exhaust with respect to load applied for 17.5 and 20.1 compression ratios and advanced, standard and retard injection timings for normal and modified pistons are shown in exhibits 7&8. Here some amount of lean mixture present in the cylinder. Turbulence can be obtained by the modified piston. With the turbulence rich mixture is obtained. This causes the reduction of hydrocarbons in the exhaust. So that the hydrocarbon emissions are reduced with modified piston. So that HC emissions are reduced by 13% with modified piston. Compared to normal piston the HC emissions are reduced by 14% for modified piston with 17.5 compression ratio. For 20.1 compression ratio the reduction in HC emissions is 12% for modified piston. Thus we can get good reduction in HC emissions at 17.5 compression ratio and advanced injection timing.
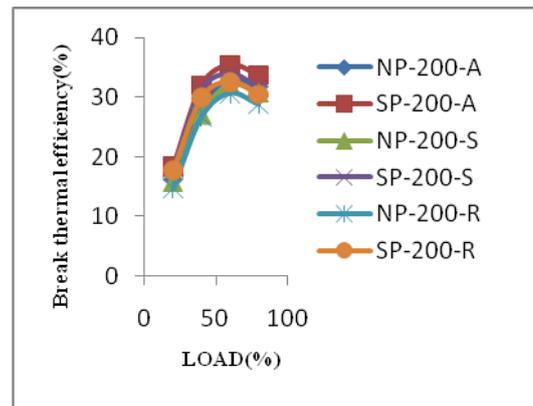

Exhibit 1.comparison of brake thermal efficiencies with load applied for 17.5 Compression ratio and different injection timings of normal& modified pistons.
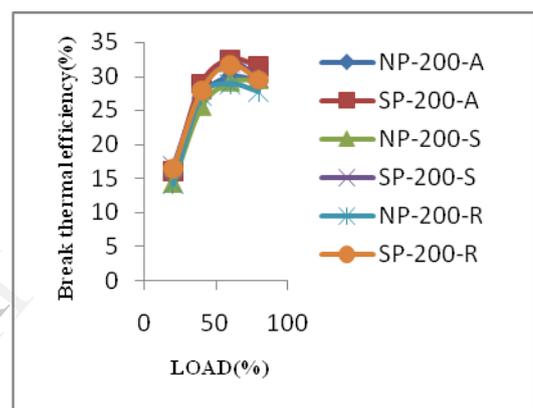

Exhibit 2.comparison of brake thermal efficiencies with load applied for 20.1 Compression ratio and different injection timings normal& modified pistons.
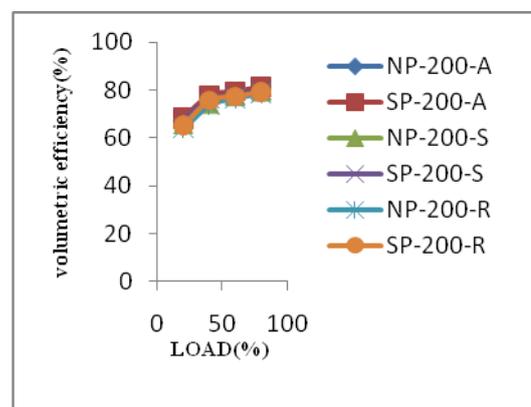

Exhibit 3.comparison of volumetric efficiencies with load applied for 17.5 compression ratio and different injection timings of normal& modified pistons
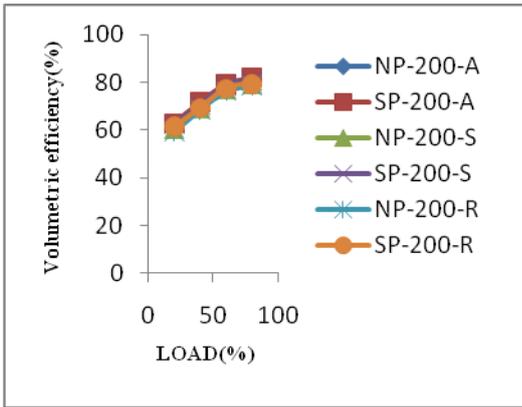
Exhibit 4.comparison of volumetric efficiencies with load applied for 20.1 compression ratio and different injection timings of normal& modified pistons

Exhibit7.comparison of Hydro carbon emissions with load applied for 17.5 compression ratio and different injection timings of normal& modified pistons

Exhibit5.comparison of carbon monoxide emissions with load applied for 17.5 compression ratio and different injection timings of normal& modified pistons.

Exhibit8.comparison of Hydro carbon emissions with load applied for 20.1 compression ratio and different injection timings of normal& modified pistons.
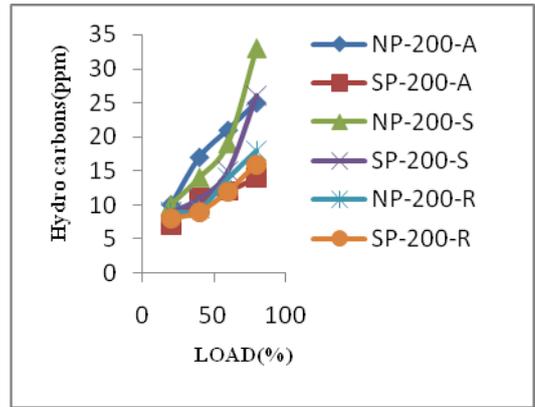

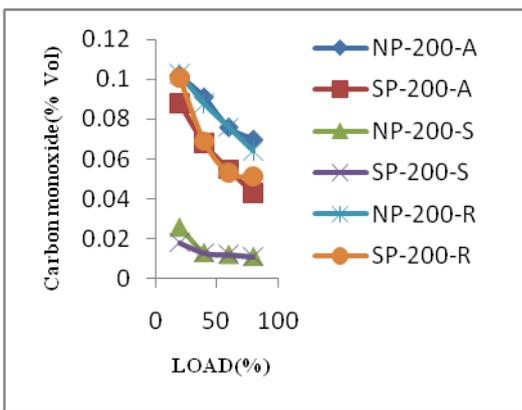
Exhibit6.comparison of carbon monoxide emissions with load applied for 20.1 compression ratio and different injection timings of normal& modified pistons.
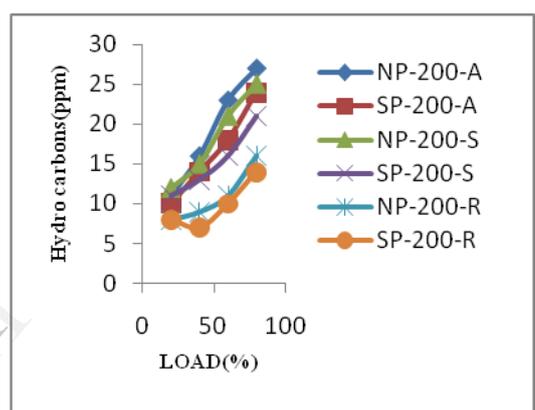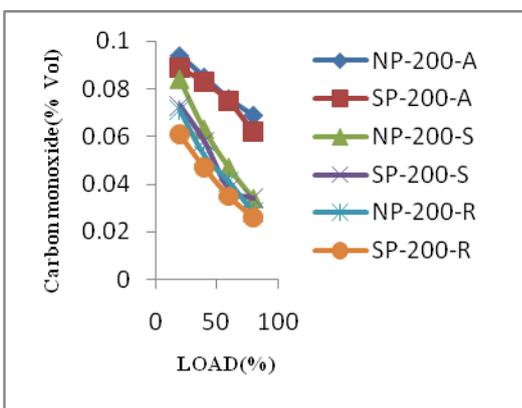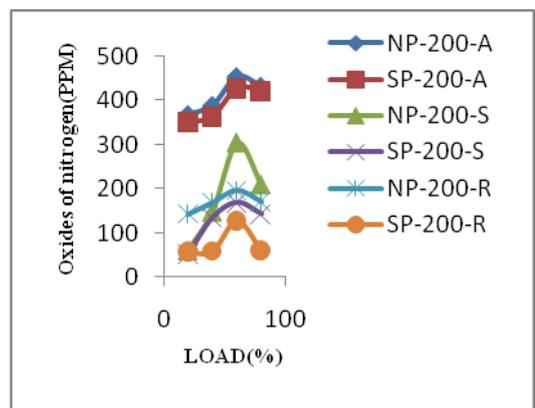

Exhibit 9.comparison of Oxides of Nitrogen with load applied for 17.5 compression ratio and different injection timings of normal& modified pistons.
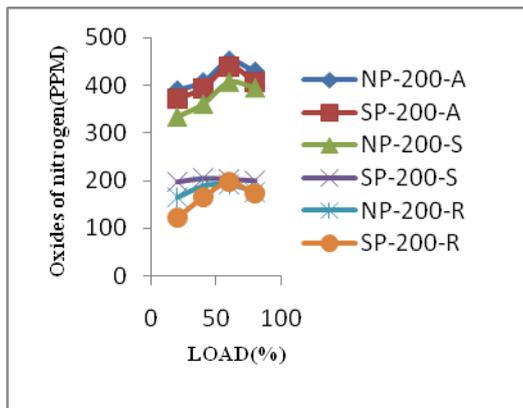
Exhibit 10.comparison of Oxides of Nitrogen
With load applied for 20.1compression ratio and different injection
timings of normal& modified pistons.

OXIDES OF NITROGEN (NO$_X$)

The amount of Oxides of Nitrogen (NOx) emissions present in the exhaust with respect to load applied for 17.5 and 20.1 compression ratios and advanced, standard and retard injection timings for normal and modified pistons is shown in exhibits 9&10. NOx is created mostly from nitrogen in the air. NO$_X$ is a very undesirable emission, and regulations that restrict the allowable amount continue to become more stringent. Released NOx reacts in the atmosphere to form ozone and is one of the major causes of photochemical smog. Most of this will be nitrogen oxide (NO), with a small amount of nitrogen dioxide (NO$_2$), and traces of other nitrogen-oxygen combinations. NOx emissions are reduced by 7% with modified piston. Compared to normal piston the NOx emissions are reduced by 6% for modified piston with 17.5 compression ratio. For 20.1 compression ratio the reduction in NOx emissions is 8% for modified piston. Thus we can get good reduction in NOx emissions at 20.1 compression ratio and standard injection timing.

CONCLUSIONS

Based on the above results and discussions, the following conclusions are drawn:

▪ With the rotating blades inside the piston, turbulence is generated inside the combustion chamber. This further increases the combustibility of the mixture.

▪ The homogeneous mixture inside the combustion chamber increases the break thermal efficiency of modified piston by 2% compared to normal piston.

▪ The turbulence in the combustion chamber provides the homogeneous mixture, This increases the volumetric efficiency by 2% with modified piston.

▪ The turbulence in the combustion chamber increases the oxygen present in it. With this emissions are drastically reduced.

▪ The NOx emissions are increased due to the high temperatures in the combustion chamber caused by the turbulence.

REFERENCES

1. Katasuhika Moyamito Yoshiyuki Hosiba, Kiyotaka Hosono, Syunichi Hirao "Enhancement of Combustion by Means of Squish Pistons" MITSUBISHI MOTORS technical review 2006, NO 18.
2. B. Murali Krishna and J. M. Mallikarjuna "Tumble Flow Analysis in an Unfired Engine Using Particle Image Velocimetry" World Academy of Science, Engineering and Technology 5-4- 2009.
3. John B. Heywood "Internal combustion Engine fundamentals". McGraw-Hill International Edition, Automotive technology series. year 1998.
4. S. Baghdar Hosseini, K. Bashirnezhad, A.R. Moghiman, Y. Khazraii, N. and Nikoofal, "Experimental Comparison of Combustion Characteristic and Pollutant Emission of Gas oiland Biodiesel," International Journal of Mechanical and Materials Engineering 1:1 2010.
5. Lu¨ Xingcai *, Hou Yuchun, Zu Linlin, Huang Zhen "Experimental Study on The Auto-Ignition and Combustion Characteristics in the Homogeneous Charge Compression Ignition (HCCI) Combustion Operation with Ethanol/n-heptanes Blend Fuels," by Port Injection School of Mechanic and Power Engineering, Shanghai Jiaotong University, Shanghai, People's Republic of China. Received 2 August 2005; received in revised form 23 April 2006.
6. Z.H.Huang, .W.Wang, H.Y.Chen,L.B.Zhou & D.M.Jiang"Study of combustion characteristics of a compression ignition engine fuelled with dimethyl ether," Xi'an Jiao tong University Institute of Internal Combustion Engines, School of Energy and Power Engineering Xi'an, People's Republic of China.
7. M. Pugazhvadivu1 and S. Rajagopan Dept. of Mechanical Engineering, "Investigations on a Diesel Engine Fuelled with Biodiesel Blends and Diethyl Ether as an additive," Dept. of Chemistry, Pondicherry Engineering College, Pondicherry, India- 605 014 ,Vol.2 No 5 (May 2009) ISSN: 0974- 6846.
8. Yi Ren, Zuohua Huang , Deming Jiang, Liangxin Liu, Ke Zeng, Bing Liu, Xibin Wang, "Combustion Characteristics of a Compression-Ignition Engine Fuelled with Diesel–di-Methoxy Methane Blends Under Various Fuel Injection Advance Angles," State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an 710049, People's Republic of China.
9. Kidoguchi Yoshiyuki (univ. Of Tokushima) Miwa Kei (univ. Of Tokushima) Yang.C (zexel corp., jpn) kato ryoji (Isuzu Motor Ltd.)"Effect of High Squish Combustion Chamber on Smoke and NOx Emissions of a Direct-Injection Diesel Engine" ISSN: VOL.2000; NO.Vol.4; PAGE.335-336(2000).

Energy Based Analysis of a Thermal Power Station for Energy Efficiency Improvement

Dr. Mohammed Yunus[1], Mohammed Asadullah[2], Dr. Hamza A. Ghulman[3], Dr. J. Fazlur Rahman[4], Mohammed Irfan[5]

[1,2,4,5] Department of Mechanical Engineering, H.K.B.K.College of Engineering/ Visvesvaraiah Technological University, India
[3]Department of Mechanical Engineering, Ummul Qura University, Mekkah, Kingdom of Saudi Arabia

ABSTRACT: *Despite of growth of renewable energy stations installations like wind, solar, Tidal power, the energy for the world depends heavily on fossil fuels for electricity generation. It is also expected to continue the dependence on fossil fuels for next few decades. Therefore, given the continued reliance on the fossil fuels for some time, it is important to note these plants must reduce their environmental impact by operating fossil fuels more efficiently. Two types of analysis namely, energy and exergy analysis can be developed for the system. Energy analysis based on first law of thermodynamics cannot be applied as it cannot justify the real useful energy loss because it does not differentiate between the quality and quantity of energy within the system. Whereas, exergy analysis will characterize the work potential of a system based on the second law of thermodynamics and the maximum work that can be obtained from the system when its state is brought to the reference or dead state (standard atmospheric conditions).This technical paper presents the results of exergy and energy analysis carried out on 62 MW coal-based thermal power plant to evaluate the performance. The performance of the plant was estimated by a component-wise modeling followed by a system simulation. A parametric study is conducted for the thermal plant under various operating conditions, including different operating condenser pressures, temperatures and flow rates of cooling water across the condenser etc, in order to determine which parameter that maximizes plant performance. Energy loss distribution to find out the amount and source of irreversibilities generated in boiler and turbine in a plant so that any process in the system having largest energy destruction can be identified and that helps the designer to re design the system components.*

Keywords: Exergy Analysis, Energy analysis, Coal based Thermal Power station, Fossil fuels, Irreversibility, Second Law of Thermodynamics.

I. Introduction

Despite of growth of renewable energy stations installations like wind, solar and tidal power, the energy for the world depends heavily on fossil fuels for electricity generation. It is also expected to continue the dependence on fossil fuels for decades. Therefore, given the continued reliance on the fossil fuels for some time, it is important that fossil fuel plants reduce their environmental impact by operating more efficiently. The heavy dependence on fossil fuels is expected to continue for decades. Despite the depletion of fossil fuel reserves and environmental concerns such as climate change, the growth in oil demand is expected to be 60% between 2014 and 2035, 94% for natural gas and 96% for coal [24]. Since it is very clean process, it is continued to reliance on the fossil fuels for some more time. Therefore, it is important that fossil fuel plants should reduce their environmental impact by operating more efficiently.

There are two types of analysis used for thermal power plants, namely, energy and exergy analysis can be developed for the system. Energy analysis based on first law of thermodynamics cannot be applied as it cannot justify the real useful energy loss because it does not differentiate between the quality and quantity of energy within the system and also does not characterize the irreversibility of processes within the system. Whereas, exergy analysis will characterize the work potential of a system based on the second law of thermodynamics and the maximum work that can be obtained from the system when its state is brought to the reference or dead state (standard atmospheric conditions). Exergy analysis is based on the second law of thermodynamics. Past exergy studies have evaluated the performance of power plants, as a means to optimize the performance and turbine power output.

Using exergy and energy analysis, the performance of 400MW capacity coal-fired and nuclear power plants carried out successfully by Habib et. al.and Zubair et.al [17] conducted a second law analysis of regenerative Rankine power plants with reheating. Sengupta et al. [19] conducted an exergy analysis of a 210 MW thermal power plant in India. Rosen et.al.[13], [16], [20], [21] and [22] performed exergy analysis of power plants that operate on various fuels. They have also investigated capital costs involved and thermodynamic

losses. Most common size of power plants in India are 100/110/200/210 MW [6]. The exergy analysis is not so popular among industries especially in India and it needs much more attention and application so that the irreversibilities can be minimized and thus the systems can be operated at much higher efficiency. The present work is to show the application of energy and exergy based analysis. The performance of the plant was estimated by a component-wise modeling followed by a system simulation (computer program) and detailed break-up of exergy losses are evaluated. For the low performance of plant, the various parameters responsible for the plant are mismatching of equipments/ components, improper maintenance, over a period of time, low performance due to deteriorated equipments, inadequate instrumentation, mismatching of equipments etc. [3].

The power plant is designed to utilize an air cooled condenser to condense the exhaust steam. This paper will identify major sources of losses and energy destruction in the power plant. It will provide ways and means to improve the system performance and reduce environment impact. Finally, it will perform a parametric study to determine how the system performance varies with different operating parameters. he introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

II. Experimental Methodology

A detailed process flow-sheet of a Thermal Power Station consists of a unit employs regenerative feed water heating system which is carried out in two stages of low pressure heaters and high pressure heaters along with one open de-aerating heat exchanger. Saturated steam from the boiler drum is fed to the super heater to heat it up to 500°C at a pressure of 85 bars.
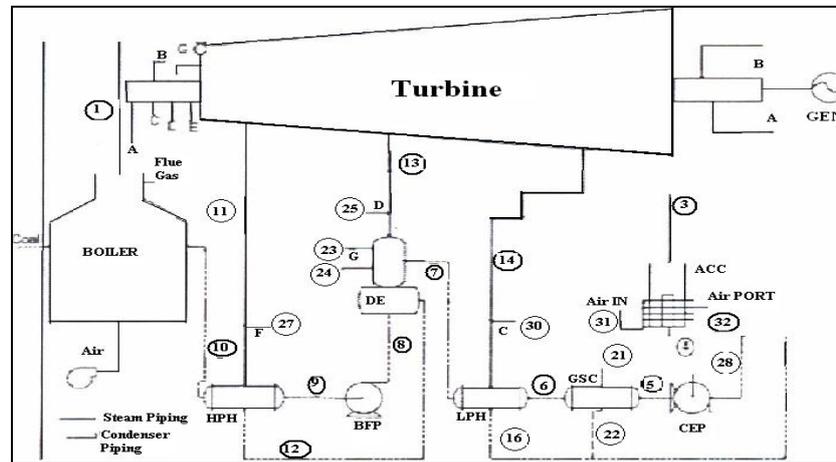
Fig. 1. Process flow diagram: ACC - air cooled condenser, BFP - boiler feed pump, CEP condensate extraction pump, DE - deaerator, GEN - generator, GSC gland steam condenser, HPH - high pressure heater, LPH - low pressure heater.

The condenser pressure is taken as 10 kPa. The extraction pressures of steams from the turbine varies at High Pressure Heater of fist stage of 30 bars to High Pressure Heater of stage of 16 bars , De-aerator of 6 bars and Low Pressure Heater of fist stage of 2.8 bars to Low Pressure Heater of 2 stage of 0.8 bar.

2.1 Composition Details

Coal available in India is the supply fuel of the power plant with the following components and the compositions of it used for coal fired thermal power plant are shown in table 1. Calorific value of Indian coal supplied to Raichur Thermal Power station has 15.5 MJ/kg.

Table 1.Composition of typical Indian coal

Components	Mass in percentage
Moisture	10
Ash	40
Hydrogen	2.68
Nitrogen	0.8
Sulphur	0.65
Oxygen	7
Carbon	38.87

2.2 Assumptions to be made for using flow sheet program method of analysis.
1. Reference temperature for water / steam is at 25^0C and incoming fuel temperature is also 25^0C.
2. Neglect the potential and kinetic exergies.
3. Environment model to calculate exergy has reference pressure and temperature are 1.013 bar and 25^0C and the composition of environment(% mole)for CO_2, H_2O, N_2, O_2, are 0.03, 3.12, 76, 21.
4. Excess air is 20%.
5. Generator efficiency is 95%.
6. Isentropic efficiency of pumps / fans and turbine are 70% and 80% respectively.

The present study has been performed using a flow-sheet program, which is a well-structured program for the thermodynamic analysis of energy systems. The ash content of Indian coal, as already mentioned is around 40 - 50% as against 5 - 10% in the coal being used in the western countries. This is one of the important factors contributing to the lower overall efficiency of the plant. Being a tropical country, the cooling water temperature in majority of the parts in India throughout the year is around 25^0C. In Europe and other western countries the cooling water temperatures are lower in the range of $5 - 10^0$C, which enables the operation of the condenser at much lower vacuum pressures (5 kPa), thus resulting in higher operating efficiencies. Since, both the above factors are nature's limitation; though coal can be beneficiated to a small extent, designer's / plant operator's focus should shift to other major sites of potential improvement. Thus, the goal of this paper is to identify such sites so that the overall efficiency of the system can be improved.

III. Results and Discussion

Parametric study has been carried out in order to account the performance of the over the parameters such as gain in cooling water temperature across the condenser, Steam temperature, steam pressure, inlet air temperature, and the condenser pressure. Fig 2. shows that the reference temperature does not have an effect on the energy efficiency, but it affects then exergy efficiency. The performance of the system depends on the surroundings of the system i.e. inlet air temperature. Fig. 4. shows the variation of efficiencies (both exergy and energy) with the increase in cooling water temperature across the condenser and it is found about $0.15 - 0.20\%$ for the temperature variation of 5^0C. As this power plant uses an air cooled condenser to condense the exhaust steam of the turbine and mainly the improvement that can be achieved by lowering the condenser pressure as shown in fig.3 due to the higher expansion of steam through the turbine, resulting in higher power output.
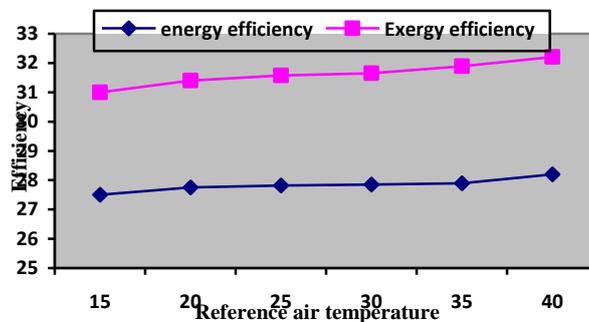
Fig.2. Variation of efficiencies v/s Reference air temperature
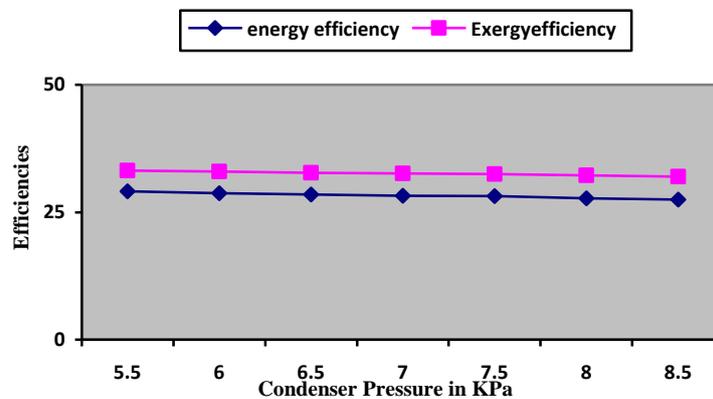
Fig. 3. Variation of efficiency vs. condenser pressure

In case of water cooled condensers, where the temperature of water can be easily controlled, but not in an air cooled condenser, the temperature at which the steam to be condensed cannot be reduced.
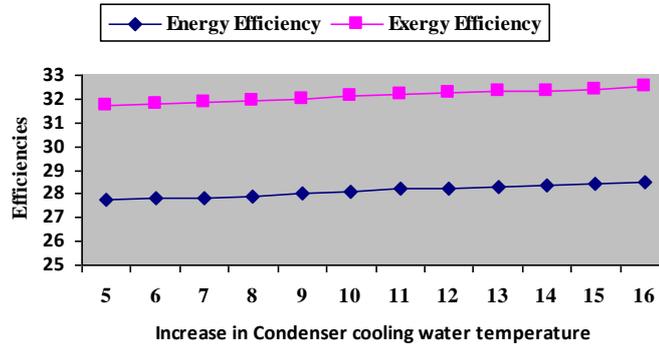
Fig. 4. Variation of efficiencies with increase in condenser cooling water temperature.

It is seen that the efficiency rises with an increase in the superheated steam parameters as presented in fig. 5. Show the effects of the steam temperature on the cycle performance. It is evident the increasing the cycle steam temperature will result in a higher power output for the same mass flow rate of steam and fuel input into the boiler. Therefore steam has higher energy/exergy content, resulting in higher work output of the turbine.
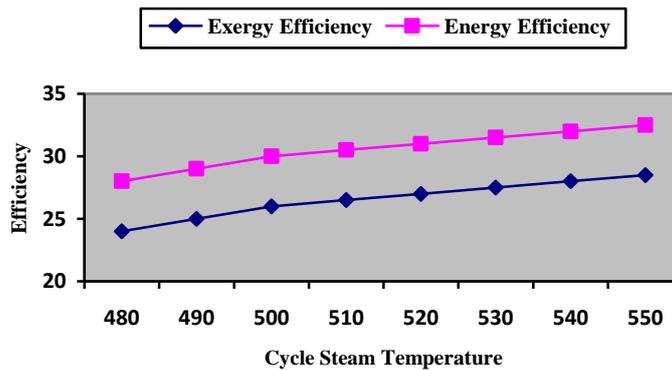
Fig.5.Illustrates the efficiency vs. Cycle steam pressure

It is seen that the efficiency rises with an increase in the superheated steam parameters as presented in fig. 5. Show the effects of the steam temperature on the cycle performance. It is evident the increasing the cycle steam temperature will result in a higher power output for the same mass flow rate of steam and fuel input into the boiler. Therefore steam has a higher energy/exergy content, resulting in higher work output of the turbine.
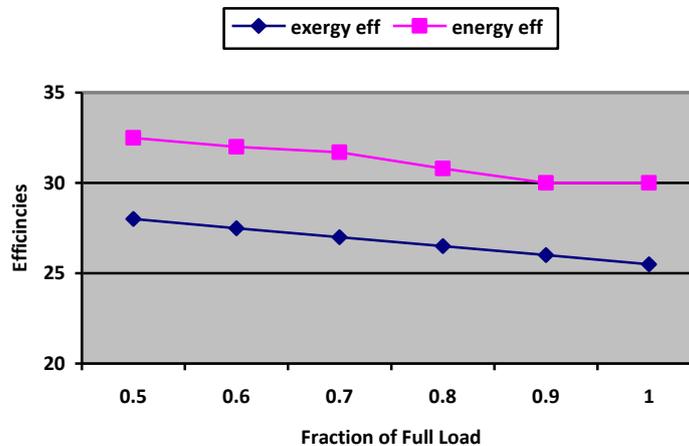
Fig. 6. Efficiency vs. Fraction of Full Load (% of generator output power)

It is evident from figs.6 and 7, that the variation of energy and exergy efficiencies with lower auxiliary power consumption, in terms of the percentage of generator output power which leads to higher system efficiencies. The operation of the plant below 50% of the designed capacity results in the significant increase of irreversibilities and indicates that when the plant is operated at its rated capacity would be more economical than operating at part loads. Figs.8 and 9 show the detailed energy and exergy balance of the considered system at the maximum operating load of 60 MW and difference in the composition of energy and exergy balances. It is noted that the exergy analysis has enabled the identification of the causes of process inefficiencies in detail when compared to the energy analysis.
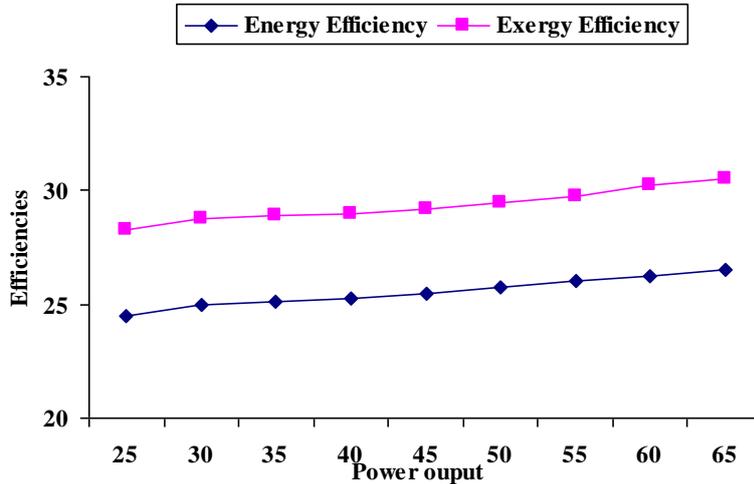
Fig.7. Variation of efficiencies vs. power output of Turbine
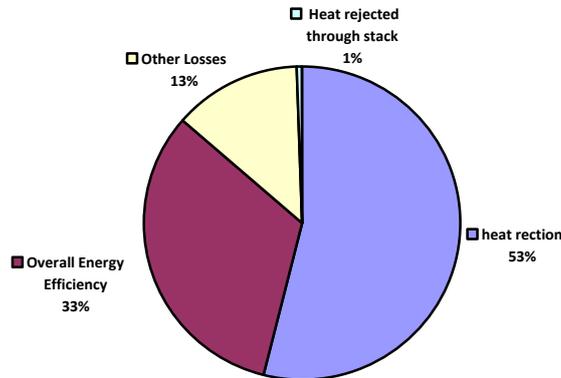
Fig. 8.Energy balance of 62 MW thermal power plant
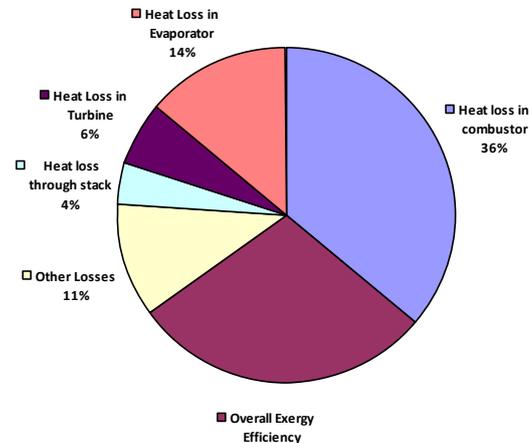
Fig. 9.Exergy balance of 62 MW thermal power plant

In order to utilize non-renewable sources more effectively like fossil fuels without damaging the environment, so that it can achieve better environmental sustainability. This will enable us to maximize its use of limited resources and make existing resources last longer. Fig. 10 shows the effect of exergy efficiency on the sustainability index.
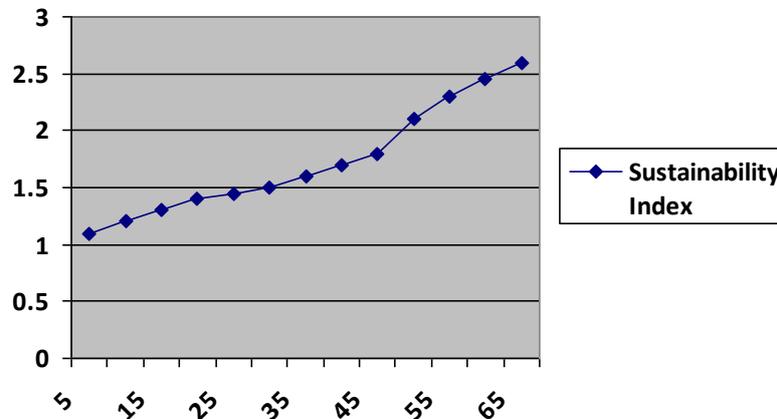
Fig.10. Sustainability index vs. exergy efficiency.

IV. Conclusion

Energy analysis of a thermal power plant based on a second law analysis has been presented and a detailed parametric study considering the effects of various parameters on the system performance has been performed to identify and quantify the sites having largest energy and exergy losses. The power plant's energy and energy efficiency is determined to be 32.5% and 27.5% for the gross generator output. The maximum exergy loss is found to occur in the boiler and turbine and if the performance of a boiler and turbine are improved, plant performance will also be improved. Hence the largest improvement the power plant efficiency. The exergy analysis of the plant showed that lost energy in the condenser is thermodynamically insignificant due to its low quality.

REFERENCES

[1]   T. J. Kotas, "Exergy Criteria of Performance for Thermal Plant: Second of Two Papers on Exergy Techniques in Thermal Plant Analysis," International Journal of Heat and Fluid yongping yang "comprehensive exergy based evaluation and parametric study of a coal fired ultra super critical power plant.

[2]   Mali Sanjay D, Dr. Mehta N S, " Easy Method Of Exergy Analysis For Thermal Power Plant", International Journal of Advanced Engineering Research and Studies,Vol. I, Issue III, April-June, 2012, PP-245-247

[3]   P Regulagadda "energy analysis of a thermal power plant with measured boiler and turbine losses" applied thermal engineering vol 30-[2010], PP.970-976.

[4]   T. Ganapathy, N. Alagumurthi, R. P. Gakkhar and K. Murugesan, "Exergy Analysis of Operating Lignite Fired Thermal Power Plant," Journal of Engineering Science and Technology Review, Vol. 2, No. 1, 2009, pp. 123-130.

[5]   S. C. Kamate and P. B. Gangavati, "Exergy Analysis of Cogeneration Power Plants in Sugar Industries," Applied Thermal Engineering, Vol. 29, No. 5-6, 2009, pp. 1187-1194.

[6]   A. Datta, S. Sengupta and S. Duttagupta, "Exergy Analysis of a Coal-Based 210 mw Thermal Power Plant," International Journal of Energy Research, Vol. 31, No. 1, 2007, pp. 14-28.

[7]   I. H. Aljundi, "Energy and Exergy Analysis of a Steam Power Plant in Jordan," Applied Thrmal Engineering, Vol. 29, No. 2-3, 2009, pp. 324-328.

[8]   Ankit patel "energy and exergy analysis of boiler with different fuels like Indian coal ,imported coal and L.H.H.S oil vol 8 oct 2012.

[9]   A. Rashad, and A. El Maihy, "Energy And Exergy Analysis Of A Steam Power Plant In Egypt" 13th International Conference on Aerospace Sciences & Aviation Technology, *ASAT- 13,* May 26 – 28, 2009.

[10]   Sarang j Gulhane, Prof. Amit Kumar Thakur, " Exergy Analysis of Boiler In cogeneration Thermal Power Plant", American Journal of Engineering Research (AJER), Volume-02, Issue-10, 2013, pp-385-392.

[11]   R saidur "energy and exergy economic analysis of industrial boiler" Vol 38(2010)2188-2197

[12]   R. Jyothu naik "exergy analysis of 120MWcoal based thermal power plant ''vol 2 4 apil 2013 issn 2278-0181.

[13]   M. A. Rosen, "Energy- and Exergy-Based Comparison of Coal-Fired and Nuclear Steam Power Plants," Exergy, Vol. 1, No. 3, 2001, pp. 180-192.

[14]   M.K. pal "energy and exergy analysis of boiler and turbine of a coal fired thermal power plant '' vol 2. Issue 6, June 2013.

[15]   H. Erdem, A. V. Akkaya., A. Dagdas, S. H. Sevilgen, B. Sahin, I. Tek, C. Gungor and S. Atas, "Comparative Energetic and Exergctic Performance Analyses for Coal-Fired Thermal Power Plants in Turkey." International Journal of Thermal Sciences, Vol. 48, No. 11, 2009, pp. 2179-2186.

[16]   M.A. Rosen, Energy and exergy-based comparison of coal-fired and nuclear steam power plants, Exergy - International Journal 1 (3) (2001) 180-192.

[17]   M.A. Habib, S.M. Zubair, 2nd-law-based thermodynamic analysis of regenerative-reheat Rankine-cycle power plants, Energy, vol. 17, Pergamon- Elsevier Science Ltd., 1992. pp. 295 301.

[18]   Tapan K. Ray, Amitava Datta, Amitava Gupta, Ranjan Ganguly, Exergy-based performance analysis for proper O&M decisions in a steam, Energy Conversion and Management 51 (2010) 1333–1344.

[19]   S. Sengupta, A. Datta, S. Duttagupta, Exergy analysis of a coal-based 21 OMW thermal power plant, International Journal of Energy Research 31 (2007) 14-28.

[20]   M.A. Rosen, 1. Dincer, Exergoeconomic analysis of power plants operating on various fuels, Applied Thermal Engineering 23 (2003) 643-658.

[21]   M.A. Rosen.. I. Dincer, On exergy and environmental impact, International Journal of Energy Research 21 (1997) 643-654.

[22]   M.A. Rosen. 1. Dincer, M. Kanoglu. Role of exergy in increasing efficiency and sustainability and reducing environmental impact, Energy Policy 36 (2008) 128-137.

[23]   M.J. Moran, H.N. Shapiro, Fundamentals of Engineering Thermodynamics, sixth ed., John Wiley & Sons, Inc., 2006.

[24]   S.C. Kaushika, V. Siva Reddya, S.K. Tyagib. Energy and exergy analyses of thermal power plants: A review, Renewable and Sustainable Energy Reviews 15(2011) 1857–1872.

OPTIMIZATION AND ANALYSIS (FAILURE MODE EFFECT AND FINITE ELEMENT) OF A COMMON DTH DISH ANTENNA BRACKET ASSEMBLY

Article · October 2014

9 authors, including:

Mohammed Yunus
Umm Al-Qura University,saudi arabia, mecca.
38 PUBLICATIONS   **112** CITATIONS

SEE PROFILE

Hamza A. Ghulman
Umm Al-Qura University
43 PUBLICATIONS   **130** CITATIONS

SEE PROFILE

Shadi Munshi
Umm Al-Qura University
8 PUBLICATIONS   **25** CITATIONS

SEE PROFILE

Sufyan Azam
Umm Al-Qura University
12 PUBLICATIONS   **68** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Measurement View project

thermal barrier coating View project

OPTIMIZATION AND ANALYSIS (FAILURE MODE EFFECT AND FINITE ELEMENT) OF A COMMON DTH DISH ANTENNA BRACKET ASSEMBLY

Dr. Mohammed Yunus[1],   Dr. Hamza A.Ghulman[2],   Dr. Shadi M. Munshi[3],   Sufyan Azam[4],

Dr. J. Fazlur Rahman[5],   Mohammed Irfan[6],   Mohammed Asadulla[7]

[1, 2, 3, 4](Department of Mechanical Engineering, College of Engineering and Islamic Architecture, Ummul Qura University, Mecca, Kingdom of Saudi Arabia)
[5, 6, 7](Department of Mechanical Engineering, H.K.B.K. C.E., Bangalore, Karnataka State, India-45)

ABSTRACT

Television (TV) is the most widely used telecommunication medium for transmitting and receiving moving images usually accompanied by sound. These signals are transmitted through either cable TV or DTH (Direct-To-Home), DTH is superior to cable TV since it offers better quality picture and it can also reach remote areas where terrestrial transmission and cable TV have failed to penetrate.

Bracket is an important part in the DTH assembly, which has to bear the antenna and feed horn (LNB converter) load and also wind force which acts on the antenna surface. It plays an important role in the reception of signal since the amount of signal receiving depends on the alignment angle of antenna, which causes the interruption in reception of signal, this is usually caused by a failure of bracket assembly used to mount the dish antenna. So it needs have good enough strength bracket.

The aim of the present work is to study the failure of the bracket and FMEA (failure mode effect and analysis) of plastic component. Optimization is carried out at the failure point location to overcome the existing chronic field failure. Different design concepts were developed and the best feasible concept is selected. The stresses were analyzed on the bracket using FEA software packages.

Keywords: Direct to Home (DTH), Dish Telivision, Die Designing Methodology, FMEA (Failure Mode Effect And Analysis), Finite Element Method, Analysis and Optimization.

1. INTRODUCTION

Television (TV) is the most widely used telecommunication medium for transmitting and receiving moving images usually accompanied by sound. The signals are reached to the television

through either cable TV or DTH (Direct-to-Home). Cable television, also referred to as cable TV or
CATV (Community Antenna Television), is a system wherein radio frequency signals are
transmitted to television sets by means of fixed coaxial cables or fiber optic cables and have become
so popular that more than half of the households in the world avail this service as of today. Whereas
DTH stands for Direct-To-Home television, which is defined as the reception of satellite
programmes with a personal dish in an individual home. DTH does away with the need for the local
cable operator and puts the broadcaster directly in touch with the consumer. Only cable operators can
receive satellite programmes and they then distribute them to individual homes.
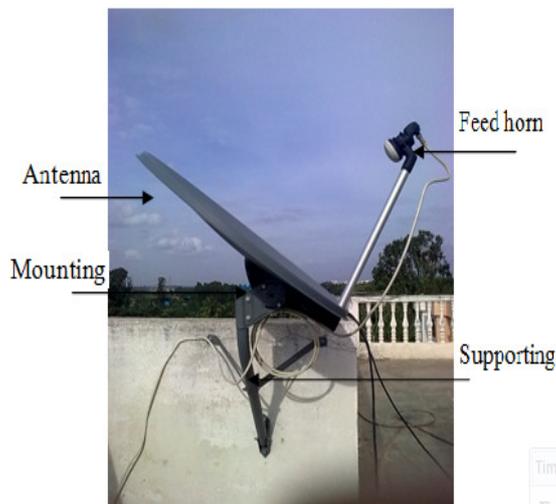
Fig 1.1 DTH dish antenna assembly
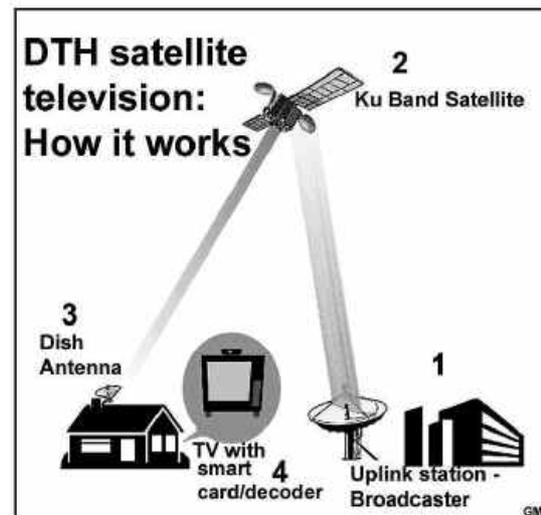
Fig 1.2 Conceptual diagram of a
satellite communication

A DTH network consists of a broadcasting centre, satellites, encoders, multiplexers,
modulators and DTH receivers. A DTH service provider has to lease Ku-band transponders from the
satellite. The encoder converts the audio, video and data signals into the digital format and the
multiplexer mixes these signals. At the user end, there will be a small dish antenna and set-top boxes
to decode and view numerous channels. DTH is an encrypted transmission that travels to the
consumer directly through a satellite. DTH transmission is received directly by the consumer at his
end through the small dish antenna. A set-top box, unlike the regular cable connection, decodes the
encrypted transmission.

1.1 Antenna mountings
Bracket is an important part in the DTH assembly, which has to bear the antenna and feed
horn (LNB converter) load and also wind force which acts on the antenna surface. It plays an
important role in the reception of signal since the amount of signal receiving depends on the
alignment angle of antenna, which causes the interruption in reception of signal, this is usually
caused by a failure of bracket assembly used to mount the dish antenna.Fig.1.3 shows Potential
mounting sites or location of antennae and fig1.4 shows the TV Antenna wall brackets or Wall
mounting brackets are ideal for ground-up and wall supported mast installations. The wall brackets
are made of 16 gauge steel with a tubular support leg for additional rigidity. Which are also called
Non roof penetrating TV antenna mounts.

1.2 Problems encountered by the customers while using DTH service
  1. Frequent disruption of the service in case of heavy rainfall.
  2. During rains, most of the times the digital TV ceases to work and there is no reception of signal.

3. Variation in the alignment of the antenna mounting bracket due to environmental condition.
4. Problem in the setup box and signal receiver.
5. The intensity of incoming signals reduces during high wind blowing over the antenna surface.
6. Even though the customer recharged, the TV channels are not getting in some DTH services.

A new dish design uses two or more horns to pick up different satellite signals. As the beams from different satellites hit the curved dish, they reflect at different angles so that one beam hits one of the horns and another beam hits a different horn. The central element in the feed horn is the low noise block down converter, or LNB. The LNB amplifies the signal bouncing off the dish and filters out the noise (signals not carrying programming). The LNB passes the amplified, filtered signal to the satellite receiver inside the viewer's house.

| Exterior wall | Wooden rai | Chimney | Ground |
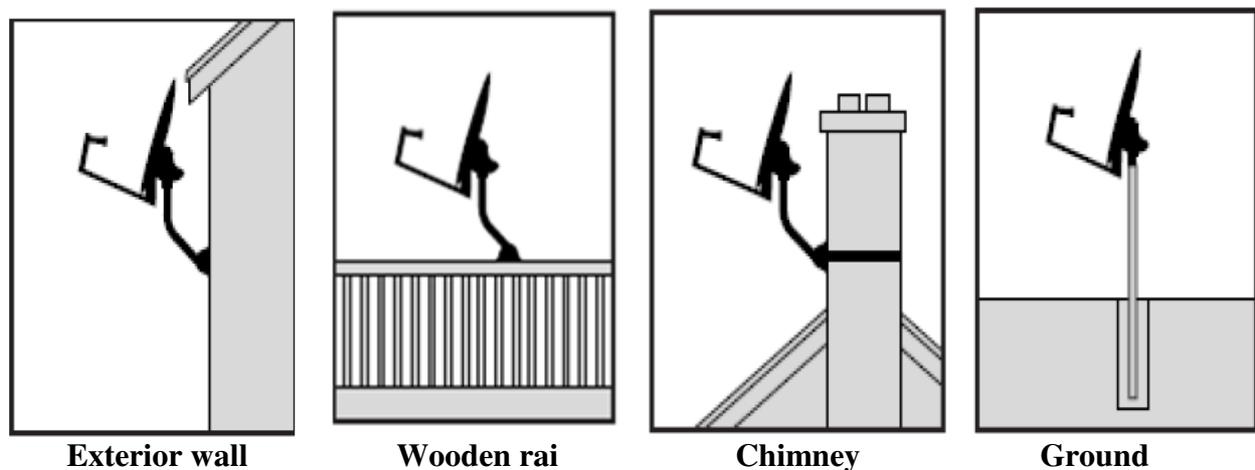
Fig 1.3 Different antenna mounting locations

Fig 1.4 TV Antenna wall brackets

2. LITERATURE REVIEW

2.1. Literature Review on Design Concept selection methods: The different design concept selection methods given by different authors are explained and also described the different benchmarking techniques such as Abdus salam[1] presented the mountings and their requirements to avoid any obstructions in reception of electromagnetic signals using non-penetrating roof mount antenna assemblies. Rolinski et al. [2] suggested the advantages of using an X-Y antenna mount for performing data acquisition and satellite tracking functions using servo-control system. Eric Michael Olsen et al. [3] invented an apparatus for holding an antenna on a mounting surface by use of suction cups or suction devices to restore or relocate to another mounting surface. Chang-Ho Cho et al. [4]

designed an antenna control system (discrete time controller) which capable of quickly and accurately tracking the target communication satellite and receiving of the signal transmitted from it without using any additional sensors. Comazell Bickham [5] invented portable adjustable stand for satellite dish antennas for mounting and supporting a digital satellite dish antenna eliminates the need for drilling holes and physical attachment to the surfaces of a dwelling with screws, bolts, or other fasteners. Albert Hugo [6] describe a motor driven adjustable mounting structure for satellite television dish antenna which operates to scan an in line of sight segment of a geostationary TV relay satellite orbit belt.

2.2. Literature Review on FMEA and Benchmarking: FMEA is used to identify potential failure modes, determine their effect on the operation of the product, and identify actions to mitigate the failures. Irem Y. Tumer et al. [7] have developed an approach for failure mode identification for the product development. a statistical clustering procedure is proposed to retrieve information on the set of predominant failures that a function experiences. Seung J. Rhee et al. [8] developed a new methodology, Life Cost-Based FMEA, which measures risk in terms of cost which is useful for comparing and selecting design alternatives. Derham et al. [9] explained failure mode analysis for plastic components used in engineering applications. Sellappan Narayanagounder et al. [10] showed the drawbacks in traditional FMEA and demonstrated a new approach to prioritize failure modes by evaluation of risk priority number. If two or more failure modes have the same RPN, suggested to prioritize the failure modes with the help of Risk Priority Code (RPC). Mohammad Reza Mehregan et al. [11] developed a simple quantitative methodology for benchmarking process, where analyze phase is developed based on two popular mathematical programming techniques TOPSIS and goal programming. Busby et al. [12] investigated the practices that engineering designers had learned to apply during concept selection. Hambali et al. [13] proposed a concept selection model called concurrent design concept selection and materials selection (CDCSMS) for appropriate design and materials at the conceptual design stage using analytical hierarchy process (AHP).

3. METHODOLOGY

Generally the mounting bracket in DTH assembly is designed to mount the antenna and the feed horn. As already discussed the bracket plays very important role for supporting the antenna and also in the reception of signal. The presently used bracket is manufacturing with the ABS material. The investigation was carried out with respect to existing DTH antenna mounting bracket. A number of design improvements have been carried out on existing model since it introduced. The improved with new design concept version is designated as New model. Since it was realized that there are some areas where performance specification of new model can be improved.
In the existing design there are some disadvantages they are:

1. The material thickness is less in some areas (those are called critical regions).
2. The failure is occurring in the critical regions due to the developed stress.

Based on the disadvantages in the existing design the problem is taken up with different design concepts. The aim of the present work is to study the failure of the antenna mounting bracket. Optimization is carried out at the failure point location to overcome the existing chronic field failure. Different design concepts were developed and the best feasible concept is selected for design and analysis. The model has developed using the CATIA modeling software. The stresses and displacements were analyzed on the bracket using Hyper mesh preprocessor and NASTRAN solver packages.
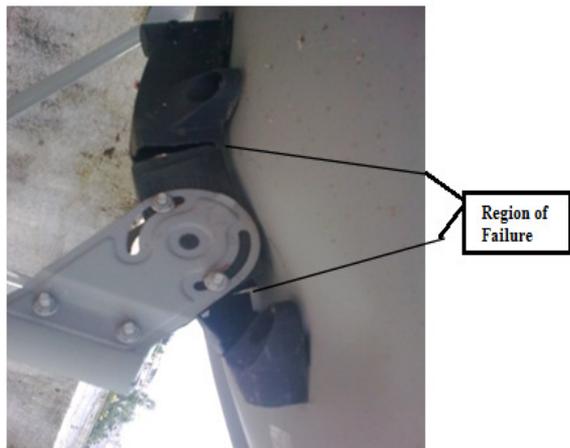
Fig 3.1 Existing mounting bracket failure zone
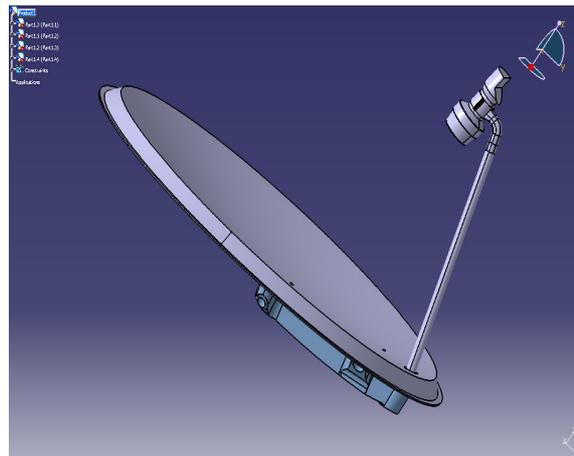
Fig 3.2: Assembled view of DTH using CATIA
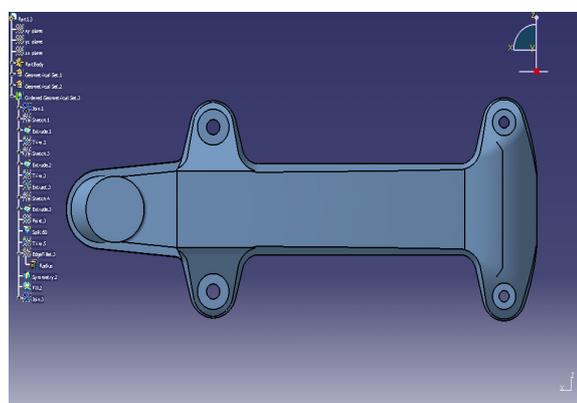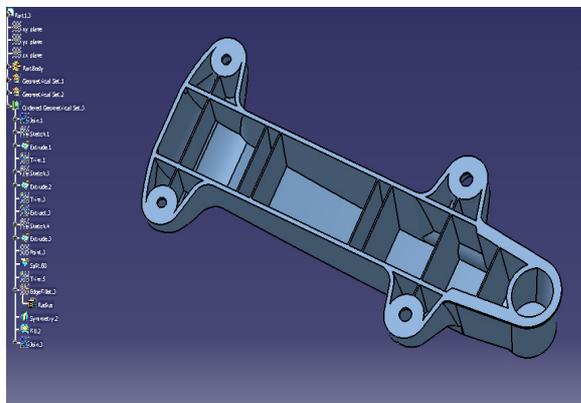
Fig. 3.3: Isometric view and Rear view Geometric model of the mounting bracket

When choosing the right antenna mount, these three factors to keep in mind: Size, Type and Cost. Figure 3.2 shows the assembly of the different parts of the DTH system and Fig.3.3 shows the different dimensions of the mounting bracket in the two different views.

3.1 Component modeling

Modeling of the component was done using commercially available software CATIAV5. It provides the tools to accurately model and document the design ready for rendering, animation, mechanism drafting, engineering, analysis and manufacturing or construction.

The selection of the appropriate antenna size helps in keeping the network up and healthy. It is decided based on the following:

1. Satellite Effective Isotropic Radiated Power (EIRP) at the particular location.
2. Rain attenuation at the location.

Adequate E_b/N_o (the energy per bit to noise power spectral density ratio) for reception of excellent picture quality.

3.2. FMEA (Failure Mode and Effect Analysis) and Benchmarking

Failure Mode and Effects Analysis (FMEA) is commonly defined as "a systematic process for identifying potential design and process failures before they occur, with the intent to eliminate them or minimize the risk associated with them". The FMEA technique was first reported in the

1920s but its use has only been significantly documented since the early 1960s. It was developed in the USA in the 1960s by National Aeronautics Space Agency (NASA) as a means of addressing a way to improve the reliability of military equipment. FMEA is used to identify potential failure modes, determine their effect on the operation of the product, and identify actions to mitigate the failures. A crucial step is anticipating what might go wrong with a product. Various benefits of FMEA

- Improve product/process reliability and quality and increases customer satisfaction.
- Early identification and elimination of potential product/process failure modes.
- Prioritize product/process deficiencies to Provide focus for improved testing and development.
- Capture engineering/organization knowledge and Minimizes late changes and associated cost.
- Documents risk and actions taken to reduce risk.
- Catalyst for teamwork and idea exchange between functions.

3.2.1. Types of FMEA's

There are several types of FMEAs, some are used much more often than others. FMEAs should always be done whenever failures would mean potential harm or injury to the user of the end item being designed. The types of FMEA are:

- System - focuses on global system functions

- Design - focuses on components and subsystems

- Process - focuses on manufacturing and assembly processes

- Service - focuses on service functions

- Software - focuses on software functions

3.2.2. FMEA Methodology

The flow chart given below describes the procedure involved in the FMEA. The basic step is to identify the potential failure mode and its effect on the system. It also shows the parameters used to determine the criticality of an item failure mode are, the severity of its failure effects, its frequency of occurrence, and the likelihood that subsequent testing of the design will detect that the potential failure mode actually occurs.

Severity is a rating corresponding to the seriousness of an effect of a potential failure mode on the next higher level assembly, the system or the user. (Scale: 1-10. 1: no effect on output, 5: moderate effect, 8: serious effect, 10: hazardous effect)

Occurrence is a rating corresponding to the rate at which a first level cause and its resultant failure mode will occur over the design life of the system, over the design life of the product, or before any additional process controls are applied. (Scale: 1-10. 1: failure unlikely, 5: occasional failure, 8: high number of failures likely, 10: failures certain).
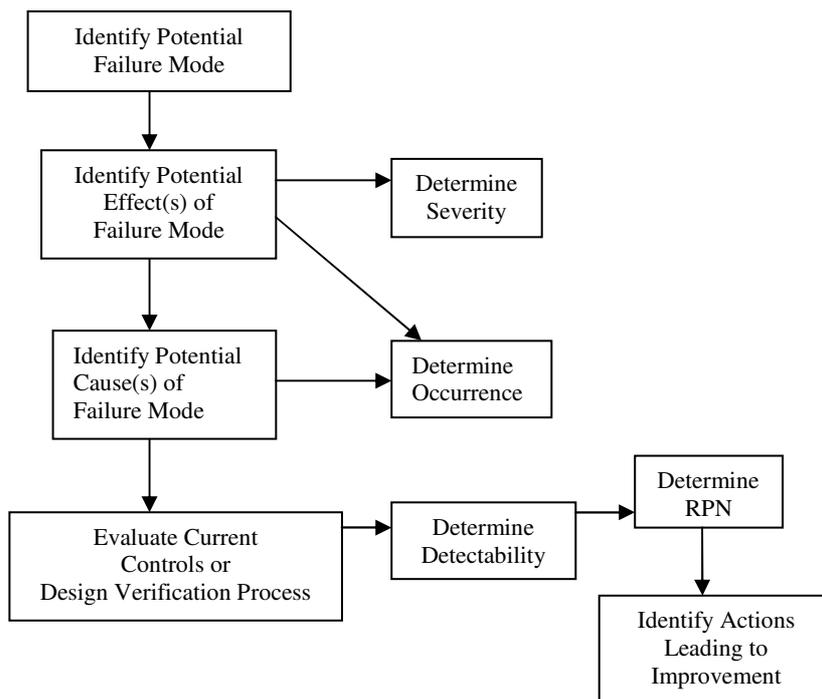
Fig 3.4: Flow chart of FMEA methodology

Detection is a rating corresponding to the likelihood that the detection methods or current controls will detect the potential failure mode before the product is released for production for design, or for process before it leaves the production facility. (Scale: 1-10. 1: will detect failure, 5: might detect failure, 10: almost certain not to detect failures)

Risk Priority Number (RPN)
The RPN is a mathematical product of the severity(S), the occurrence (O) and the detection (D). It is used to identify the most critical failure mode, leading to corrective action
In equation form, **RPN = S x O x D**

Reasons for observed failure
- In effective loading due to weather conditions that is too much wind.
- Unexpected load may occur due to negligence in the form of access to domestic animals.
- Stress localization observed at the critical points.
- Manufacturing defects may appear in the mounting bracket.

3.2.3 FMEA Worksheet

Table 3.1: FMEA work sheet for DTH mounting structure

Process operation, product function or purpose	Potential failure mode	Potential effect(s) of failure	S E V	Potential cause(s) of failure	O C C	D E T	R P N	Recommended Action(s)
Mounting bracket Support the antenna and LNB	Crack initiation Breakage	DTH assembly fail to work	7	Excess load Manufacturing defect	6	4	168	Modify the design of bracket
	Alignment angle of antenna	Problem in reception of signal	6	DTH assembly not fitted properly	7	3	126	Fixing DTH at appropriate place. Assemble components properly

3.2.4 Different types of mounting bracket

Type 1

Type 2

Type 3

Type 4

Fig 3.5: Different types of DTH antenna mountings

The scaling given in the above table for the benchmarking of the different types of DTH antenna mountings available in the market is as follows;

(i) Bear to more weight corresponds to the ability of the bracket which can be able to withstand for the load (Scale: 1-10. 1-less weight, 5-average weight, 10-more weight).

(ii) Serviceable life related to the working life of the bracket without failure. (Scale: 1-10. 1-failure occurs very early, 5-average life, 10-failure doesn't occur).

Table 3.2: Benchmarking table of antenna mountings

Types Parameters	Type 1	Type 2	Type 3	Type 4
Bear to more weight	7	6	6	7
Serviceable life	8	6	6	7
Cost	5	7	7	4
Boundary(surface) contact	4	7	7	6
Geometry complexity	8	5	4	7
Total	32	31	30	31

(iii) The cost of bracket corresponds to the market price of the bracket. (Scale: 1-10. 1-very high cost, 5-high cost, 7- considerable cost, 10-less cost).

(iv) Boundary contact related to the area of contact or surface contact between the antenna and the bracket. It also relates to the amount of load transfer to the bracket, that is if the contact is good then the load will transfer equally to all portion of the mounting bracket and chances of failure is less compare to the poor contact. (Scale: 1-10. 1-less contact, 5-average contact, 10-full contact).

(v) Geometry complexity corresponds to how easily the bracket can be manufactured. (Scale: 1-10. 1- very difficult to manufacture. 5-with considerable effort, 10- can easily manufacture).

3.3. Concept Design and Generation
3.3.1. Design requirements

To provide good enough strength to the bracket, the following parameters should be taken in to account in the design:

Ribbing pattern: Ribs are commonly used to give strength and rigidity to the product. At the same time, ribs help to have thinner walls and therefore reduce the amount of material. The structure of bracket can be strengthened by ribs in specific places in order to form a more rigid and stabilized structure. The ribs are strengthening plates mainly placed along the vertical direction for preventing deflection of lateral surfaces and thus creating a rigid structure and reduce deflection.

Thickness: By increasing the material thickness of bracket at critical points, it will greatly improve the bracket strength. The strength to weight ratio is improved by adding to material thickness. It is well known that when the thickness of a product is increased, the weight of a product increases proportionally. Thus, it is important to determine the right thickness of bracket.

Curvature structure: Curvature structure of bracket determines the level of contact with the antenna surface. Since the antenna surface is curved, the effect of load transfer to the bracket depends on the contact between antenna and bracket.

Material selection: Bracket design is greatly influenced by the material selected. There are 2 factors that must be considered by designers in determining the best design concept at the early stage of product development process, namely, (a) formability of materials and (b) recyclability of materials.

Cost consideration: It is about 70% of the cost of a product that is determined before production activity. Therefore, it is very important to design and develop mounting bracket which contributes to the cost reduction without sacrificing its safety and impact performance characteristics. The two most important costs required to be considered in designing the bracket, namely, (a) Material cost (b) Manufacturing cost

Manufacturing process: Manufacturing process is also needed to be considered when designing antenna mountings at the early stage of the product development process with ease to fabricate.

Maintenance: There are two main factors influencing the selection of the antenna mountings related to maintenance consideration, namely, Easy to dismantle and Easy to install

3.3.2. Force Calculation

The static force develops in the DTH assembly due to the weight of the antenna and the feed horn (LNB) is given by

F (force) **= M (mass) x a(accelera**tion due to gravity, 9.81m/s^2)
1. Force due to feed horn mass acts at the lower portion of the bracket, where the feed horn is placed and is given by
$F = 200 \times 10^{-3} \times 9.81$ where Mass of the feed horn is 200×10^{-3} kg
$F = 1.962$ N

2. Force due to dish antenna mass
$F = 1400 \times 10^{-3} \times 9.81$ where mass of the dish antenna is 1400×10^{-3} kg
$F = 13.734$ N

3. The force developed due to the wind pressure is calculated as follows
The force equation is given by
F = A x P x C$_d$
Where, P = wind pressure of 0.04, Cd = drag co-efficient of 1, V = wind speed of 80 kmph
A = the projected area of the item is given by
A = π a b   a= major dia= 0.62m,   b= major dia= 0.55m
$A = 1.0713 \text{ m}^2$
Force F = 513.19 N
The total force acting on the antenna mounting bracket
= force due to antenna mass + wind force
= 13.734 + 513.19 = 530 N

0.55 m
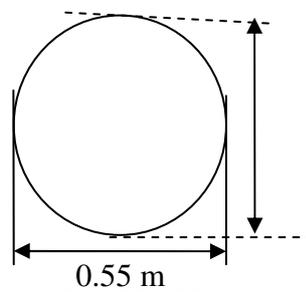
This force acts on the mounting bracket where the contact between antenna surface and bracket takes place. Usually it is considered as uniformly distributed load and acting at an inclination since the bracket mounted at an angle with respect to horizontal surface.

3.3.3. Material Properties

Plastic material is used to manufacture most of the antenna mounting bracket since plastics have more advantages compared to the metals. Acrylonitrile-Butadiene-Styrene (ABS) material is used to manufacture the antenna mounting bracket. It has excellent impact resistance, aesthetic qualities, good strength, rigidity**,** abrasion resistance, dimensional stability, resistance to low temperatures, creep resistance and stiffness and low cost. And it ha many applications in making Machined prototypes, Structural components, Support blocks, Housings and covers, Telephone handset, domestic appliances (food processors, fans, TV sets), Food containers, radiator grills.

3.3.4. Concept Generation for Optimization

Design concepts selection (DCS) is an area of design research that has been under considerable interest over the years (Salonen and Perttula, 2005). It is one of the important activities for a product development process and decision making phase of concept design, where designers evaluate concepts with respect to customer needs. According to Gerrit Muller Selection techniques should be used in the early phases of product development when stakeholder are known and when requirements are established.

Here we developed mainly three concepts and the FEA model is developed by using basic model as reference for all three concepts and analysis was done. Based on the obtained von-misses stress results, the good concept selected.

Concept 1 Providing ribs

This concept is developed based on the literature that the ribs provide strength and rigidity to the product. In present model only horizontal ribs are present so we planned to provide vertical ribs. The two ribs are placed along vertical direction at equal distance from the center plane of the bracket.

Concept 2 Thickness increased

Actually at the failure point the material thickness is less as compared to the other part of the bracket, so from the literature the strength will increase as the thickness increased. Based on this we developed the above concept where material thickness is increased to some extent.

Concept 3 Ribs with thickness

In this concept the both features are included that is the thickness is increased at failure point and also ribs are provided in vertical direction.

Concept 4 Change of material

In this concept, material used for manufacturing the mounting bracket is changed. Instead of ABS material we used polypropylene thermo plastic material, since compare to the other material it has high strength and also low density.
The material properties are given by

Table 3.3: Polypropylene material properties

Property	Value in metric unit	
Density	0.91×10^3	**kg/m³**
Modulus of elasticity	**1.36**	**GPa**
Strength	**37**	**MPa**
Poisson's ratio	**0.3**	**-**
Flexural strength	**49**	**MPa**
Thermal expansion (20 °C)	90×10^{-6}	**°C⁻¹**
Maximum work temperature	**150**	**°C**

3.4. Finite Element Analysis of Mounting Bracket for optimization of concepts

In this initially the finite element model is generated and analysis is done for the basic model of bracket and taking basic FEA model as reference, the FEA models for the different concepts are developed and analysis done for each different concepts.

3.4.1 Basic model

Figure 3.6, 3.7, 3.9, 3.11, 3.13 shows the FEA model of the original bracket, concept-1, concept-2, concept-3 and concept-4 having QUAD4, TRIA3 elements and these elements are satisfied the all quality parameters and with the boundary conditions applied and the applied forces and the constraints at different points. The different color elements represent the different collectors having variation in thickness. Figure 3.8 shows von-misses stress distribution of the basic model, here we observed that the stress generated more at the section having thin cross sections, where the actual failure had taken place.

3.4.2 Model with ribs provided

The FEA model and Von-misses stress distribution for the concept-1 are shown in Fig. 3.9 and 3.10 respectively. Analysis result shows that stress developed in the bracket is slightly reduce compare to failure stress.

3.4.3 Model with thickness increased

The FEA model and Von-misses stress distribution for the concept-2 are shown in Fig. 3.11 and 3.12 respectively. Analysis result shows that stress developed in the bracket is reduced more compare to concept1.

3.4.4. Model with ribs and increased thickness

The FEA model and Von-misses stress distribution for the concept-3 are shown in Figures 3.13 and 3.14 respectively. Analysis result shows that stress developed in the bracket is reduce to considerable amount of failure stress.

3.4.5 Model with material change

The FEA model for this concept is same as the basic model but only material properties are changed. Von-misses stress distribution for the concept-4 is shown in Fig. 3.15. Analysis result shows that stress developed in the bracket is reducing slightly compare to failure stress.
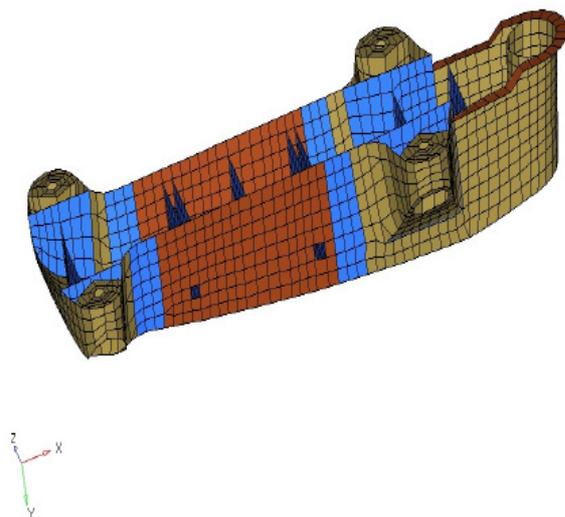
Fig 3.6: FEA model of the original bracket
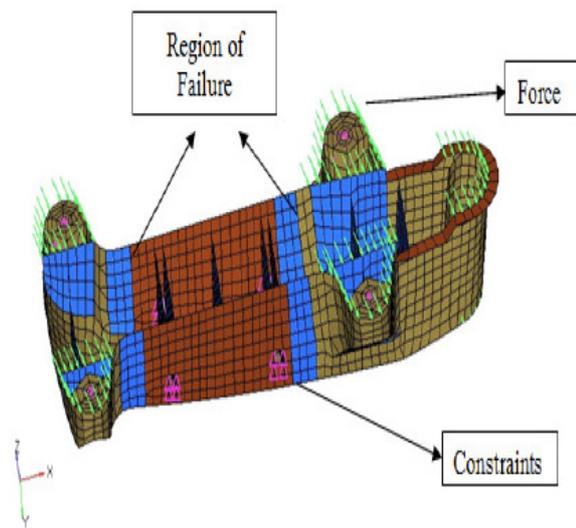
Fig 3.7: Basic FEA model with boundary conditions
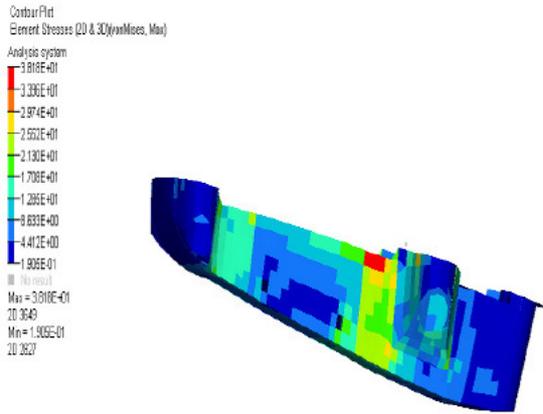
Fig 3.8: Von-misses stress distribution of basic model
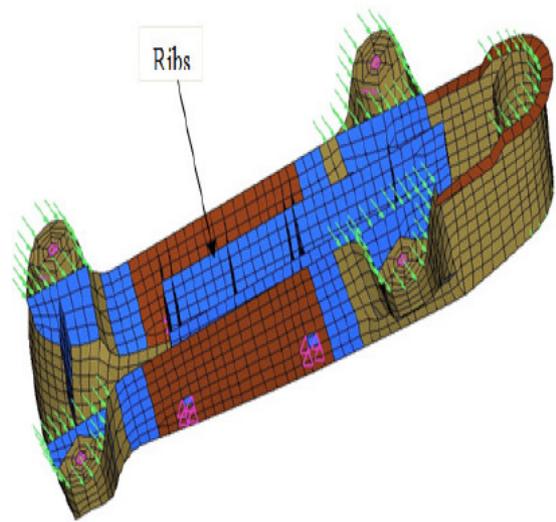
Fig 3.9: Concept-1 model with boundary conditions
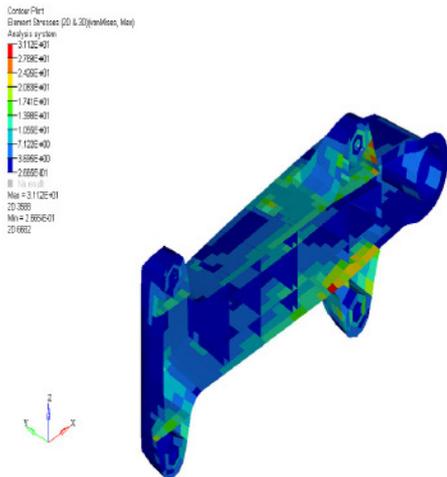
Fig.3.10: Von-misses stress distribution of concept-1
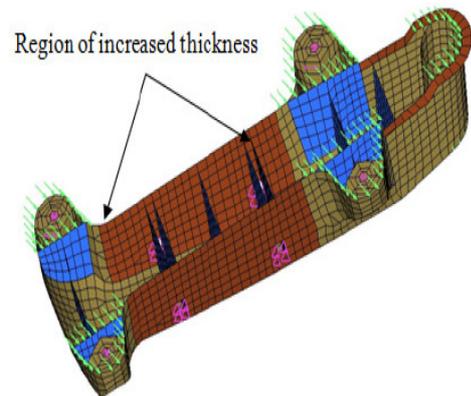
Fig.3.11: Concept-2 model with boundary conditions
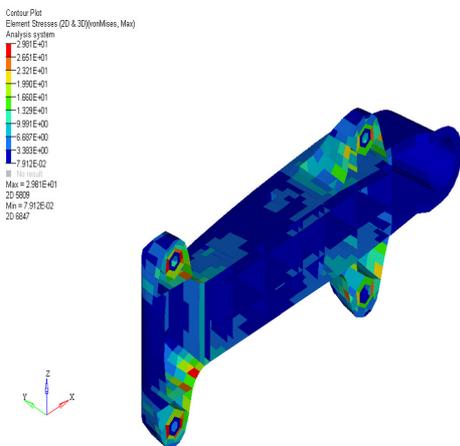
Fig.3.12: Von-misses stress distribution of concept-2
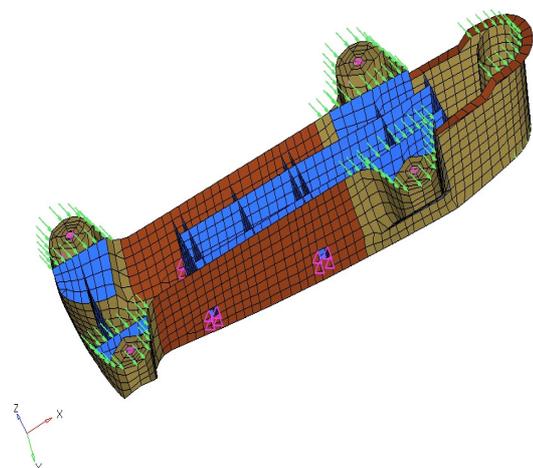
Fig. 3.13: Concept-3 model with boundary conditions
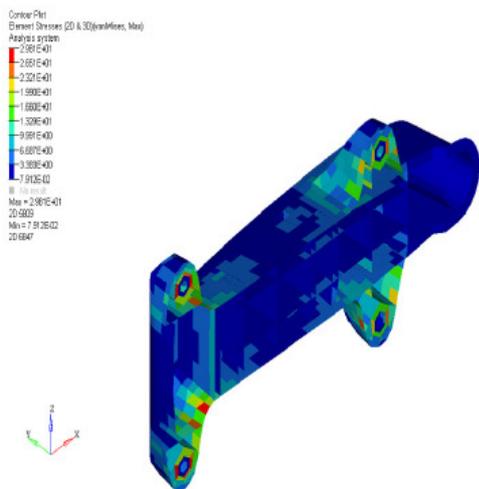
Fig.3.14: Von-misses stress distribution of concept-3
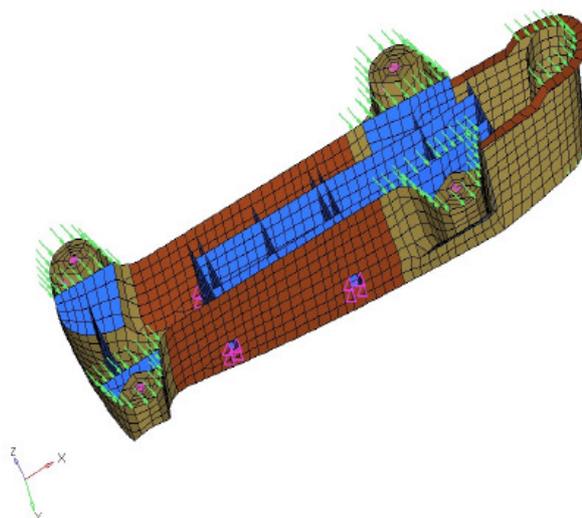
Fig.3.15: Von-misses stress distribution of concept-4

3.5. Validation of the Analysis

In this section the software and the element type used for the analysis is validated with the theoretical results for the stress developed in the bracket. The geometry of the bracket is symmetric therefore considered only half portion. Assuming it as simply supported beam. The different forces acting at different point are shown in figure below; all dimensions are in "mm".

To obtain stresses in bracket

To obtain the combined stresses acting on the selected portion of the bracket, it is sliced in to three different sections which are as shown in the Fig 7.12 and Following are the steps followed to calculate the combined stresses acting at each section

➢ Evaluating the sectional area (A) and distance of centroid

➢ Calculating moment of inertia at centroidal axis (I)

➢ Obtaining bending (σ_b), direct (σ_d) and combined stresses (σ_c)
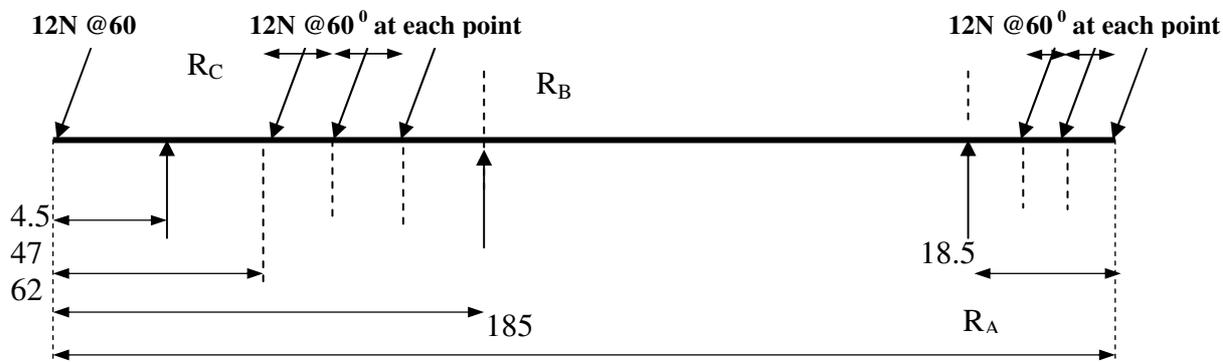
After resolving
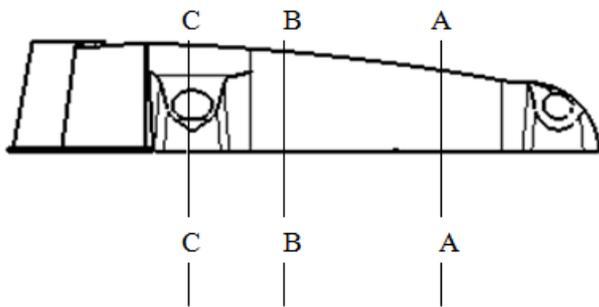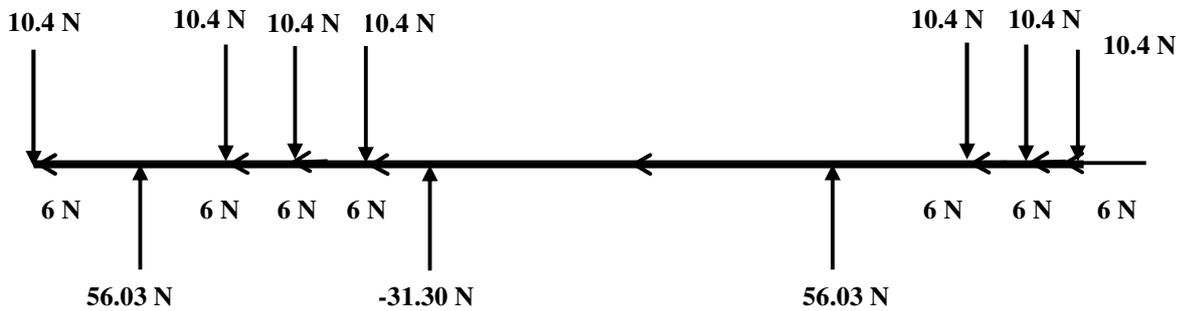
Fig 3.16: Different sections of bracket structure
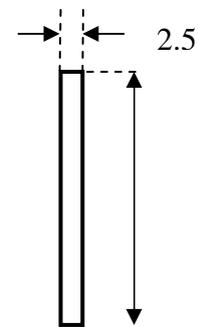
Fig. 3.17: Section A-A of Bracket

L=18.5mm from Tail (right end) point
b=2.5mm; h=10 mm;

$sectional\ area = $ b x h

$$I = b \times \frac{h^3}{12} = 2.5 \times \frac{10^3}{12} = 208.33 \quad mm^4$$

$$= 2.5 \times 10 = 25\ mm^2$$

Bending stress

$\left.\begin{array}{l}Bending \\ Stress\end{array}\right\} \sigma_b = \frac{M \times c}{I}$ C=10/2=5.0 mm $\qquad \sigma_b = \frac{-436.8 \times 5}{208.33} = -10.4832\ N/mm^2$

$\left.\begin{array}{l}Direct \\ Stress\end{array}\right\} \sigma_d = \frac{\text{Re}action\ force\ at\ A-A}{Sectional\ area} = \frac{-18}{25} = -0.729\ N/mm^2$

$\left.\begin{array}{l}Combined \\ Stress\end{array}\right\} \sigma = \sigma_b + \sigma_d = -10.4832\ -0.729 = -11.203 N/mm^2$

Similarly A, $\overline{Y}$ I, σ_b, σ_d and σ_c for remaining sections are tabulated below.

Table 3.4: Combined stress values at different sections in bracket

Section	A mm^2	$\overline{Y}$ mm	I mm^4	σ_b N/mm^2	σ_d N/mm^2	σ_c N/mm^2
A-A	25	5.0	208.33	-10.4832	-0.729	-11.203
B-B	50	10.0	1666.67	-7.95	-0.48	-8.43
C-C	56.5	14	188.75	-16.4	-0.68	-17.08

Table 3.5: Comparison of theoretical analysis results

Sections	Theoretical (MPa)	Analysis (MPa)
A-A	-11.203	16.60
B-B	-8.43	13.29
C-C	-17.08	19.92

4. RESULTS AND DISCUSSION

In this chapter the analysis results of different concepts are interpreted and showed the variations of von-misses stress developed in the different concepts. In the above plot: 0,1,2,3,4 = represent the basic model, concept-1, concept-2, concept-3 and concept-4 respectively.

The percentage of reduction in the stress generated for different concepts are given in table. From the analysis plot we can observe that in the concept-3, the stress reduction is more compare to the other concepts, but we selected the concept-2 is best concept since Simple design and more feasible, Economical in the manufacturing point of view. The existing dies with slight modification, can be used for manufacturing the bracket.
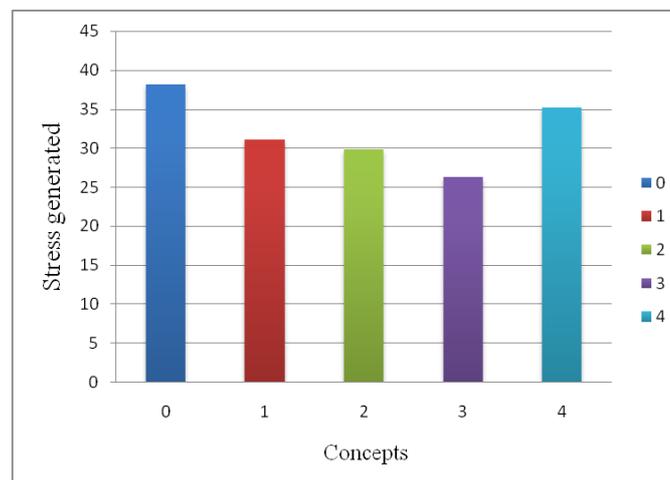
Fig 4.1: Stress generated v/s Concepts

Table 4.1: Stress reduction in different concepts

Concepts	% reduction
Concept1	18.50
Concept2	21.92
Concept3	31.04
Concept4	7.67

5. CONCLUSION

The present work is to improve the strength of the bracket, for this FMEA, Benchmarking and analysis have done by considering all the parameters. FMEA result shown that the risk priority number (RPN) has more for the failure of mounting bracket compare to the other possible problems. Hence modification has done in the geometry of the bracket.

Benchmarking has done to know the different types of bracket available in the market which are more feasible. It shows that type-1, type-2 and type-3 are almost having same rank but due to some disadvantages of type-1 the other two are now-a-days majorly used by the customers. As already stated the design concept-2 is the best possible concept for manufacturing the bracket. Hence finally it is concluded that new design is better than existing design. Further study is required to develop the prototype model and conducting the test experimentally and compare the analysis and experimental results. Some parameters could be included in future analysis like examining the model under non linear condition and composite material may be used to manufacture the bracket.

REFERENCES

[1]   Abdus Salam ICTP, "Site Surveying and Antenna Mounting", 2007.
[2]   A. J. Rolinski D. J. Carlson and R. J. Coates, "The X-Y Antenna Mount for Data Acquisition from Satellites". 1962, pp-159-163.
[3]   Eric Michael Olsen and Wiley Clifton Darling, "Antenna mount with alternative", 2007.
[4]   Chang-Ho Cho, Song-Hyo Lee, Tae-yong kwon and Cheollee, "Antenna control system using step tracking algorithm with H controller". Vol.1, No.1, 2003, pp 83-92.
[5]   Allan L. Turner and Davis Tehachapi, "Satellite TV dish antenna support", 1987.
[6]   Albert Hugo, "Television dish antenna mounting structure", 1986.
[7]   I.Y. Tumer, Srikesh G. Arunajadai and R.B.Stone, "Failure mode identification through clustering analysis", 2001, Pittsburgh.
[8]   Seung J. Rhee and Kosuke Ishii, "Using cost based FMEA to enhance reliability and serviceability", Vol. 17, 2003, pp 179-188.
[9]   C.J. Derham and J. Mater, "Failure mode analysis of plastics components & parts", 2008.
[10] Sellappan Narayanagounder and Karuppusami Gurusami, "A new approach for prioritization of failure modes in design FMEA using ANOVA", 2009, pp 524-531.
[11] Mohammad Reza Mehregan , Mahmoud Dehghan Nayeri and Vahid Reza Ghezavati, "An optimisational model of benchmarking", Vol. 17, No. 6, 2010, pp 876-888.
[12] J. S. Busby, "Practices in Design Concept Selection as Distributed Cognition", Vol 3, 2001, pp 140-149.
[13] A. Hambali, S. M. Sapuan1, N. Ismail and Y. Nukman, "Application of analytical hierarchy process in the design concept selection of automotive composite bumper beam during the conceptual design stage". Vol.4, 2009, pp 198-211.
[14] Dr. R. Dillibabu, Sangeetha. A and L. Sudha, "Development and Application of SFMEA Model to Software Testing Environment", International Journal of Mechanical Engineering & Technology (IJMET), Volume 4, Issue 3, 2013, pp. 61 - 72, ISSN Print: 0976 – 6340, ISSN Online: 0976 – 6359.
[15] Pravin Kumar.S, Venkatakrishnan.R and Vignesh Babu.S, "Process Failure Mode and Effect Analysis on End Milling Process- A Critical Study", International Journal of Mechanical Engineering & Technology (IJMET), Volume 4, Issue 5, 2013, pp. 191 - 199, ISSN Print: 0976 – 6340, ISSN Online: 0976 – 6359.
[16] A.Mariajayaprakash, Dr.T. SenthilVelan and K.P.Vivekananthan, "Optimisation of Shock Absorber Parameters using Failure Mode and Effect Analysis and Taguchi Method", International Journal of Mechanical Engineering & Technology (IJMET), Volume 3, Issue 2, 2012, pp. 328 - 345, ISSN Print: 0976 – 6340, ISSN Online: 0976 – 6359.

Integration of Web GIS and Remote Sensing for Trees Management Outside Forest

L.NARASIMHARAO NIMMAKAYALA
Asst. Professor, JBIET,
Hyderabad, Andhra Pradesh, INDIA
Email- urmail2nari@gmail.com

PUPPALA MANGALA TULASI
Asst. Professor, MRIET,
Hyderabad, Andhra Pradesh, INDIA
Email- tulasipuppala@gmail.com

ABSTRACT

"Integrating of Web GIS and Remote Sensing for Trees Management outside Forest" refers to delineation of tree cover outside forests. This initiative is taken by using high resolution CARTOSAT-1 satellite imagery. This paper introduces an integrated Web-based GIS architecture by combining three levels of geographic information services. A prototype Website (Online Forest Portal) has been developed to provide easy access of analyzed geospatial information and to facilitate web –based data sharing for natural resource managers and regional park rangers. In this context, an accurate assessment of forest and tree resources is essential for formulating sound strategy for forestry sector. Forest areas using satellite Remote Sensing are used as a tool for mapping Zones.. The Web-based integration frame work emphasizes user- oriented services, distributed network environments, metadata standards, communication protocols, client/server computation and ubiquitous access for rational utilization of funds for forest management.

INTRODUCTION

Trees are very valuable natural and renewable resource and it is difficult to understand its diverse topographic, climatic, socio-economic and its role in making the environment healthy. Deforestation is one of the major destructive elements outside forest and causes enormous damage to biotic resources, the regeneration and productivity capacity of trees is essential. Conventionally identifying the trees outside forest areas was based on knowledge and experience of the foresters by some of conservative measures. All these protective measures failed respective of all risk prone areas outside forest. Lack of scientific approach in delineating priority areas for trees has caused immense damage to the national economy. The advent of the internet and web-based geographic information systems provides a convenient and efficient way to access and disseminate geospatial data and remotely sensed imagery. There is a great potential for using web based GIS and image tools in the areas of natural habitat preservation and environmental monitoring. This research explores to develop an updated framework for combining Web GIS and remote sensing and creating a web repository for spatially analyzed data. The present paper evaluates major components by mapping and showing their inter relationship, describing status of forest health and prone areas from lowest to highest risk. This part of study also includes web analytics and methodology towards determining the efficiency to monitor various environmental issues. Remotely sensed data is also one of the geospatial data. GIS is a vital technology supporting the various phases of risk assessment.

OBJECTIVES

- ❖ Developing a prototype website for publishing and to access geospatial information.
- ❖ Development of GIS web based tool to integrate with remote sensing data that provides storing, retrieving, analyzing and presenting capability.
- ❖ To emphasize the user oriented services and metadata standards of the present study as well as other various analyzed reports.
- ❖ To design a web based repository for data archival.
- ❖ To investigate the delineation of trees outside forest cover in the study areas using ground truth information.
- ❖ To design and implementation of functional , explicit and user friendly menu screens for database maintenance, information query, information retrieval and query on spatial and non-database.
- ❖ To assess the effect of different land use systems on diversity of TOF.

METHODOLOGY

Materials Required*:*

Global Positioning System (GPS), ERDAS Imagine 9.3, Arc Map 9.2, Arc View 3.2, MS.Office-2007.
Software Requirements: JDBC, Apache Tomcat, Oracle, Microsoft Windows.

This methodology mainly includes three phases

Phase-1 Data Model Development	→	Phase-2 Final Report Generation	→	Phase-3 Website Generation
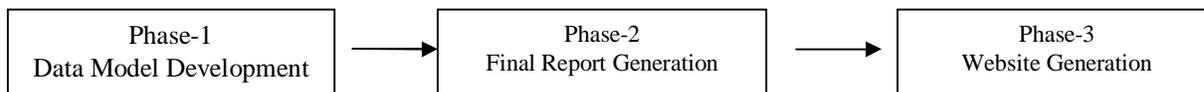
CARTOSAT-1 is the first Indian Remote Sensing satellite capable of providing in-orbit stereo images. The images are used for Cartographic applications meeting the global requirements. Cameras of this satellite have a resolution of 2.5m (can distinguish even a small car). The CARTOSAT-1 provides stereo pairs required for DEM, Ortho image Products for various applications of GIS. This carries two panchromatic cameras that can take black and white stereoscopic pictures of the earth in the visible region of the electromagnetic spectrum. The swath covered by the high resolution PAN camera is 30km and their spatial resolution is 2.5m. The cameras are mounted on the satellite in such a way that near simultaneous imaging of the same area from two different angles is possible. This facilitates the generation of accurate three dimensional maps. The cameras are steerable across the direction of the satellite movement to facilitate the imaging of an area more frequently. The images taken by Cartosat-1 camera compressed, encrypted, formatted and transmitted to the ground stations.

With the advent of new technologies like Satellite Remote Sensing, Global Positioning system, GIS revolutionary changes have been brought in handling the vast geographical data for better management of natural resources. For the trees classification, weight ages are assigned to each variable like tree cover density, type, and its proximity to road analyzed in the complex GIS environment to generate the final output. Generalization is performed by finally integrating with Web GIS and producing output by rescaling.

Methods / Procedures used*:*

Geo-referencing:

Correlating the image to the real world co-ordinates with a specific projection and specified units. Unless until the images are geo-referenced, they cannot be arranged sequentially or overlaid one upon another for any further analysis. Rough geo-referencing can be done by addresses (Lat, Long) given in the accompanied data of image for four corner pixels and one central pixel. For refined geo-referencing, a projected map can be used while rectification (warping) of image and can be transformed specific projection of that map with specific datum and units.

Mosaicking:

The area of interest exists in more than one image; the images had to be joined after geo-referencing. Rectification can be done to original images either before mosaicking or the mosaicked image afterwards.

Sub-setting:

Depending upon the camera and satellite, the area, width of the scene (swath) will change. Accordingly NRSC data centre produces the square of swath as full scene, 70 km^2 for PAN, 140km^2 for CARTOSAT-1. A full scene is divided into 42 sub scenes.

Classification:

Panchromatic classifications are the process of sorting pixels into a finite number of individual classes, or categories of data, based on their data file values. If a pixel satisfies a certain set of criteria, the pixel is assigned to the class that corresponds to that criterion. This process is also referred to as image

segmentation. An example of a classified image is a land cover map, showing vegetation, bare land, pasture, urban, etc.

Taking the advantage of panchromatic property of CARTOSAT-1 and high resolution of responding IRS PAN, a classification of TOF assessment has been developed. Firstly, the geo-referenced boundary of study area was supplied to NRSC to procure desired CARTOSAT-1. After acquiring the images, the PAN image was geometrically rectified as per the strategy adopted. The CARTOSAT-1 was co registered with the rectified PAN images. The boundary of forest area was digitized and forest area was masked. The remaining CARTOSAT-1 image apart from forest cover was left out for further classification. The classification enables to distinguish between tree cover and other dark areas PAN images. The remaining area on PAN data (pseudo image) represents only trees and agriculture and using the threshold gray value of PAN image corresponding to tree cover, image was classified. This classified image was visually analyzed with respect to Google earth for editing and refinement for inclusion and

Run the AML:

AML is the native programming language of the Arc Info Work station in GIS software. AML is commonly used in 7X versions of Arc Info. Over 150 free AML scripts are available from ESRI's Arc Scripts page. Find AML scripts covering almost every spatial function. Choose "languages" from the drop down menu and select AML before you search for AML written to convert from raster to vector files to Arc Info format. Run the AML to convert classified raster image to vector shape file.

Accuracy Assessment:

The converted vector shape formats of all the classified portions are then merged accordingly with their corresponding classifications. These classified vector coverage's are rectified using clean and build techniques that are a part of data management tools in Arc GIS. This feature helps to minimize errors of the polygons drawn with over shoots and under shoots at nodes, however to attain connectivity.

Slope map preparation:

A measure of change in surface value over distance, expressed in degrees or as a percentage. Mathematically, slope is referred to as the first

omissions. Since cluster of trees having 0.1 Ha area or more is defined as Block plantation, pixels were clumped and cluster of pixels having area less than 0.1Ha were eliminated. Incorporating these collections final classified image was prepared having three classes in TOF areas, namely, Block, Linear, Habitation, and Scattered. This classification is dependent upon the data itself for the definition of classes. This method is usually used when less is known about the date before classification. It is then the analyst's responsibility after classification, to attach meaning to the resulting classes.

Raster to Vector Conversion:

The classified raster image is converted into Arc/info coverage (vector format) using the ERDAS Imagine Raster to Vector conversion option. Coverage obtained will be pixel based and each class is given a specific grid code, using grid code the polygons of same grid code have to be dissolved. Coverage needs to be splinted in order to get smooth arcs.

Digitization of Contours:

Contours of Prakasam Division are digitized using the SOI topo sheets of 1:150000 Scale are used (Contour Interval is 20m). First the topo sheets that fall under the study area are Gecoded in the Erdas Imaging. Then the contours are digitized giving elevation as parameter in the attribute table.

DEM (Digital Elevation Model):

Digital Elevation Model is a raster representation of a continuous surface, usually referring to the surface of the earth. The accuracy of this data is determined primarily by the resolution (distance between sample points). Other factors affecting accuracy are data type (integer or floating point) and actual sampling of the surface when creating the original DEM. Digital Elevation models are typically used to represent terrain relief as this helps in association with sampling points, also referred to as 'Digital Terrain Model' (DTM). In the present study DEM is created using Arc/Info software's topo grid command. DEM produced by topo grid command is floating point grid inputs used are boundary of the district and contour coverage's.

derivative surface; slope identifies the maximum rate of change in value from each cell to its neighbors. As output slope grid can be calculated as percent slope or degree of slope.

Slope Grid creation:

Slope grid can be derived from the DEM using grid tools surface analysis function. Slope grid derived by DEM is floating grid, it is converted into integer grid using float to integer conversion option provided by grid tool expression function. Then the slope grid is reclassified to five classes as per the modeling strategy.

Slope Coverage:

Reclassified slope grid is converted into slope coverage using grid to poly conversion function provided by the command tools of Arc/Info software. Slope coverage assigned the slope index and multiplied with the internal weight ages using Arc View software according to the value in the modeling table.

Modeling:

The various spatial layers can be integrated for modeling TOF. Integration of these layers would be done in a hierarchical scheme. Different layers
.

have different degree of contribution on TOF. According to pre field Observation report , reference points are generated with respect to relationship between spatial features. The accuracy of classification was assessed by taking average points in block, linear, habitation and scattered stratum. It is recommended that 50 or more points should be located for ground verification for each class done in post field work.

Sampling Method:

This stratification having done with the help of appropriate sampling design optimum number of plots can be randomly selected in every stratum. Since the variability in each stratum is expected to be different demanding different sample and plot sizes, pilot studies were conducted to ascertain this so that the variability of the stratum can be properly addressed. In this pilot study, 0.1 Ha, 0.2 Ha and 0.3 Ha plots were considered for natural and habitat stratum. Desired number of sample points was randomly generated in each stratum, separately and the data on pre decided variables were collected on designed formats.

STUDY AREA

Prakasam District

Forest Circle- Prakasam;

Revenue District- Nellore, Gudur, Kavali

State – Andhra Pradesh

Location –

Latitude $14^0 57^1 0.49$"N to $16^0 17^1 51.74$"N

Longitude $78^0 45^1 23.78$"E to $80^0 25^1 53.48$"E

Land use	Area in Ha	%
Total geographical area	1762600	
Forest including scrub	442598	28.42
Agriculture	990841	51.14
Gross irrigated area	72.86	36.36
Fallow lands	155900	0.89
Grasslands	0.49	0.02
Settlements	20.80	0.83
Vegetation outside forest	75.75	3.03
Water bodies	24682	1.05

Phase-1

Phase-2

```
Phase-1

        Data collection
              │
              ▼
         Spatial data
              │
      ┌───────┴───────┐
      ▼               ▼
 SOI Topo sheet   Satellite imagery
      │               │
      ▼               ▼
 Geo-referencing  Pre processing
      │               │
      ▼               ▼
 Rectified topo   Enhancement
   sheet
      │               │
      └───────┬───────┘
              ▼
        Geo-referencing
              │
              ▼
 Final rectified scenes of CARTOSAT-1
```

```
Phase-2

 Cartosat-1 Data          Attribute Data
      │                        │
      ▼                        ▼
 Conceptualize TOF        Data collection
      │                        │
      ▼                        ▼
 Image interpretation     Field survey
      │                        │
      ▼                        │
 Overlay analysis ◄────────────┘
      │
      ▼
 Image classification
      │
      ▼
 Accuracy assessment
      │
      ▼
 Data processing
      │
      ▼
 Final report
```

Phase-3

```
Phase-3

  ORACLE        JAVA SERVLET Pages      Analyzed satellite Data & report
    │                  │                          │
    ▼                  ▼                          │
 Data base         HTML & CSS                     │
 Generation            │                          │
    │                  │                          │
    └──────────────────┴──────────────────────────┘
                       ▼
        Integration of Web GIS & Remote Sensing
                       │
                       ▼
        Connection Orientation with Apache Tomcat
                       │
                       ▼
        Development of Prototype Website
```

Final Report Generated

Showing the stratum wise areas in Ha, distributed in the district

S.No	Stratum	Area in Ha
1	Natural Forest	63558.77
2	Habitation	18021.90
3	Linear	5027.92
4	Scattered	9044.69

Web Design & Development:

Architecture of integrated Web GIS:
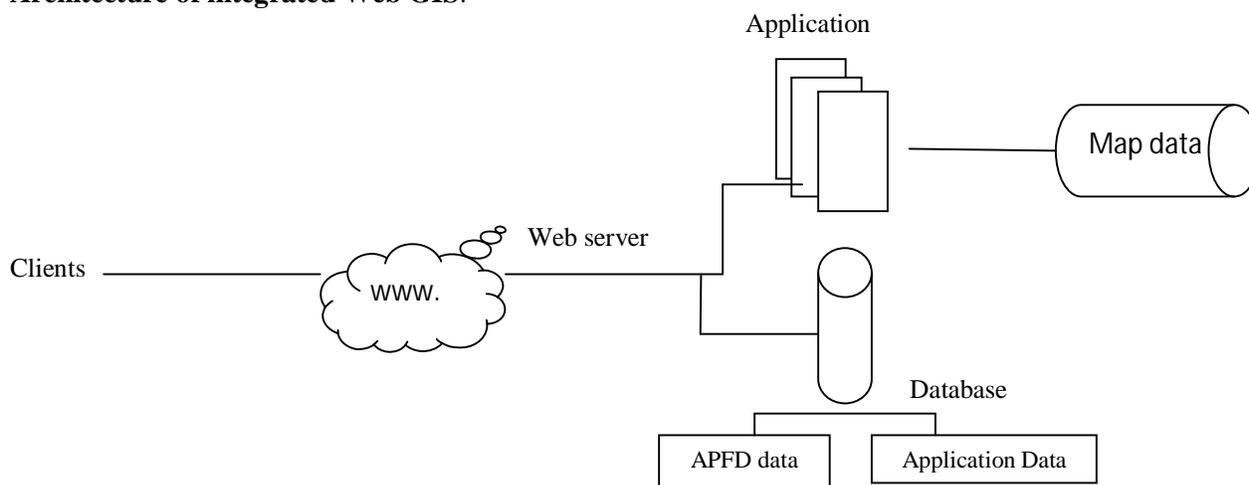
Conclusion

This prototype website online forest portal is very much useful for various applications like assessment of the natural resources, evaluation of LULC patterns, understanding environmental clearance, geology and topography. This sort of design can be used as a platform for publishing any other projects. It is also useful for industrial estate developers, environmental professionals and researchers have several advantages to get faster results.

References

[1] Burroughs, P.A; Principles of geographic information system for Land resource assessment; Oxford university Press; Newyork

[2] Thomas M. Lillesand and Ralph W. Keifer, Remote sensing and Image interpretation, fourth Edition, john Wiley and sons, Inc, Newyork.

[3] Star, J. Estes, J.; Geographic Information system an introduction; Prentice- Hall; Inc; NewJersy.

[4] Tsou, M.H. (2004) integrating web based GIS and online Remote sensing facilities for environmental Monitoring and Management.

[5] Biswanth Sharma Buragohain; development of web based land information system using integrated GIS and Remote Sensing technology for Guwahati City, India.

[6} John Duckett, "Beginning Web Programming with HTML, XHTML, CSS 2nd Edition, john wiley &sons.

[7] CYN Norasma, Web-Based GIS Decision Support System for natural resources, Malaysia.

[8] Casey Kochmer, Erica Frandsen, "Jsp and Xml and CSS" 2nd Edition, John Wiley and Sons.

Using Checkpoint For Implementing Fault-Tolerant On Desktop Grids

M.Udaya Prakash Reddy[1]
Assistant Professor[1]
Department Of Computer Science and Engineering ,
Malla Reddy Institute Of Engineering and Technology
email- udhayreddi@gmail.com

P.Mangala Tulasi[2]
Assistant Professor[2]
Department Of Computer Science and Engineering ,
Malla Reddy Institute Of Engineering and Technology
email- tulasipuppala@gmail.com

Abstract:

Grid computing uses massive power of idle cycles of PC's .Desktop grids is nothing using the idle cycles of desktop PC's for computing large scale applications. There are many fields which requires large scale massive power such as   scientific fields to handle complex and demanding problems. Desktop grids uses widely distributed grids the probability of occurring fault is more. Desktop Grids are being increasingly used as the execution platform for a variety of applications that can be structured as Bag-of-Tasks (BoT)[1].
In this paper we proposes a fault tolerant fair scheduler for bag of tasks application on desktop grid, which ensures error free transmission of data and performing tasks by using resources and also   fair sharing of resources. Fault tolerant is implemented on desktop grid by using check point.

Keywords - Scheduler, Grid Information System, checkpoint

INTRODUCTION

Almost every college, office and every member have computers. In fact modern world is incomplete without Computers. Desktop Grids are computational grids formed by using resources of idle desktop machines. Most of the computers in offices and personal computers are used only for certain time and are idle for most of the time and also they are not using the whole storage of the system .Grid computing combines all the machines that are idle and form as Virtual Group and uses the group for computing large-scale applications. There are two types of desktop grids one is local and other is individual computers . Local computers are the group of computers in an organization and educational institutes . Second is the individual computers which are used by citizens . This offers the opportunity to resolve the increasing need for computational resources. As most desktop systems are idle for significant periods of time, it should be possible to harvest their idle CPU cycles or other unused resources and apply them towards projects in need of such resources. Apart from providing huge computational power and storage capacity desktop grids also have several challenges in using this volatile and shared platform effectively. The usefulness of desktop grid computing is not limited to major high throughput public computing projects. Many institutions, ranging from academics to enterprises, hold vast number of desktop machines

and could benefit from exploiting the idle cycles of their local machines[2] . Important examples of desktop grids are SETI@home and PrimeGrid, Almere Grid, Condor based grids[4], the WISDOM project is using grid computing to speed the search for a cure for malaria, a disease that effects millions of people all over the developed world, MammoGrid is building a grid for hospitals to share and analyse mammograms in an effort to improve breast cancer treatment.

Desktop grids faces many challenges and the most important challenges are platform is volatile, since users may reclaim their computer at any time, which makes centralized schedulers inappropriate. Second, desktop grids are likely to be shared among several users, thus we must be particularly careful to ensure a fair sharing of the resources. Fair sharing of resources means there should be balanced share of resource no resource should get more load and no resource should get less instead there should be balanced sharing to the resources. The solution to the fair sharing of resources is already give by fair decentralized scheduler[1]. The main aim of our model is provide fault tolerant by using check points. Fault tolerance is an important property in Grid computing as the dependability of individual Grid resources may not be able to be guaranteed; also as resources are used outside of organizational   boundaries, it becomes increasingly difficult to guarantee that a resource being used is not malicious in some way[3].

PROBLEM DESCRIPTION

In this section, we formally define the problem we target. Our goal is to design a fault-tolerant for fair scheduler on desktop grid. Our main objective while scheduling tasks of concurrent applications is to ensure fairness among users. There is more chance of occurring of resources failures in grid computing because grids are in distributed environment. Desktop Grids is forming Virtual Group by using many computers around world and using computer power and storage so at any time their is a chance of reclaiming the computer at any time from the virtual Group.In the desktop grids it is more because even and individual computer also comes under this category.

ARCHITECTURE
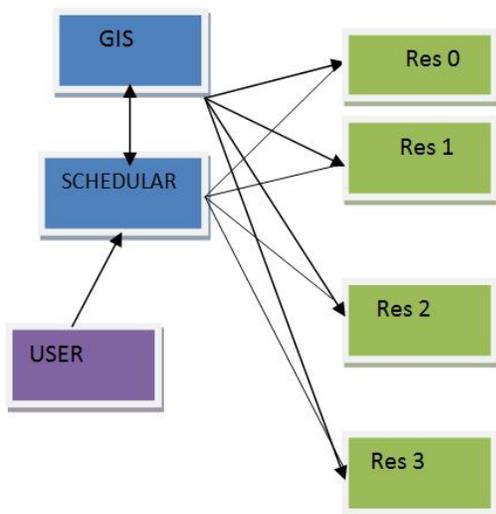
Figure 1:Architecture of Scheduler and GIS
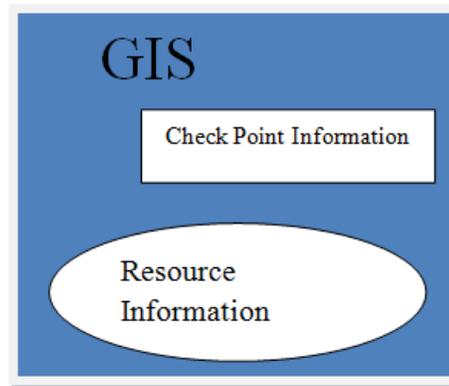
Figure 2: GIS architecture

Algorithm 1 Resource Failure Detection Algorithm used by GIS.
_____

repeat
send the messages to all checkpoints up to resource from GIS
if a checkpoint does not respond sending acknowledge back **then**
remove it from the list
update GIS entities about the failure
end if
wait for Time GIS seconds
until simulation is over
_____

Algorithm 2 Resource Failure Detection Algorithm used by Scheduler .
_____

repeat
push the messages to all resources which are running jobs
if a resource does not respond by sending acknowledge **then**
Scheduler ask the GIS for a list of resources
choose one of them
resubmit the jobs
end if
wait for T seconds
until all my jobs have been successfully executed.
_____

GIS: maintains an up-to-date list of available resources. GIS collects the information from all the checkpoints of all the resources and maintains an up-to-date list.
 According to Algorithm 1 :
Message will be send to all the checkpoints to all the resources and if message is not send back from the then remove the resource from the resource information maintained in the GIS. Contact a GIS

entity for a list of available resources in order to know where to run their jobs. The functionality of this entity can be summarized in Algorithm 2. For enabling an efficient pushing mechanism, User Datagram Protocol (UDP) is used by these entities. This is due to the fact that UDP requires a less significant network latency in comparison with a Transmission Control Protocol (TCP), although UDP does not provide retransmission of lost packets. The sequential steps are shown in a box with a number inside. Here is list of steps showing the working of the model .First, *R1,R2,R3* and *R4 resources* register to *GIS* (step 1). Then, *GIS* creates a list of available resources. In order to keep that list up-to-date, *GIS* push the messages to the resources periodically (step 2). When *User* wants to run a job, he/she contacts scheduler and scheduler contacts *GIS* in order to get a list of available resources (step 3). Upon receiving the scheduler's request, *GIS* returns its list. In that moment, scheduler   will choose *R1* for example, based on the features of the resource and the job scheduling. When *User* has chosen the resource, he/she submits the job to *R1* and starts a regular pushing mechanism.

In the event of a failure affecting *R1*, *GIS* is able to detect this problem due to the pushing mechanism in place (step 4). Hence, *GIS* removes the failed resource from the list. During a routine push, GIS discovers that *R1* has failed. As a result, *scheduler* ask *GIS* for a list of resources (step 5). When *R1* recovers, it registers itself again to *GIS* (step 6). With this approach, *GIS* is able to maintain an up-to-date list of available resources. If the failure only affects some of the machines in a resource, what happens next depends on the allocation policy of this resource. If the resource runs a *space-shared* allocation policy, the jobs that are currently running on the failed machines will be terminated and sent back to users. However, when the resource runs a *time-shared* (round-robin) allocation policy, no jobs will be failed, as their execution will continue in the remaining machines of the resource. For both allocation policies, the remaining machines are responsible for responding to pushing requests from users and GIS. Moreover, they are required to inform the GIS about such failure. This way, the GIS can have accurate information on the current status of the resource.

USING GridSim FOR RESOURCE FAILURES

GridSim:

GridSim allows modeling and simulation of entities in parallel and distributed computing systems such as users, applications, resources, and resource brokers/schedulers for design and evaluation of scheduling algorithms.

Overview of GridSim functionalities:

Incorporates failures of Grid resources during runtime. New allocation policy can be made and integrated into the GridSim Toolkit, by extending from Alloc class. Has the infrastructure or framework to support advance reservation of a grid system. Incorporates a functionality that reads workload traces taken from supercomputers for simulating a realistic grid environment. Incorporates an auction model into GridSim. Incorporates a datagrid extension into GridSim. Incorporates a network extension into GridSim. Now, resources and other entities can be linked in a network topology. Incorporates a background network traffic functionality based on a probabilistic distribution. This is useful for simulating over a public network where the network is congested. Incorporates multiple regional GridInformationService(GIS) entities connected in a network topology. Hence, you can simulate an experiment with multiple Virtual Organizations (VOs).Adds ant build file to compile GridSim source files[10].

Along with GridSim classes we are using many new classes for implementing resource failures.
UserFailure: as its name suggests, this class implements the behavior of the users of our grid environment. Its functionality can be summarized as follows: (1)creation of jobs; (2) submission of jobs to resources; (3)push the resources used to run its jobs; (4) on the failure of a job, choose another resource and re-submit the failed job to it; (5) receive successful jobs.

ResourceFailure: based on Grid-Sim's GridResource class, this class interacts with RegionalGISWithFailure to set machines as failed or working. It also interacts with classes implementing AllocPolicyWithFailure to set jobs as failed.

AllocWithFailure: it is an interface class, which provides some functions to deal with resource failures. Each allocation policy implementing this interface will have a different behaviour with regard to the failures.

AvailabilityInfo: This class is used to implement the pushing mechanism. The user and GIS send objects of this class to resources, which in turn send them back, as mentioned previously. When a resource still has some working machines left, it will send these objects back with no delay. However, when all machines are out of order, the resource sends these objects back with some delay with a

special tag. This is done to simulate a situation, where if a resource does not reply to the given push before a specified time out, then it is interpreted as not available. This method is used to overcome the same problem in GridSim, i.e. waiting for events that never arrive.

Resource failure statistics

Virtual Group	Resources	Failed Resources
V1	100	5
V2	20	1
V3	60	30
V4	23	23

Job failures

	Jobs	Failed Jobs
1	200	52
2	89	8
3	100	65
4	10	10

CONCLUSION AND FUTURE WORK

Grid computing is the hot topic now-a-days which is used in many fields such as scientific, global warming etc. GridSim is the simulation tool used for simulation. By using Gridsim we model failure detection and handling the failures by using checkpoints. Failure model is implemented by using Gridsim, by this model researchers can be able to develop more realistic Grid models.In this paper we handled exception handling by using Grid sim.

As for future work, we are planning to use the improved simulation tool to carry out research aimed at providing more security and QoS in Grids.

References

[1]: Javier Celaya, Loris Marchal ” A Fair Decentralized Scheduler for Bag-of-tasks Applications on Desktop Grids"
[2]: Derrick Kondo and Filipe Araujo"Characterizing Result Errors in Internet Desktop Grids".
[3]: Domingues, P.Sch. of Technol. & Manage., Polytech. Inst. of Leiria, Portugal.Silva, J.G. ; Silva, L.Sharing Checkpoints to Improve Turnaround Time in Desktop Grid Computing
[4]Universiteit Antwerpen
[5] Paul Townend and Jie Xu"Fault Tolerance within a Grid Environment"Department of Computer ScienceUniversity of Durham, DH1 3LE, United Kingdomp.m.townend@dur.ac.uk jie.xu@dur.ac.uk
[6] Agust´_n Caminero and Anthony Sulistio

"Extending GridSim with an Architecture for Failure Detection" Department of Computing Systems 2Dept. of Computer Sc. & Software Eng.
The University of Castilla La Mancha, Spain The University of Melbourne, Australia
fagustin, blanca, carmeng@dsi.uclm.es fanthony, rajg@csse.unimelb.edu.au 2007
[7] N. Hayashibara, A. Cherif, and T. Katayama. "Failure detectors for large-scale distributed systems" In *Proc. of the 21th Symp. on Reliable Distributed Systems, (SRDS)*, Japan, 2002.
[8] Nikolaos D. Doulamis"Fair Scheduling Algorithms in Grids"IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS, NOV 2007
[9] Fangpeng Dong and Selim G. Akl "Scheduling Algorithms for Grid Computing: State of the Art and Open Problems"January 2006.
[10] http://www.cloudbus.org/gridsim/

PREDOMINANCE OF BLOWFISH OVER TRIPLE DATA ENCRYPTION STANDARD SYMMETRIC KEY ALGORITHM FOR SECURE INTEGRATED CIRCUITS USING VERILOG HDL

V. Kumara Swamy[1] Prabhu Benakop[2]

[1]Dept of ECE, Sreenidhi Institute of Science and Technology, Yamnampet, Ghatkesar, Hyderabad, Telangana, India
[2]Dept of ECE, Indur Institute of Engineering and Technology, Siddipet Dist, Telangana, India

ABSTRACT

Computer data communication is the order of the day with Information Communication Technology (ICT) playingmajor role in everyone's life, communicating withsmart phones, tabs, laptops and desktops usinginternet. Security of the data transferred over the computer networks is most important as for as an organization is concerned. Hackers attempt hard to crack the software key and indulge in cyber crimes. In this paper, the main concern is not only to provide security to the data transferred at the software level but it provides the security at hardware level by the modified Blowfish Encryption and Decryption Algorithms. It results minimum delay, high speed, high throughput] and effective memory utilization compared to Blowfish (BF) and Triple Data Encryption Standard (TDES) algorithms. The implementation of Blowfish with modulo adder and Wave Dynamic Differential Logic (WDDL) is to provide security against Differential power analysis (DPA). In the proposed four implementations, BF with constant delay n-bit adder (BFCDNBA) yielded minimum delay, maximum frequency, high memory utilization and high throughput compared to BF with modulo adder and WDDL logic (BFMAWDDL), BF with modulo adder (BFMA) and TDES algorithms. The VLSI implementation of Blowfish and TDES algorithms is done using Verilog HDL.

KEYWORDS:

BF, TDES, WDDL, DPA, BFMA, BFCDNBA, BFMAWDDL, HDL.

1. INTRODUCTION

Many encryption algorithms have come into an existence for information confidentiality, authenticity, integrity, nonrepudiation and access control such as DES, TDES, Advanced Encryption Standard (AES) and Blowfish [4, 10] etc. This research work analyzes the merits and demerits of Blowfish compared to TDES algorithm in terms of their operation, propagation delay, memory utilization and throughput of the algorithms considered. The brief information about following algorithms is explained below:

1.1. DATA ENCRYPTION STANDARD (DES)

Data Encryption Standard encrypts 64-bit block plain text with 56- bits key length. It is a fiestel network. After initial permutations, it undergoes 16- rounds of processing steps. It can operate in Cipher Block Chaining (CBC), Electronic Code Book (ECB), Cipher Feedback (CFB) and Output Feedback (OFB) modes [10] [12]. It is prone to Brute Force attack in which hacker attempts to break the key by applying all possible combinations of inputs. It's a popular and most widely used algorithm before TDES, AES, and BF algorithms. It's an insecure algorithm [23] [10]

CHARACTERIZATION OF SILICATE SOLUBILISING BACTERIA ISOLATED FROM DIFFERENT HABITATS FOR PLANT GROWTH PROMOTING ACTIVITIES

*Associate Professor, Gokaraju Rangaraju College of Engineering and Technology, Hyderabad.
Chegunti.kala@gmail.com, lnthapo@gmail.com.

ABSTRACT

Silicon is ... second largest element after oxygen. Its availability in soil is in polymer form which is not useful for plant uptake. Silicate solubilising bacteria which will convert silicate polymer in to plant available silicon can help in its accumulation in rice plants thereby enabling the plant to withstand stresses. In the present study, silicate solubilising bacteria were isolated from different environments and they were tested for multiple plant growth promoting traits. Multiple plant growth promoting activities were observed only in bacteria isolated from cultivated soils. Six isolates tested positive for auxin production, ACC deaminase activity, siderophore and HCN production, while three isolates showed potential for solubilisation of insoluble phosphorus and zinc.

Key words: Silicate solubilizing bacteria, plant growth promotion, IAA, ACC deaminase, rice.

Silicon though the fourth largest element in plants after nitrogen, phosphorus and potassium, is not considered as an essential element as its role is often minimal under conducive unstressed plant growth environment (1). The positive and manifold effect of plant silicon is evident only when the plant is exposed to various abiotic and biotic stresses (2). It is the second largest element in the earth's crust and generally occurs as silicate polymers unavailable for plant uptake. The depolymerized monosilicic acid preferred by plants for uptake is normally available at concentration of 10^{-4} mole l-1, within a narrow soil pH range of 6–9 (3). A novel strategy to increase monosilicic acid concentration is to exploit naturally occurring bacteria involved in weathering of soil silicates. In the present study, silicate solubilising bacteria were isolated from different environments and they were assessed for plant growth promoting traits.

MATERIALS AND METHODS

Soil and rock samples were collected from different habitats which include Kerala, Andhra Pradesh, Bihar and Orissa. Modified Bunt and Rovira medium with insoluble magnesium trisilicate was used for isolation of silicate solubilising bacteria (SSB) from soils of different environment. SSB's were selected based on the formation of clear zone around the colonies which is indicative of silicate solubilisation (4). Silicate solubilized by the isolates was determined by silico molybdate method (5) after 7 days of growth in basal medium containing insoluble magnesium tri silicate.

Characterization of plant growth promoting activities of isolates

Indole acetic acid (IAA) production was assessed by using culture supernatant of isolates grown for seven days at 28°C in TSB broth amended with tryptophan by using Salkowski reagent. The reaction is determined by comparing the absorbance at 530nm of a sample to a standard curve of IAA ranging between 10-100µg/ml (6). Bacterial cells incubated for 24h in Dworkin and Foster's (DF) minimal medium containing 3mM 1-aminocyclo-propane-1-carboxylic acid (ACC) as sole nitrogen source was used for quantification of ACC deaminase activity (7). The toluenized cell suspension is used to determine ACC deaminase activity according to a modified Honma and Shimomura method which measures the amount of á-ketobutyrate produced when the enzyme ACC deaminase cleaves ACC in to ammonia and á-ketobutyrate (8). The isolates were screened for solubilisation of insoluble phosphorus (P) and zinc (Zn) by using Pikovskaya medium with tri calcium phosphate as insoluble phosphate source (9) while modified Bunt and Rovira medium (4) with 0.1% zinc carbonate as insoluble zinc source was used for zinc solubilisation. Colonies surrounded by a clear halo indicated solubilization of insoluble P and Zn. Siderophore production was determined by plating on Chrome Azurol S (CAS) agar media. Appearance of orange halos around the colonies implied the production of siderophores (10) by the isolates. Bacterial isolates were grown on Tryptone soya agar amended with glycine (4.4 g l-1) was used for assessment of hydrogen cyanide production (HCN) Development of reddish brown colour on the filter paper soaked in 0.5% picric acid dissolved in 2% sodium carbonate and placed underneath the sealed petridish lid denoted positive HCN production by isolates (11).

Seed Germination assay for testing Plant growth promoting activity

Effect of SSB isolates on germination of surface sterilized rice seeds (Swarna variety) were studied through in vitro petri plate assay. Swarna seeds were surface sterilized

An Enhancement System for Efficient Driving

[1]KUNTA MAHESH[1], M. J. PRAKASH[2], DR. SANDEEP SINGH RAWAT[3], DR.S. SREENATHA REDDY[4]

[1]PG Scholar, Dept of CSE, Guru Nanak Institute of Technology, Hyderabad, India.
[2]Professor, Dept of CSE, Guru Nanak Institute of Technology, Hyderabad, India.
[3]HOD, Dept of CSE, Guru Nanak Institute of Technology, Hyderabad, India.
[4]Principal, Guru Nanak Institute of Technology, Hyderabad, India.

Abstract: Route recommendation is a critical peculiarity of GPS route frameworks. As of late, Microsoft T-drive has been empowered to propose courses picked by accomplished cabbies for given source/objective matches in given time periods, which regularly take less time than the courses computed as per separation. GPS-prepared taxis can be viewed as portable sensors examining traffic flows on street surfaces, and cabbies are typically accomplished in finding the quickest (speediest) course to a terminus focused around their insight. In this paper, we mine shrewd driving headings from the chronicled GPS trajectories of a substantial number of taxis, and furnish a client with the essentially speediest course to a given goal at a given flight time. we propose a period subordinate historic point diagram, where a hub (milestone) is a street fragment as often as possible crossed by taxis, to model the brainpower of cab drivers and the properties of element street systems. At that point, a Variance-Entropy-Based Clustering methodology is contrived to gauge the dispersion of travel time between two historic points in distinctive time openings. Taking into account this chart, we outline a two-stage steering calculation to process the basically quickest course. We assemble our framework focused around a true world trajectory dataset produced by in excess of 33,000 taxis in a time of 3 months, and assess the framework by leading both engineered investigations and in the field assess.

Keywords: GPS, Clustering, Entropy.

I. INTRODUCTION

A cloud-based digital physical framework for processing essentially quick courses for a specific client, utilizing countless prepared taxis was proposed. In existing framework[1-11], the physical peculiarity of a course, for example, separation, limit (paths), and the quantity of activity lights and bearing turns .The time-ward movement stream on the course. A client's driving conduct. Time-subordinate point of interest diagram, which well models the insights of cab drivers focused around the taxi trajectories. Detriments of the framework[12-25] are that is, we can't answer client inquiries by specifically mining trajectory designs from the information. Consequently, how to model cabbies' insights that can answer a mixture of inquiries is a

test. We can't promise there are sufficient taxis navigating on every street section regardless of the possibility that we have countless. That is, we can't precisely evaluate the pace example of every street portion. . In this paper, we propose a cloud-based digital physical framework for processing for all intents and purpose quick courses for a specific client, using countless prepared taxis and the client's GPS empowered telephone.

II. SYSTEM OVERVIEW

In this paper, we propose to mine keen driving headings from an expansive number of genuine chronicled GPS trajectories of taxis. As indicated in Figure 1, taxi trajectories are amassed and mined in the Cloud to answer inquiries from normal drivers or Internet clients. Given a begin point and end, our technique can recommend the essentially speediest course to a client as indicated by his/her takeoff time and focused around the knowledge mined from the verifiable taxi trajectories. As the taxi trajectories are always redesigned in the Cloud, the recommended courses are condition of-the-workmanship. At the point when proposing the aforementioned methodology, two mama jor concerns go to individuals' brains. To start with, a few courses on which a taxi can rapidly navigate may not be practical for typical drivers, e.g., the carpool tracks in a few parkways and a couple of transport taxi-safeguarded tracks in a city. In any case, much of the time, particularly in numerous urban areas like New York and Bei jing, private autos can have the same tracks with taxis. That is, taxis' trajectories can even now be referenced by different drivers when finding driving bearings in a urban city. Second, the verifiable trajectory-based methodology may not be agile enough to handle some critical mishaps rather than continuous traffic examination. Characteristically.

The traffic flows of a city take after a few examples unless some emanant occasions hap pen, for example, genuine mischances, traffic control and street meets expectations. Given that the likelihood of these occasions is much lower than that of customary traffic designs, our strategy is still extremely utilize fulI as a part of generally circumstances. In the meantime, other than the traffic flow, our strategy likewise verifiably fuses extra factors, for example, course

KUNTA MAHESH ,M. J. PRAKASH ,DR.SANDEEP SINGH RAWAT,DR.S.SREENATHA REDDY

changes and traffic signals. Besides, this system can find the quickest course in a future time and needs less online correspondence
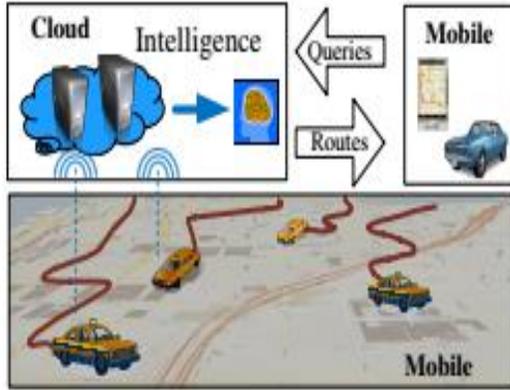

Fig.1. A cloud-based driving directions service

Consequently, our answer and the continuous based methodology can supplement one another. Be that as it may, we have to face the accompanying three difficulties when performing our strategy. Sagacity Modeling: As a client can choose wherever as a source or objective, there would be no taxi trajectory precisely passing the question focuses. That is, we can't answer client questions by specifically mining trajectory designs from the information. Consequently, how to model cab drivers' discernment that can answer a mixed bag of questions is a test. Information Sparseness and Coverage: We can't promise there are sufficient taxis crossing on every street section regardless of the possibility that we have a substantial number of taxis. That is, we can't precisely evaluate the velocity example of every street section.. Low-sampling-rate Problem: To save energy and com munication loads, taxis usually report on their locations in a very low frequency, like 2-5 minutes per point. This increases the uncertainty of the routes traversed by a taxi[11]. As shown in Figure 2, there could exist four possible routes ($R1$-$R4$) traversing the sampling points a and b.
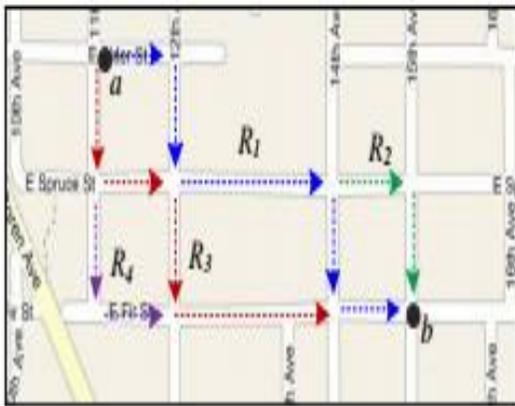
Fig 2. Low-sampling-rate problem

In our approach, we model a large number of historical taxi trajectories with a time-dependent landmark graph, in which a node (landmark) represents a road segment frequently tra versed by taxis. Based on this landmark graph, we perform a two-stage routing algorithm that first searches the land mark graph for a rough route (represented by a sequence of landmarks) and then finds a refined route sequentially con necting these landmarks. The contributions of this paper lie in the following aspects: · We propose the notion of a landmark graph, which well models the intelligence of taxi drivers based on the taxi trajectories and reduces the online computation of route-finding. · We devise Variance-Entropy-Based Clustering (called VE-Clustering) to learn the time-variant distributions of the travel times between any two landmarks. · We build our system by using a real-world trajectory dataset generated by 33,000+ taxis in a period of 3 months, and evaluate the system by conducting both synthetic experiments and in-the-field evaluations (per formed by real drivers). The results show that our method cans find out faster routes with less online com putation than competing methods

A. Learning Custom Factor

This section describes the process for learning the user's custom factor and providing self-adapted fastest route, which contains five steps as illustrated in Fig. 3:
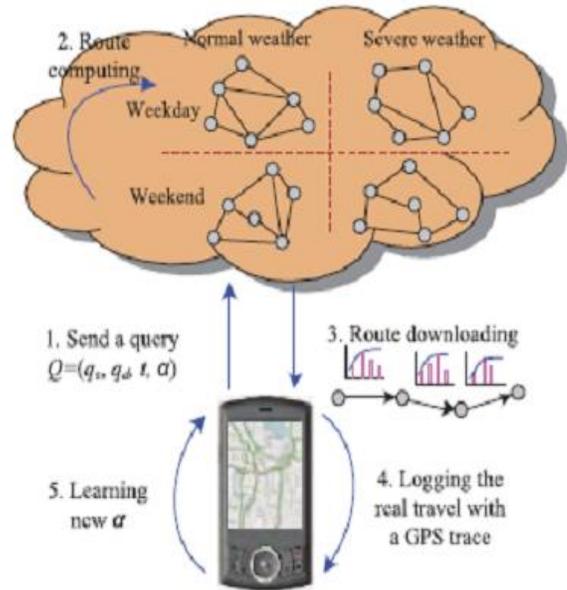
Fig.3. Framework of self-adapted routing service.

1. Query sending. First, the user sends her query tuple to the cloud, where qs and qd are start point and destination and td is the departure time. The parameter, is the custom factor.
2. Route computing. According to the departure time, start and destination point, the cloud chooses a proper landmark graph considering the weather information and whether it's a holiday or a workday. Based on the landmark graph, a two stage routing algorithm is performed to obtain a time-dependent fastest route based.

3. Route downloading.
4. Path logging. The cloud sends the computed driving routes along with the travel time distributions of the landmark edges contained in the driving route to the phone. Later, the mobile phone logs the user's driving path with a GPS trajectory, which will be used for recalculate the user's custom factor. The more a driver uses this system, the deeper this system understands the driver; hence, a better driving direction services can be provided.
5. Adapting the custom factor. The custom factor of a given user can be learned in a self-adaptive way.

III. TRAVEL TIME ESTIMATION

Since the road network is dynamic we can use neither the same nor a predefined time partition method for all the landmark edges. Meanwhile, the travel times of transitions pertaining to

---

Algorithm 1: LandmarkGraphConstruction

> **Input**: a road network G_r, a collection of road segment sequences M, the number of landmarks k, the thresholds δ and t_{max}
> **Output**: landmark graph G_l
> 1 $M \leftarrow \varnothing$, $E \leftarrow \varnothing$, Count[ ]$\leftarrow 0$;
> 2   **foreach** *road segment sequence* $S \in M$ **do**
> 3   **foreach** *road segment* $r \in S$ **do**
> 4   Count[r]++
>
> 5 $V_l \leftarrow$ Top-k(Count[ ], k);
> 6   **foreach** *road segment sequence* $S \in M$ **do**
> 7 $S \leftarrow$ Convert(S, V_l)/* Converted to landmark sequence */
> 8   **for** $i \leftarrow 1$ **to** $|S| - 1$ **do**
> 9 $u \leftarrow S[i]$, $v \leftarrow S[i+1]$;
> 10   **if** $v.t - u.t < t_{max}$ **then**
> 11   **if** $e_{uv} = (u, v; \mathcal{T}_{uv}) \notin E$ **then**
> 12 $E.$Insert(e_{uv})
> 13 $e_{uv}.supp$++;
> 14 $\mathcal{T}_{uv}.$Add$((u.t, v.t))$
>
> 15 **foreach** *edge* $e = (u, v; \mathcal{T}_{uv}) \in E$ **do**
> 16   **if** $e.freq < \delta$ **then** $E.$Remove(e) ;
> 17 **return** $G_l \leftarrow (V_l, E)$;

A. Landmark graph construction algorithm

A landmark edge clearly gathers around some values (like a set of clusters) rather than a single value or a typical Gaus Sian distribution, as many people expected this may be prompted by

1. The Deferent number of traffic lights encoun tered by different drivers,
2. The Deferent courses picked by different drivers venturing to every part of the point of interest edge, and 3) drivers 'personal conduct, ability and inclination. Consequently, different from existing systems in regards to the travel time of an edge as a solitary esteemed capacity focused around time of day, we consider a historic point edge's travel time as a set of distri butions relating to different time openings. D), 41

percent of drivers need to use 10~14 minutes (allude to the red bar) to navigate $e16$ ($r1 \rightarrow r6$) in the time opening 17:00–19:00, while 44 percent of drivers can finish this move with a 5~10 moment expense (spoke to by the yellow bar) and whatever is left of them need short of what 5 minutes (denoted as green color).
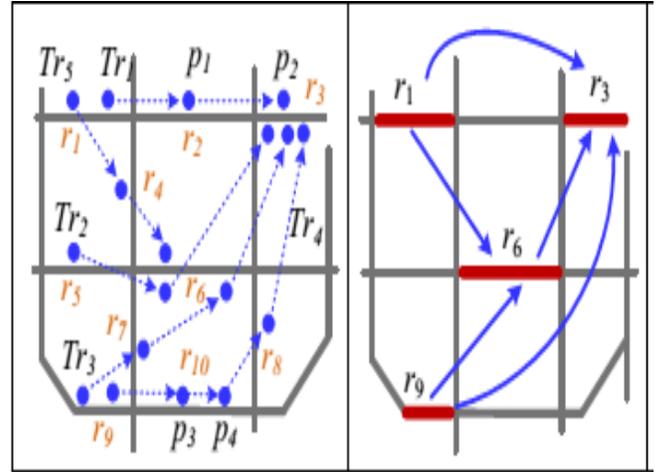
A) Matched taxi trajectories   B) Detected landmarks
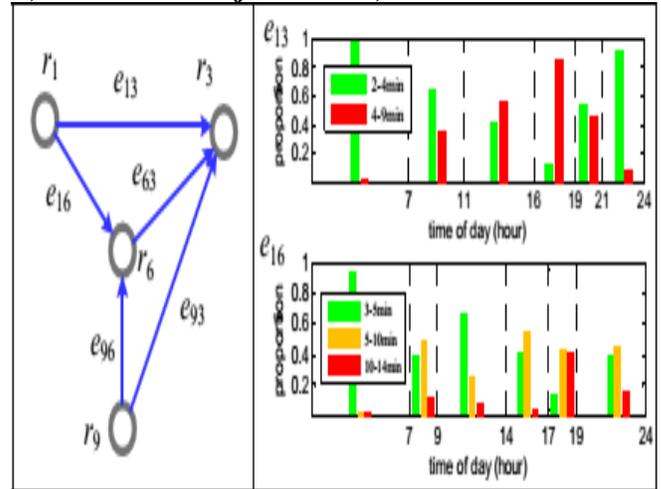
C) A landmark graph   D)Travel time estimation
Fig.4.

IV. CONCLUSION

This paper shows an approach that discovers the for all intents and purpose quickest course to a terminus at a given takeoff time regarding cabbies' insights gained from an extensive number of chronicled taxi trajectories. In our system, we first build a period subordinate milestone chart, and afterward perform a two-stage steering calculation focused around this diagram to discover the speediest course. We construct a true framework with certifiable GPS trajectories produced by in excess of 33,000 taxis in a time of 3 months, and assess the framework with far reaching analyses and in-the-field assessments. The results demonstrate that our system altogether beats both the pace stipulation based and the ongoing movement based technique in the parts of viability and productivity.

V. REFERENCES

[1] H. Gonzalez, J. Han, X. Li, M. Myslinska, and J. Sondag. Adaptive fastest path computation on a road network: A traffic mining approach. In Proc. VLDB, 2007.

[2] G. Andrienko, N. Andrienko, and S. Wrobel. Visual analytics tools for analysis of movement data. ACM SIGKDD Explorations Newsletter Special Issue on Visual Analytics, 12(3):38–46, 2007.

[3] J.Yuan, Y.Zheng, C. Zhang, And X. Xie, "An Interactive-Voting Based Map Matching Algorithm," Proc. Int'l Conf. Mobile Data Management (Mdm), 2010.

[4] E.Kanoulas, Y. Du, T. Xia, And D. Zhang, "Finding Fastest Paths On A Road Network With Speed Patterns," Proc. Int'l Conf. Data Eng. (Icde), 2006.

[5] D. Pfoser, S. Brakatsoulas, P. Brosch, M. Umlauft, N. Tryfona, and G. Tsironis. Dynamic travel time provision for road networks. In Proc. GIS. ACM, 2008.

[6] J.Yuan, Y. Zheng, C. Zhang, and X. Xie. An interactive-voting based map matching algorithm. In Proc MDM, 2010.

[7] A. Steiner and A. Leonhardt. A map generation algorithm using low frequency vehicle position data. In Transportation Research Board, 2011.

[8]A. Thiagarajan et al. Accurate, low-energy trajectory mapping for mobile devices. In NSDI, 2011.

[9] T. Vanderbilt. It wasn't me, officer! It was my GPS. Slate, June 2010. www.slate.com.

[10] M.Joseph Prakash, Dr.V.VijayaKumar, Dr.A.Vinaya Babu,"Morphology Based Technique For Texture Enhancement and Segmentation", Signal & Image Processing : An International Journal(SIPIJ), Volume 4, Number 1, Feb 2013, pp.49-56.

[11] M.Joseph Prakash, Dr.V.VijayaKumar, "A New Texture Based Segmentation Method to Extract Object from Background", Global Journal of Computer Science and Technology Graphics & Vision, Volume 12, Issue 15 , Dec 2012, pp.47-53.

[12] M.Joseph Prakash, Saka.Kezia, B.V.Ramana reddy, "An Approach for Texture Segmentation based on Random Field Model and Wavelet Fusion", International Journal of Signal and Image Processing (IJSIP), Vol.1, Issue 3, May 2010, pp.183-189.

[13] M.Joseph Prakash, Saka.Kezia, Dr.I.Santi Prabha, Dr.V.VijayaKumar, "A Novel Approach For Texture Segmentation Based On Rotationally Invariant Patterns", International Journal of Computer Engineering & Sciences (IJCES), Volume 2, Issue 2, , Jan 2013, pp.1-8.

[14] M.Joseph Prakash, Saka.Kezia, Dr.I.Santi Prabha, Dr.V.VijayaKumar, "A New Approach for Texture Segmentation Using Gray Level Textons", International Journal of Signal and Image Processing(IJSIP), vol. 6, no. 3, June 2013, pp.81-89.

[15] M.Joseph Prakash, Dr.Kezia.J.M, Dr.V.VijayaKumar, "Morphological Multiscale Stationary Wavelet Transform based Texture Segmentation", International Journal Image, Graphics and Signal Processing, Vol. 6, No. 8, July 2014.

[16] M.Joseph Prakash, Saka.Kezia, Dr.V.VijayaKumar, "Innovative Pattern Based Morphological Method for Texture Segmentation-IEEE Xplore, ICCCNT, Chennai, June 4-6, 2013, pp.11-15, Print ISBN 978-1-4799-3925-1.

[17] Saka Kezia, Dr.I.Santi Prabha, Dr.V.VijayaKumar, "A New Texture Segmentation Approach for Medical Images", International Journal of Scientific & Engineering Research, Vol. 4, No. 1, pp.1-5, January 2013.

[18] SakaKezia, Dr.ISanti Prabha, Dr.V.VijayaKumar, "Innovative Segmentation Approach Based on LRTM", International Journal of Soft Computing and Engineering, Vol. 2, No. 5, pp. 229-233, November 2012.

[19] Saka Kezia, Dr.I.Santi Prabha, Dr.V.VijayaKumar, "A Color-Texture Based Segmentation Method to Extract Object from Background", International Journal Image, Graphics and Signal Processing, Vol. 5, No. 3, pp.19-25, March 2013.

[19] Saka Kezia, Dr.V.VijayaKumar, Dr.I.Santi Prabha, "Auto Detection of Tubercle Bacilli Based on Wavelets", International Journal on Graphics Vision and Image Processing, Vol. 11, No. 3, pp.980-986, June 2011.

[20]G.Venkata RamiReddy, Saka Kezia, Dr.V.VijayaKumar, " Texture Synthesis Based on Image Resolution Enhancement using Wavelet Transforms", International Journal of Computer Science and Information Security, Vol. 10, No. 4, pp.60-64, April 2012.

[21] M.Joseph Prakash, "An Innovative Multicloud Implimentation of Computing Clusters for Loosely Coupled MTC Applications", International Journal of Technology and Engineering Science, Vol.1, No. 8, pp: 1283-1290, Nov. 2013.

[22] M.Joseph Prakash, "Fuzzy Random Impulse Noise Removal From Color Image Sequences", International Journal of Technology and Engineering Science [IJTES], Volume 1, Issue 8, pp: 1273-1276, November 2013.

[23] M.Joseph Prakash, "A New Method of Automatic and Accurate Image Registration through Histogram Based Image Segmentation", International Journal of Advanced and Innovative Research, Vol.2, No.9, Sept. 2013, pp. 439-446.

[24] M.Joseph Prakash, "Wavelet approach for detecting clouds and their Shadows", International Journal of Latest Trends in Engineering and Technology, Vol. 3 Issue 1 September 2013, pp. 259-266.

Improving The Scalability And Efficiency Of K-Medoids By Map Reduce

Mr D Lakshmi Srinivasulu, Mr A Vishnuvardhan Reddy, Dr V S Giridhar Akula

Abstract— **Day to day the size of data increased enormously. Big Data concerns large-volume, complex, growing data sets with multiple, autonomous sources. With the fast development of networking, data storage, and the data collection capacity. Big Data is now rapidly expanding in all science and engineering domains, including physical, biological and bio-medical sciences. Mining knowledge from the large amount of data is a challengeable task. Map Reduce is a programming model and an associated implementation for processing and generating large data sets. Map reduce is one of the technique to achieve parallelism.** *map* **function that processes a key/value pair to generate a set of intermediate key/value pairs, and a** *reduce* **function that merges all intermediate values associated with the same intermediate key . Programs written in this functional style are automatically parallelized and executed on a large cluster of commodity machines. The run-time system takes care of the details of partitioning the input data, scheduling the program's execution across a set of machines, handling machine failures, and managing the required inter-machine communication. This allows programmers without any experience with parallel and distributed systems to easily utilize the resources of a large distributed system. In the perspective of clustering, grouping of similar of objects from big data is a challengeable task .In order to deal with the problem; many researchers try to design different parallel clustering algorithms. In this paper, we propose a parallel K-Medoids clustering algorithm to improve scalability without noise and efficiency based on Map Reduce.**

Index Terms— **Clustering: K-Medoids, Hadoop (HDFS),Map reduce**

I. INTRODUCTION

From day to day data size has been increased enormously in various formats from various sensor devices which are connected to different applications. The existing algorithms don't have the capability to analyze the large amount of data with different formats. The challenges include in 1.Hardware configuration 2.algorithm design. To face these challenge

Hardware configuration,storing the data in Hadoop Distributed File System(HDFS).

HDFS is a file system designed for storing very large files with streaming data access patterns, running on cluster of commodity hardware[1].The size of large file may be hundreds of mega bytes,giga bytes or tera bytes. The total data is distributed in more number of nodes. Hence instead of

Mr D Lakshmi Srinivasulu, Assistant Professor in CSE Dept,G.Pulla Reddy Engineering College(Autonomous) Kurnool,AP
Mr A Vishnuvardhan Reddy, Assistant Professor in CSE Dept,G.Pulla Reddy Engineering College(Autonomous) Kurnool,AP
Dr V S Giridhar Akula, Professor and Principal in Methodist College of Engineering & Technoloy,Hyderabad,Telangana

single system, more number of systems are used to store huge amount of data.

We can face the challenge "algorithm design" by parallel processing.Effecient parallel algorithms and implementation techniques are the key to meet the scalability and performance.Upto now so many parallel clustering algorithms [2,3,4].All these algorithms having the following drawbacks)They assume all objects can reside in main memory at the same time their parallel systems have provided restricted programming models and used the restrictions to parallelize the computation automatically. Both are prohibitive for very large data sets. So there is a need to develop parallel clustering algorithms. Hadoop MapReduce is a software framework for easily writing applications which process vast amounts of data (multi-terabyte data-sets) in-parallel on large clusters (thousands of nodes) of commodty hardware in a reliable, fault-tolerant manner.

The MapReduce framework operates exclusively on <key, value> pairs, that is, the framework views the input to the job as a set of <key, value> pairs and produces a set of <key, value> pairs as the output of the job, conceivably of different types.The key and value classes have to be serializable by the framework and hence need to implement the Writable interface. Additionally, the key classes have to implement the writablecomparable interface to facilitate sorting by the framework.

Input and Output types of a MapReduce job:
(input) <k1, v1> -> **map** -> <k2, v2> -> **combine** -> <k2, v2> -> **reduce** -> <k3, v3> (output).

Map Reduce is a framework for processing parallelizable problems across huge datasets using a large number of computers (nodes), collectively referred to as a cluster (if all nodes are on the same local network and use similar hardware) or a grid (if the nodes are shared across geographically and administratively distributed systems, and use more heterogenous hardware). Computational processing can occur on data stored either in a filesystem (unstructured) or in a database (structured). MapReduce can take advantage of locality of data, processing it on or near the storage assets in order to reduce the distance over which it must be transmitted.

"Map" step: The master node takes the input, divides it into smaller sub-problems, and distributes them to worker nodes. A worker node may do this again in turn, leading to a multi-level tree structure. The worker node processes the smaller problem, and passes the answer back to its master node.

"Reduce" step: The master node then collects the answers to all the sub-problems and combines them in some way to form

the output – the answer to the problem it was originally trying to solve.

In this paper, we adapt *K-MEDOIDS* algorithm [5] in MapReduce framework is implemented by Hadoop to make the clustering method applicable to large scale data. By applying proper <key, value> pairs, the proposed algorithm can be parallel executed effectively. We conduct comprehensive experiments to evaluate the proposed algorithm. The results demonstrate that our algorithm can effectively deal with large scale datasets.

The rest of the paper is organized as follows. In Section 2, we present our parallel *K-Medoid* algorithm based on MapReduce framework. Section 3 shows experimental results and evaluates our parallel algorithm with respect to speedup, and sizeup. Finally,we offer our conclusions in Section 4.

II. PARALLEL K-MEDOID ALGORITHM BASED ON MAPREDUCE:

In this section we propose parallel K-MEDOIDS clustering algorithm based on MapReduce.Initially we give brief overview of K-Medoids ,later we explain the how mapreduce will be integrated with the basic K-Medoids.

2.1 K-Medoids Algorithm:
K-Medoids is a representative of object-based technique. It is a partitioning based on medoid or central objects. The K-Medoids method is more robust than k-means in the presence of noise and outliers because a medoid is less influenced by outliers or other extreme values than mean.
The K-Medoids algorithm is as follows:
Algorithm:K-Medoid algorithm for partitioning based on central object.
Input: K: number of clusters, D:a data set containing n objects.
Output set of k clusters.
Method:
1.arbitarly choose k objects in D as the initial representative objects
2.repeat
  {
    Assign each remaining object to the   cluster with the nearest representative object.
Randomly seslect a non representative object ,O_{random} ;
Compute total cost,S,of swapping representative objet,O_j with O_{random}
If S<0 then swap O_j with O_{random} to form the new set of k representative objects;
3.Until no change;

 k-medoid is not sensitive to noisy data and outliers, but it has high computation cost.If the data size becomes too large, the computation cost increases extremely. So to overcome this problem implementing the K-Medoids by map reduce technique.

2.2 Parallel K-Medoids based on Map Reduce:
As the analysis above-Medoids algorithm can be implemented by applying the technique MapReduce.The map function performs the procedure of assigning each sample to the closest medoid while the reduce function performs the procedure of updating the new centers.The cost of network

communication will be reduces by using a combiner function by partial combination of the intermediate values with the same key within the same map task.
Map-function : The input dataset is stored on HDFS[5] as a sequence file of <key, value> pairs, each of which represents a record in the dataset. The key is the offset in bytes of this record to the start point of the data file, and the value is a string of the content of this record. The dataset is split and globally broadcast to all mappers. Consequently, the distance computations are parallel executed. For each map task, Parallel K Medoids construct a global variant medoids which is an array containing the information about medoids of the clusters. Given the information, a mapper can compute the closest medoid for each sample. The intermediate values are then composed of two parts: the index of the closest center point and the sample information. The map function is shown in Algorithm 1.

Algorithm 1. map (*key*, *value*)
Input: Sample Values
Output: <*key*', *value*'> pair, where the *key*' is the index of the closest center point and *value*' is a string comprise of sample information
1. Construct the sample *instance* from *value*;
2. *minDis = Double.MAX VALUE*;
3. *index = -1*;
4. For i=0 to *centers*.length do
dis= ComputeDist(instance, data[i]);
If *dis < minDis {*
minDis = dis;
index = i;
}
5. End For
6. Take *index* as *key*';
7. Construct *value*' as a string comprise of the values of different dimensions;
8. output < *key, value*> pair;
9. End
 Step 2 and Step 3 initialize the auxiliary variable *minDis* and *index* ; Step 4 computes the closest center point from the sample, Step 8 outputs the intermediate results.

Combine-function. After each map task, we apply a combiner to combine the intermediate results of the same map task. Here there is no communication cost because intermediate results are stored in local disk of the host. In the combine function, we partially sum the values of the points assigned to the same cluster. In order to calculate the median value of the objects for each cluster, we should record the number of samples in the same cluster in the same map task. The pseudo code for combine function is shown in Algorithm 2.
Algorithm 2. combine (*key*, C)
Input:Subset of original data,Array C stores the samples assigned to the same cluster.
Output:Partial Clusters
1.repeat
2.{
3.Assign each remaining object to the cluster with the nearest representative object.
4.Randomly seslect a non representative
  object ,O_{random} ;

5.Compute total cost,S,of swapping
representative objet,O_j with O_{random}

6.If S<0 then swap O_j with O_{random} to form
the new set of k representative objects;

7.number++

7.}Until no change;

Reduce-function.

The input of the reduce function is the data obtained from the combine function of each host. In reduce function, we can sum all the samples and compute the total number of samples assigned to the same cluster. Therefore, we can get the new medians which are used for next iteration. The reduce function is shown in Algorithm3.

Algorithm 3. reduce (*key*, C)

Input: *key* is the index of the cluster, *V* is the list of the partial sums from different host

Output: < *key , value*> pair, where the *key'* is the index of the cluster, *value'* is a string representing the new center

1. Initialize one array record the sum of value of each dimensions of the samples contained in the same cluster, e.g. the samples in the list C;

2. Initialize a counter *NUM* as 0 to record the sum of sample number in the same cluster;

3. while(C.hasNext())*{*

Construct the sample *instance* from C.next();

NUM += number;

4. *}*

5. Divide the entries of the array by *NUM* to get the new median;

6. Take *key* as *key'*;

7. Construct *value'* as a string comprise of the *center*'s coordinates;

8. output < *key, value*> pair;

9. End

III. EXPERIMENTAL RESULTS

In this section results has been shown of our proposed algorithm in the sense of size(X axis) and speed (Y-axis).The data size increases from node1 to node4. Our proposed algorithm performance better than existing algorithm. The difference is shown as follows.
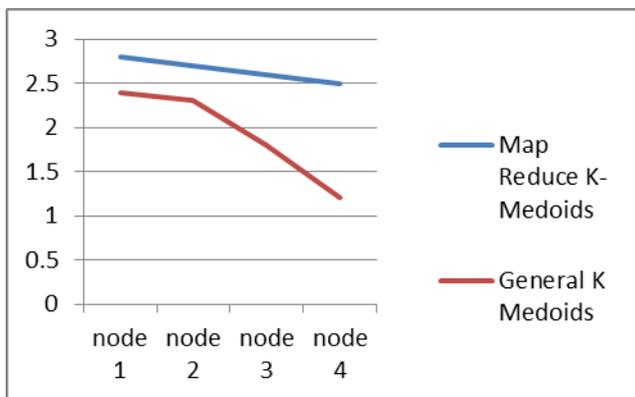
IV. CONCLUSION

Many clustering algorithms have been proposed in the last past decades. These algorithms are having maximum time complexity once the data size has been increased and also there is a problem to store big amount of data. To solve these kind of problems, we propose HDFS technique to store large amount of data and fast parallel k-medoids clustering algorithm for speed up the process on the big data.

REFERENCES:

[1] The Hadoop Distributed File System by Konstantin Shvachko ,Hairong Kuang,sanjay Radia and Robert Chansler.

[2] Ramissen,E.M.,Willet,P:Efficiency of Hierarchial Agglomarative clustering using the ICL Distributed Array Processor.Journal of Documentation 45(1),1-24(1989)

[3] Li, X., Fang, Z.: Parallel Clustering Algorithms. Parallel Computing 11, 275–290(1989)

[4] Olson, C.F.: Parallel Algorithms for Hierarchical Clustering. Parallel Computing21(8), 1313–1325 (1995)

[5] Borthakur, D.: The Hadoop Distributed File System: Architecture and Design(2007)

[6] Lammel, R.: Google's MapReduce Programming Model - Revisited. Science of Computer Programming 70, 1–30 (2008)

[7] Borthakur, D.: The Hadoop Distributed File System: Architecture and Design (2007)

[8] J. Cohen, B. Dolan, M. Dunlap, J. Hellerstein, and C. Welton. MAD skills: New analysis practices for big data. In VLDB, 2009.

[9] R. Vernica, M. J. Carey, and C. Li. Efficient parallel set-similarity joins using mapreduce. SIGMOD, 2010

[10] Remzi H. Arpaci-Dusseau, Eric Anderson, Noah Treuhaft, David E. Culler, Joseph M. Hellerstein, David Patterson, and Kathy Yelick. Cluster I/O with River: Making the fast case common. In *Proceedings of the Sixth Workshop on Input/Output in Parallel and Distributed Systems (IOPADS '99)*, pages 10–22, Atlanta, Georgia, May 1999

Author's Profile

D.Lakshmi Srinivasulu is working as an Assistant Professor in Department of Computer Science and Engineering of G. Pulla Reddy Engineering College (Autonomous), Kurnool, AP,India.. He received B.Tech degree in CSIT from JNTUH and M.Tech degrees in CSE from JNTUA. His areas of interest include . Big Data, Data mining . He attended 2national conferences ,2 international conference and published 4 international journals.

A Vishnuvardhan Reddy, is working as an Assistant Professor in Department of Computer Science and Engineering of G. Pulla Reddy Engineering College (Autonomous), Kurnool, India. He received his M.E degree in Software Engineering from Jadavpur University, Kolkata, India. He received his B.Tech degree in CSE from SVU, tirupati, India. His area of research is in the design and implementation of transport layer protocol for vehicular ad-hoc networks

Dr V S Giridhar Akula has obtained PhD in Computer Science and Engineering from JNTU, Anantapur.He obtained BE and M Tech degrees in CSE. He is put up with 22 years of teaching and 2 years industry experience. Presently working as Professor and Principal at Methodist College of Engineering and Technology, Abids,Hyderabad, India. He is a life member of ISTE, IEEE,IAE,ICES,AIRCC, Member of Computer Science Teacher's Association, USA,Member of IAE. He has authored 8 text books and editorial board member for 8 national and 12 International Journals.

A Novel Approach to Encrypt and Decrypt Color Images

V. S. Giridhar Akula

Professor and Principal
Methodist College of Engineering and Technology, Hyderabad, India
E-mail: akulagiri2002@yahoo.com

Abstract - **The proposed cryptosystem avoids all the crypto graphical weaknesses of earlier chaos-based encryption systems. Number of security analysis were carried out on the new algorithm and simulation results show that encryption and decryption are good and the proposed chaotic algorithm is proven to be the good procedure in terms of robustness.**
Keywords: **Image Encryption, Data Hiding, Chaotic Maps, Secret Image Holder, Pixel, Visual Cryptography, diffusion function.**

I.INTRODUCTION

Image encryption can be accomplished by scrambling image pixel positions using different techniques in the spatial domain .One example is the recursive sequence based image scrambling approach. It scrambles images using different recursive sequences such as the Fibonacci sequence, Cellular automata and chaotic maps .Image encryption can also be accomplished by scrambling coefficient matrices/blocks in the transform domain. Nevertheless, these approaches have extremely low security levels due to the lack of security keys or the small key space. Furthermore, the permutation-only based encryption schemes are known to be vulnerable for plaintext attacks. Another approach for image encryption is to change image pixel values based on the combination of image bit plane decomposition and logic operations. The security level of this method is much lower because the results of its decomposition process and logic operations are predictable. It is not immune to plaintext attacks.

To achieve higher levels of security, one solution is to change image pixel values while scrambling the positions of image pixels or blocks using different techniques. In this paper, we introduce two new lossless image encryption algorithms using a new concept "key-image" which is a binary image with the same size as the original image to be encrypted. One algorithm, called the Bitplane Crypt, generates the key-image by extracting a binary bit plane from another new or existing image. The key image of the other algorithm, called Edge map Crypt, is an edge map obtained from a new or existing image using a specific edge detector with a specified threshold. The algorithms decompose the original image into its binary bit planes. The bit planes are encrypted by performing an XOR operation with the key-image one by one. And then the order of all the bit planes is inverted. The resulting encrypted image can be obtained by applying a scrambling algorithm to the image from a combination of all bit planes.

Steganography is one of the data hiding technique in which Secret communications take place that conceal the very existence of the message. Cryptography in another type of data hiding technique in which message to be hidden is encoded using encryption or coding techniques. Here we know that a message is there but cannot understand it. Watermarking is another technique in which information that is hided is directly related to the item in which it is embedded.

On the other hand, in visual cryptography or visual secret sharing (vss), the original input image is shared between a set of participants P by a dealer (secret image holder). Based on the sharing policy, only qualified subsets of participants can recover the original input image.

Two important factor s that used to determine the efficiency of any visual cryptography scheme, namely:

1. The quality of the reconstructed image and
2. The pixel expansion (m).

Any loss of information during the reconstruction phase leads to reduction in the quality of the recovered image. On the other hand pixel expansion refers to the number of sub pixels in the generated shares that represents a pixel of the original input image. For bandwidth constrained communication channels it is desirable to keep m as small as possible. For color images, reducing pixel expansion is of paramount importance since they occupy more space and consume more bandwidth compared to grayscale and binary images. Most of the previous works in this area try to optimize pixel expansion or obtain perfect reconstruction.

II.METHODS AND MATERIALS

Cryptography is, the study of means of converting information from its normal, comprehensible form into an incomprehensible format, rendering it unreadable without secret knowledge the art of encryption. In the past, cryptography helped ensure secrecy in important communications, such as those of spies, military leaders, and diplomats. In recent decades, the field of cryptography has expanded its remit in two ways. Firstly, it provides mechanisms for more than just keeping secrets: schemes like digital signatures and digital cash, for example. Secondly, cryptography has come to be in widespread use by many civilians who do not have

extraordinary needs for secrecy, although typically it is transparently built into the infrastructure for computing and telecommunications, and users are not aware of it.

Cryptography has had a long and colorful history. Generally speaking the earliest forms of secret writing required only pen and paper, and are now collectively termed classical cryptography. The two main categories are transposition ciphers, which rearrange the order of letters in a message, and substitution ciphers, which systematically replace groups of letters with others. Classical ciphers tend to leak varying amounts of information about the statistics of the plaintext, and because of this they are easily broken, for example by frequency analysis. Classical ciphers still enjoy popularity today, though mostly as puzzles .

Various devices and aids have been used for encryption. Early in the 20th century, several mechanical devices were invented for performing encryption, including rotor machines - most famously the Enigma cipher used in World War II. The ciphers implemented by these machines brought about a significant increase in the complexity of cryptanalysis. The various attacks on Enigma, for example, succeeded only after considerable effort. Occasionally, these devices have featured in films, such as in the James Bond adventure From Russia with Love.

With the advent of digital computers and electronics, very complex ciphers could be implemented. A characteristic of computer ciphers is that they operate on binary strings unlike classical and mechanical schemes, which use an alphabet of around 26 letters, depending on the language. Computer ciphers are also much more resistant to cryptanalysis; few are susceptible to a cipher text-only attack.

Visual cryptography is a cryptographic technique which allows visual information (pictures, text, etc.) to be encrypted in such a way that the decryption can be performed by humans (without computers).

The first visual cryptographic technique was pioneered by Moni Naor and Ad Shamir in1994. It involved breaking up the image into n shares so that only someone with all n shares could decrypt the image by overlaying each of the shares over each other. Practically this can be done by printing each share on a separate transparency and then placing all of the transparencies on top of each other. In their technique n-1 shares revealed no information about the original image.

Visual Cryptography is a graphical form of information concealing. It can be seen as a cryptographic primitive, since it offers methods and technologies for building more complex information security systems.

The techniques of visual cryptography are inspired from the general secret sharing schemes as presented by Adi Shamir and G.R. Blakley. The main difference between the visual and the general secret sharing schemes is that for the first ones the secret will be visually reconstructed in the decryption phase.

Novelty contributions are provided in implementing general k–out–of–n visual cryptography schemes. In such schemes the secret information can be reconstructed if and only if a minimum of k participants in a set of n participants will superimpose the shares they own. An adversary analyzing less then k shares can obtain no information (from the theory of information point of view) considering the secret message, no matter her computing power and analysis method used.

On special interest are the extended visual cryptography schemes for "natural images" – continuous tone gay images. In a two–out–of–two extended visual cryptography scheme, the two shares the secret image is split into are "innocent" images hiding the very intention of sending a secret message.

Further contributions are made considering the applications of visual cryptography in e-commerce, especially for scenarios that involve the presence of a corrupt Post of Sale (POS)[7].

Steganography is the art and science of hiding the fact that communication is taking place. Using steganography, you can embed a secret message inside a piece of unsuspicious information and send it without anyone knowing of the existence of the secret message. Steganography and cryptography are closely related. Cryptography scrambles messages so they cannot be understood. Steganography on the other hand, will hide the message so there is no knowledge of the existence of the message in the first place. In some situations, sending an encrypted message will arouse suspicion while an "invisible" message will not do so. Both sciences can be combined to produce better protection of the message. In this case, when the steganography fails and the message can be detected, it is still of no use as it is encrypted using cryptography techniques.

The chaos-based image cryptosystem[3] mainly consists of two stages [2]. The plain image is given at its input. There are two stages in the chaos- based image cryptosystem. The confusion stage is the pixel permutation where the position of the pixels is scrambled over the entire image without disturbing the value of the pixels and the image becomes unrecognizable. The pixel permutation is carried out by a chaotic system [1,2]. The chaotic behavior is controlled by the initial conditions and control parameters which are derived from the 16-character key. To improve the security, the second stage of the encryption process aims at changing the value of each pixel in the whole image an important tool to protect image from attackers. The basic idea of encryption[5,6] is to modify the message in the diffusion stage, the pixel values are modified sequentially

by the sequence generated from one of the three chaotic systems selected by external key. The whole confusion-diffusion round repeats for a number of times to achieve a satisfactory level of security. The randomness property inherent in chaotic maps makes it more suitable for image encryption.

III.PROPOSED METHOD

1. First input original image s taken and then to get the cipher image we used chaotic algorithm in which should pixels positions are change for high security
2. In the decryption we use reverse process of the encryption means input is cipher image and result image is plain image

A.The Edge Map Crypt Algorithm

The edge map is frequently used in image enhancement, compression, segmentation and recognition. The application of edge maps can also be extended to image encryption. In this section, we introduce a new image encryption algorithm using an edge map which is called the Edge map Crypt algorithm. An edge map is considered as the key-image in this algorithm. Such edge map is generated from another different image with the same size as the original image using a specific edge detector with a selected threshold value.

The Edge map Crypt algorithm first decomposes the original image into its binary bit planes. Each of them is encrypted by performing an XOR operation with the key-image, which is an edge map created from another image. Next, the algorithm inverts the order of all XORed bit

planes and combines them together. The resulting image is scrambled by using a selected scrambling algorithm to generate the final resulting encrypted image. The Edge map [4] Crypt algorithm is illustrated in Fig. 1. Similar to the Bitplane Crypt algorithm, a 3D image can be encrypted by applying the Edge map Crypt algorithm to all its 2D components individually. Any new or existing image with the same size of the original image can be used to generate the edge map, the key image.

It could be an image in the public online database or a new image generate by the users. The edge map can be obtained by using any existing edge detector such as Canny, Sobel, Prewitt, or any other edge detector. The users have flexibility to choose any existing image or any existing edge detector or any threshold value to generate the edge map used as a key-image. They also have flexibility to use any existing image scrambling method for the Edge map Crypt algorithm. Therefore, the security keys for this algorithm consist of the image or its location which is used to generate the edge map, the type of the edge detector, the edge detector's threshold, and the security keys of the scrambling algorithm. To reconstruct the original image, the users should be provided the security keys which help them to obtain the correct edge map. The decryption process first generates the edge map from the selected image using the security keys. It then unscrambles the encrypted image using the selected scrambling algorithm. Next, it decomposes the unscrambled image into its binary bit planes and performs XOR operation between the edge map and each bit plane. The order of all bit planes is restored to the original order. The reconstructed 2D image/component can be obtained by combining all bit planes.
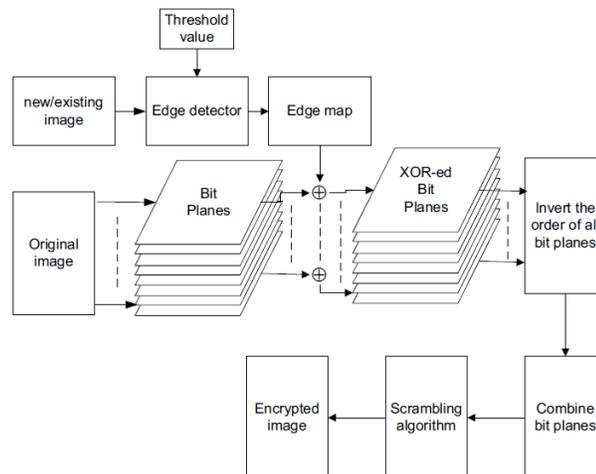
Fig.1 The Edge map Crypt algorithm

IV. RESULTS AND DISCUSSION

The proposed image encryption system uses any one of the chaotic system for pixel position permutation and one of the same chaotic system for pixel value modification.

Several simulation results are provided to show the performance of the algorithms for 2D and 3D image encryption. In all experimental results of this paper, both algorithms utilize the image scrambling algorithm based on

the Generalized P-Gray Code in with the security keys: $n=2=2$, $p=0$.

Fig. 2 shows several 2D images to be used as test images or images to generate the key-image.
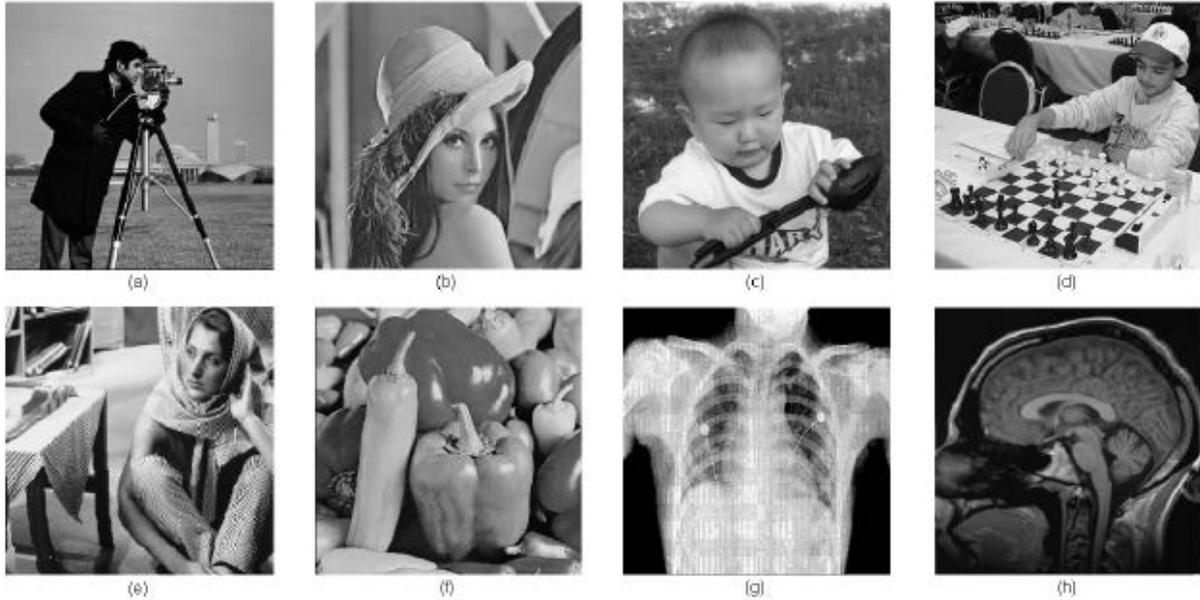
Fig. 2 Test images. (a) 256×256 Cameraman; (b) 256×256 Lena; (c) 256×256 Baby; (d) 256×256 Chessplayer; (e) 512×512 Barbara; (f) 512×512 Peppers; (g) 512×512 CT ribs image; (h) 512×512 MRI brain image

A. 2D IMAGE ENCRYPTION

There are several types of 2D images such as grayscale images, medical images and biometrics. The 2D image can be decomposed into several binary bit planes and encrypted one by one. Figure 3 shows the Grayscale image encryption using the Edge map Crypt algorithm, Color image encryption using the Edge map Crypt algorithm.
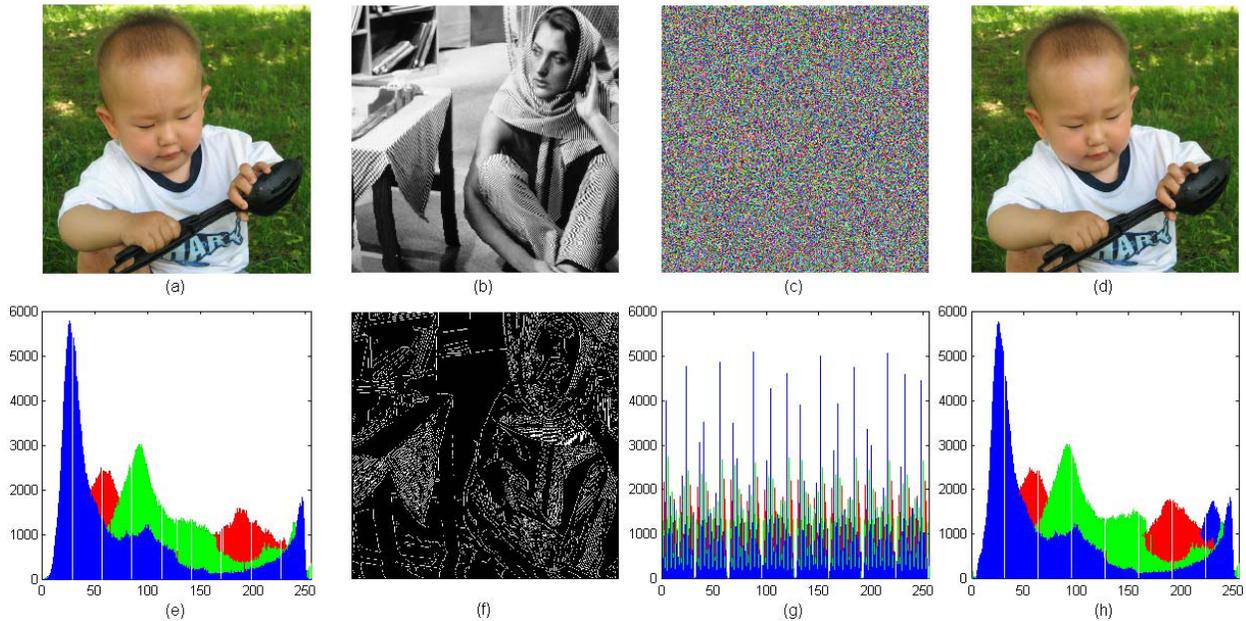
Fig.3 Color image encryption using the EdgemapCrypt algorithm.
(a) The original 512×512 color image; (b) A 512×512 grayscale Barbara image; (c) The encrypted color image; (d) The reconstructed color image;(e) Histogram of the original image in (a); (f) The edge map of the Barbara image in (b), Canny, 0.1; (g) Histogram of the encrypted image in (c); (h) Histogram of the recontructed image in (d).

V. CONCLUSION

Based on the design rules discussed earlier, the new image encryption scheme was designed. A suitable chaotic map preserving the properties of chaos after discretization was chosen. By choosing a high dimensional chaotic system, the key space is increased. Complex non-linearity was preserved by choosing suitable chaotic maps. Repeated permutations are avoided but pixel values are changed by the diffusion function. By incorporating all these features, the proposed cryptosystem avoids all the crypto graphical weaknesses of earlier chaos-based encryption systems. Number of security analysis were carried out on the new algorithm and simulation results show that encryption and decryption are good and the algorithm has good security and robustness.

REFERENCES

[1] Xiping He Qionghua Zhang , "Image Encryption Based on Chaotic Modulation of Wavelet Coefficients", Congress on IEEE Image and Signal Processing (CISP'08), Sanya, Hainan, Vol.1, pp.622-626, 27- 30 May 2008.

[2] Xin Zhang, Weibin Chen, "A New Chaotic Algorithm For Image Encryption", pp 889-892 IEEE ICALIP2008

[3] Dong enxeng, Chen Zengqiang, Yuan zhuzhi, Chen zaiping, "A Chaotic Images Encryption Algorithm with The Key Mixing Proportion Factor",pp 169-174 Computer Society IEEE 2008.

[4] Chong Fu, Zhen-chuan Zhang, Ying-yu Cao, "An Improved Image Encryption Algorithm Based on Chaotic Maps", Computer Society, IEEE 2007

[5] Huang Yuanshi, Xu Rongcong, Lin Weiqiang, "An Algorithm for JPEG Compressing with Chaotic Encrypting", Proceedings of the International Conference on Computer Graphics, Imaging and Visualisation (CGIV'06), 2006

[6] Peng Fei, Shui-Sheng Qui, Long Min, "An Image Encryption Algorithm based on Mixed Chaotic Dynamic Systems and External Keys", Proceedings of 2005 International Conference on Communications, Circuits and Systems,,Vol. 2, pp.1139, 27-30 May 2005.

[7] Guang ZH, Huang FJ, Guan WJ, "Chaos-based Image Encryption Algorithm", Physics Letters A, Vol.346, pp.153 – 157, 2005.

Biotechnological Production of Polyhydroxyalkonates by Various Isolates: A Review

[1,]Chaitanya.K , [2,]Mahmood.S.K , [3,]Rana Kausar , [4,]Sunilkumar.N

[1.] *Research scholar, University College of Science, India.*
[2.] *Head, Dept of botany, Nizam College, India*
[3.] *Head, Board of studies, Dept of Botany, Osmania University, India.*
[4.] *Head, Dept of Biotechnology, GRIET, India.*

ABSTRACT : *Plastics have been the integral part of our life. However, disposal of these non biodegradable (petrochemical derived) plastics poses threat to environment. Since global petroleum reserves are finite, there is a need for the additional new sources of durable materials. Renewable materials from microorganisms can provide the source of sustainable alternative to petroleum derived chemicals including polymers.. Biodegradable polymers release carbon dioxide and water vapour in the air while undergoing biological decomposition and growing biomass during photosynthesis, subsequently absorb the released carbon dioxide. Hence, the problems associated with conventional petroleum-based plastics have brought biodegradable polymers to forefront. PHA (polyhydroxy alkonates) having properties similar to isotactic polypropylene gained importance. But, their wide spread use has been impeded to high production costs. With the isolation of the genes responsible for PHA biosynthesis and in vivo / in vitro metabolic engineering of microorganisms, an enhanced and cost effective production of PHA should be possible is not so a distant future.*

KEYWORDS: *Biodegradablepolymers, Polyhydroxy alkonates, PHA.*

I. INTRODUCTION

Ecological niches are positions designated to microbes where they perform individual role and interact all together to constitute ecosystem. Ecosystem is influenced by biotic and abiotic altercation as result of natural and anthropogenic activities. Microorganisms derive their food via diverse behavioural adaptation in environment to put together thriving existence. PHA accumulation is among such responses towards stress experienced by microorganisms residing at different ecological niches. Ecological niches like estuarine sediments, marine microbial mats, rhizosphere, groundwater sediments, and engineered ecosystems with fluctuating nutrient contents support the population actively involved in PHA accumulation to meet the metabolic energy requirements during starvation period and this concept can be implemented industrially to reduce the cost of biopolymers commercially with sustainable production processes [1]. Synthesis of PHA occurs in a wide variety of organisms, like prokaryotes, eukaryotes, plant and animal tissue [2] [3]. Among prokaryotes, PHA biosynthesis is known to occur in Gram positive and Gram negative bacteria[4] [5], aerobic and anaerobic[6] [7] heterotrophic and also in cyanobacteria [8] [9], archaebacteria [10] [11] [12], marine bacteria [13] [14], bacteroids [15] [16], Azotobacter spp [17] [18], Methylotrophs[19][20] and floc formers like Zoogloea ramigera [21] [22]. More than 80 different forms of PHA have been detected in bacteria [23]. Only two forms of PHA, i.e., PHB homopolymer and 3HB-3HV copolymer are commercially produced by Zeneca. Nature has evolved several different pathways for PHA formation, each optimized for the ecological niche of the PHA producing microorganisms. These include, PHA biosynthesis represented by Ralstonia eutropha, PHA synthesis with an enoyl-CoA hydratase, Methyl malonyl-CoA pathway for P (3HB-3HV) synthesis from sugars, PHA biosynthesis from fatty acids represented by the Pseudomonads and also PHA biosynthesis from carbohydrates represented by the Pseudomonads.

Polyhydroxyalkanoates (PHA) : Polyhydroxyalkanoic acids (PHA) are polyesters synthesized from optically active thiol esters that accumulate as granular inclusions in the cytoplasm of various bacteria [24] [25]. The 3-hydroxyalkanoic acids are all in R- configuration due to the stereo specificity of the polymerizing enzyme PHA synthase. Only in the case of Rhodococcus spp. S-monomers were detected [26].

Physiological role of PHA : PHA are synthesized and accumulated by the cells as a carbon reserve in the presence of excess carbon, but otherwise in growth limiting nutrient environments. Waste disposal creates toxic, growth inhibiting, and unfamiliar environmental conditions [27]. Even though, at such state of physiological stress, PHA producers have been reported to be residing with properties like degrading dyes,

aromatic compounds, and left over organic matter discharge from industries [28] [29] [30] [31]. During starvation, PHA serves as a carbon and energy source and is rapidly oxidized as demonstrated in Staphylococci [32]. Due to its preferable catabolic role as a carbon reserve under stress, PHA retard the degradation of cellular components [33] and thus offer an advantage to the accumulator organism in a mixed flora to survive under adverse condition[34]. PHA plays a significant role in the survival of the microorganism, under conditions of environmental stress, such as, when subjected to osmotic pressure, dessication or UV irradiation[35].In cyanobacteria, glycogen, which is a common storage material, undergoes fermentation in the dark period forming PHA, which is assimilated in the next light period [36]. The advantage of the PHA formation over the other fermentation products is that the stored carbon remains inside the cell. As a carbon and energy reserve, PHA also assist in the sporulation process in Bacillus sp. [37] [38] though the accumulation of PHA is not a prerequisite for the sporulation process.

Growth conditions for accumulation of PHA : PHB has some properties, including tensile strength and flexibility, similar to polyethylene and polystyrene[39]. PHA is mainly composed of poly-β -hydroxybutyric acid (PHB) and poly-β- hydroxyvaleric acid (PHV), although other forms are possible. When nutrients such as, nitrogen, phosphorus or sulfate become limiting, when oxygen concentration is low or when the C: N ratio of the feed substrate is high. The nutrient limiting conditions led to PHA accumulation in different microorganisms [40]. Carbon/nitrogen (C/N) ratio is a very important variable to consider during PHA production supported by the fact that optimum C/N ratio of 25 showed maximum PHA productions [41]. In addition to nitrogen, phosphorus, oxygen, and sulfate limitations, limitations of iron, magnesium, manganese, potassium, sodium and also Oleic acid (with C/N ratio of 20) enhanced PHA production in Cupriavidus sp. USMAA2-4 [42].

Apart from PHA, wide variety of organisms can accumulate glycogen and glycogen-like materials. According to the review [43] in addition to nitrogen limiting conditions, glycogen can be accumulated under sulfur limiting or phosphorus limiting conditions or when pH for growth is unfavorable. pH is also a very important factor in relation to PHA productivity and its monomer composition. Study on effect of pH on acidogenic fermentation shows that initial alkaline pH of 9 can generate good amount of VFAs [44]. However, nitrogen limiting condition was reported to be the most stimulating condition for glycogen accumulation in many organisms. Low concentration of phosphorus and nitrogen is favourable to PHB accumulation rather than complete under provided conditions. PHA production under low nitrogen and phosphorus concentration was reported to be 45.1% and 54.2% of CDW, respectively. Optimizing the same cultural conditions enhanced copolymer P 3(HB-co-HV) content by 14%, constituting 88% of HB and 8% of HV [45].

Classification of Polyhydroxyalkanoates : Bacteria synthesize a wide range of PHA and approximately 150 different constituents of PHA have been identified [46]. PHA produced by bacteria consist of three main types : (i) polymers composed of short-chain- length (scl) monomers(ii) polymers composed of medium-chain-length (mcl) monomers and (iii) polymers composed of scl-mcl monomers. Scl-PHA consists of monomeric subunits 3 to 5 carbons in length, while mcl PHA consists of monomers 6 to14 carbons in length and scl-mcl PHA copolymer consists of monomeric subunits 4 to12 carbons in length[47]. Polyhydroxybutyrate (PHB) is the most common type of scl- PHA and this homopolymer of 3-hydroxybutyric acid has been studied most extensively. Copolymers of PHA can be formed containing 3-hydroxybutyrate (HB) 3- hydroxyvalerate (HV), or 4-hydroxybutyrate (4HB) monomers. Most of the microbes synthesize either scl-PHA containing primarily 3HB units or mcl- PHA containing 3- hydroxyhexanoate (HH) 3-hydro-xyoctanoate (HO) or 3-hydroxydecanoate (HD) as the major monomers [48] [49].

Properties of Polyhydroxyalkanoates : PHA extracted from bacterial cells has properties similar to conventional plastics, such as polypropylene [50]. PHA can be degraded at a high rate (3-9 months) by many microorganisms into carbon dioxide and water using their own secreted PHA depolymerises [51]. Most of the studies on physical and thermal properties of bacterial PHA have been carried out with PHB and PHV. Since the presence of functional groups, epoxy-, hydroxy-, aromatic- side chains, opens up a wide range of possibilities for further chemical modification of the polymer structure, their incorporation to polymers influences the physical [52] and material properties of PHA [53]. PHB has a melt temperature of 1750C and a glass transition temperature (Tg) of 40C [54]. PHB, a short chain length polymer, is optically pure i.e. it is 100% stereo specific with D (-) configuration and isotactic in nature. It is relatively stiff and highly crystalline with crystallanity ranging between 55 to 88% [55]. The co- polymer PHB-co-HV has much improved mechanical properties than the homo polymer P (3HB).

Biosynthesis of PHA : The PHA biosynthesis of bacteria can apparently be divided into two major types based on the biosynthesis of bacteria can be the monomer composition of PHA produced by various wild-type bacteria. R. eutropha represents one group while the Pseudomonads represent the other major type of PHA biosynthesis. The chemical diversity of PHA is large of which the most well-known and widely produced form is PHB [56]. The synthesis of PHB is considered the simplest biosynthetic pathway. The process involves three enzymes and their encoding genes [57] [58] [59]. PhaA gene encodes-ketothiolase, the first enzyme for the condensation of two acetyl-CoA molecules to form acetoacetyl-CoA .The next step is the reduction of acetoacetyl-CoA to (R)-3-hydroxybutyryl-CoA catalyzed by the acetoacetyl-CoA reductase [60]. The last reaction is the polymerization of (R)-3-hydroxybutyryl-CoA monomers catalyzed by PHA synthase, which is encoded by the phaC gene [61].

II.   BIOSYNTHESIS IN GRAM NEGATIVE (-VE) BACTERIA

a. Ralstonia eutropha (Cupriavidus necator) : The enzymes involved in this biosynthesis pathway have been extensively studied [62]. R. rubrum, which shows similar PHA biosynthesis pathway as R. eutropha, the reductase gives rise to (S)-isomer of 3-HB-CoA. This is converted to (R)-type by two enoyl-CoA hydratases [63]. The (R)-3HB-CoA is then converted to (R)-P (3HB) by PHA synthase. In R. eutropha accumulates copolymer of 3HB and 3HH when grown on between C 3 -5 substrates with odd number of carbon atoms [64].In C. necator, the PHA formed generally contains monomers having only 3-5 carbon atoms. This has led to the conclusion that in C. necator, the PHA synthase enzyme is only active towards scl-HA [65].

b. Pseudomonas : This pathway is exhibited in Pseudomonads (P. oleovorans) belonging to various alkanes, alkanols or rRNA homology group I. In this alkanoates PHA SCL -C are obtained from intermediates of group 3-hydroxyacyl CoA substrates of C 6-14 fatty acid -oxidation pathway [66]. P. aeruginosa, P. aureofaciens, P. citronellis, P. mendocina and P. putida are shown to possess this pathway. Even over expression of transacylating enzyme such as malonyl-CoA-ACP transacylase (FabD) also seems to generate monomers for PHA biosynthesis [67].

Pseudomonas putida KT2440 growing on nonionic acid under nitrogen limitation produced 27% mcl PHA at specific ratio of 0.48/h [68]. Palm oil utilization for the simultaneous production of polyhydroxyalkanoates and rhamnolipids by Pseudomonas aeruginosa IFO3924 was reported [69]. The bacterium P. guezennei produces a novel PHA mcl with elastomeric properties [70]. Adrian et al. (2010) reported as Jatropha curcas seed oil can be used as a substrate to produce the copolymer poly (3- hydroxybutyrate-co-3-hydroxyvalerate) [71]. P.putida, the site-specific mutagenesis for PHA synthase PhaC2Ps1317 from Pseudomonas stutzeri 1317. Recombinant R. eutropha PHB-4 containing phaC2PsQKST could be used as a strain for production of copolymers consisting of dominated HB and medium-chain-length 3-hydroxyalkanoates (HA) with better application properties [72].

PHA synthesis with an enoyl-CoA hydratase : In Rhodospirillum rubrum, Moskowitz and Merrick proposed a the pathway that included two hydratases, one specific for the R enantiomer and the other specific for the S enantiomer [73] . In Aeromonas caviae, the PHA biosynthetic pathway proceeds from enoyl-CoA derivatives of the fatty acid oxidation pathway . PhaJ converts crotonyl-CoA, pentenoyl-CoA and hexenoyl-CoA to PHA precursors, but it does not convert octenoyl-CoA [74][75]. Methylobacterium rhodesenium again uses two hydratases for PHB synthesis. Along with two hydratases, this bacterium has two constitutive acetoacetyl-CoA reductases, one NADH dependent and the other NADPH dependent [76]. These four enzymes work in combination to synthesize 3-hydroxybutyryl-CoA needed for PHB formation.

Methylmalonyl-CoA pathway for P (3HB-3HV) synthesis from sugars : In Rhodococcus ruber and Nocardia corallina, during P (3HB-3HV) synthesis monomers are derived from both the fatty acid degradation pathway and the traditional C.necator PHB biosynthetic pathway [77]. Recently, Aid used Cupriavidus necator as production strain, polymer content (77%, w/w) and polymer properties (Mw=665 kg/mol, PI=2.6) [78].

Biosynthesis of PHA in Gram Positive Bacteria : Among Gram-positive bacteria, Bacillus spp.[79][80][81], Clostridium spp [82], Corynebacterium spp.[83], Nocardia spp.[84], Rhodococcus spp. [85], Streptomyces spp. [86]and Staphylococcus spp. [87] accumulate PHA. Further, interestingly, the Gram-positive genera Corynebacterium, Nocardia and Rhodococcus are the only wild-type bacteria, which naturally synthesize the commercially important co-polymer P (3HB-co-3HV) from simple carbon sources such as glucose [88][89]. This could allow a considerable decrease in the production cost of the co-polymer. Demonstration of Bacillus sphaericus was done using statistical experimental design and RSM in submerged fermentation with jackfruit seed hydrolysate as the sole source of carbon [90].

a. Bacillus spp. : During the initial stages of PHA research, the polymer was particularly studied in the genus Bacillus. P (3HB), the best characterized PHA, was identified and isolated from a Bacillus sp [91]. P (3HB) was formed and degraded by Bacillus cereus and Bacillus megaterium in washed suspensions [92]. The production of PHV along with PHB from Bacillus megaterium NCIM 2475 and the results show that this was made up of PHB-co-PHV when grown in presence of sucrose [93]. Biodiversity of Bacillus spp. using phenotype microarray panels which allowed the testing of the effect of more than 90 different carbon, nitrogen, sulfur and phosphorus sources as well as pH on the growth characteristics of these strains[94]. Bacillus spp. MC1 from the gut of termites, was able to accumulate PHA utilizing different carbon sources like glucose, fructose, sodium acetate, sodium valerate and 1,4-butanediol. Gas chromatography analysis of the polymer has shown it to be basically composed of poly (3-hydroxybutyrate) [95].

b. Clostridium spp. : Clostridium botulinum accumulates P (3HB) as an energy source for sporulation [96]. Clostridium acetobutylicum ATCC824 has a thiolase homologous to b-ketothiolase from other PHA accumulating bacteria.

c. Corynebacterium spp. : Corynebacterium spp. accumulate PHA co-polymers containing 3HV monomer units from a range of unrelated carbon sources such as glucose (PHA content of 8% w/w dcw) and fructose (PHA content of 1% w/w dcw)[97].

d. Nocardia spp. : Accumulation of PHA co-polymers containing 3HV monomer units from a range of unrelated carbon sources such as acetate (PHA content of 20% w/w dcw) and fructose (PHA content of 0.3% w/w dcw) by Nocardia lucida NCIB10980 [98].

e. Rhodococcus spp. : Species of Rhodococcus have attracted great interest in recent years due to their unusual and diverse abilities to catalyze biotransformation and degradation of various hydrophobic substances such as hydrocarbons, chlorinated phenols, steroids, lignin, coal and crude oil [99]. This interesting finding led to further metabolic analysis which proposed that succinate may be a precursor of the 3HV monomer unit [100] [101].

f. Staphylococcus spp. : P (3HB) has been extracted from various species of Staphylococci such as Staphylococcus aureus, Staphylococcus xylosus, Staphylococcus simulans, Staphylococcu swarneri, Staphylococcus sepidermidis and Staphylococcus haemolyticus [102]. P (3HB) is present in cells in trace quantities (such as 0.15% w/w dcw for S.aureus grown in fructose) and most importantly it does not form granules as in other bacteria indicating possible existence as cPHB. However, the metabolic role of PHA in this genus is poorly understood [103].

PHA synthesis by other bacterial spp. :PHA productions from Azotobacter and Methylotrophs were also investigated earlier. However, PHA with low yield and molecular weight was produced from Methylotrophs. Renner studied the production of copolymer by 13 bacteria from the rRNA super family III [104]. Sinorhizobium fredii strain grown on glucose and sodium dodecanoate in a two stage fed batch fermentation produced poly (3-hydroxybutyrate-co-3hydroxyoctonoate) [105]. Comamonas acidovorans JCM10181 with additional copies of its PHA synthase gene and β-Ketothiolase gene produced poly (4- hydroxybutyrate) [106]. A Hydrogenophaga pseudoflava strain was able to synthesize P (3HB-co-4HB) having a high level of 4-hydroxybutyric acid monomer unit (4HB) from γ- butyrolactone during 3 to 4 days of incubation [107].

Azotobacter chroococcum H23 when grown in culture media amended with alpechin (waste water from olive oil mills) as the sole carbon source. A strain of Azotobacter chroococcum H23 (CECT 4435), Azotobacter vinelandii UWD, and Azotobacter vinelandii (ATCC 12837), members of the family Pseudomonadaceae, were used to evaluate their capacity to grow and accumulate polyhydroxyalkanoates (PHA) using two-phase olive mill wastewater diluted at different concentrations as the sole carbon source [108]. Fernanda analyzed the PHB production in Bradyrhizobium spp [109]. A strain of Serratia sp. showed intracellular electron-transparent inclusion bodies when incubated in the presence of citrate and glycerol 2-phosphate without nitrogen source following pre growth under carbon-limitation in continuous culture [110].

Twenty strains from the collection of the luminescent bacteria CCIBSO (WDCM839) of the Institute of Biophysics, Siberian Branch, Russian Academy of Sciences, assigned to different taxa (Photobacterium leiognathi, Ph. phosphoreum, Vibrio harveyi, and V. fischeri) were analyzed for polyhydroxyalkanoates production. The most productive strains were identified, and the conditions ensuring high polymer yields in batch culture (40–70% of the cell dry mass weight) were determined [111]. In different systems like,

cyanobacteria and actinomycetes PHB has been reported to be produced indigenously. This includes report about PHB in Spirulina sp [112].

PHA synthesis by recombinant bacteria : In recent years, a combination of genetic engineering and molecular microbiology techniques has been applied to enhance PHA production in microorganisms. Growth of the recombinant cells was impaired in many of these studies, especially in nutrient-rich medium [113]. Recombinant E.coli cultured under optimal conditions has been shown to accumulate PHB up to 85% of the cell dry weight. PHB formed in these E. coli, however, were of higher molecular weight than PHB produced by natural producers [114].

Even after extensive attempts at maximizing PHB production in non-PHB producing microorganisms, the PHB accumulation level was not as high as what could be obtained with the natural producers of the biopolymer. One of the major obstacles in producing PHB in recombinant organisms is associated with the instability of the introduced pha genes and loss of the plasmid due to metabolic load of ten limits high yields of the biopolymer [115]. PHA polymerase phaC1/C2 genes were successfully amplified from genomic DNA of three bacterial isolates showing 540 bp DNA fragment which confirmed the presence of phaC1/C2 gene presence [116].

Biosynthesis of PHA in eukaryotic cells : The production of bioplastics in bacteria is limited by its high cost compared to the costs associated with petroleum-derived plastics production. Studies of PHA formation in yeast and insect cells can provide valuable information about how these pathways can be incorporated into plants. Synthesis of PHB has been demonstrated in Saccharomyces cerevisiae by expressing the PHB synthase gene from R.eutropha [117]. Poirier introduced a modified phaC1 gene from P.aeruginosa into S.cerevisiae. [118]. The above PTS1-modified P.aeruginosa phaC1 gene into P.pastoris and achieved mcl-PHA synthesis in this yeast system with fattyacids in the growth medium [119].

III.   FACTORS AFFECTING PHA SYNTHESIS AND COMPOSITION

It is considered to be well known that copolymer composition, i.e., %PHB and %PHV is primarily influenced by the substrate used [120]. The author reported the concentration of a substrate supplied also affects the amount of polymer produced. When recombinant E.coli expressing PHA biosynthesis genes from Alcaligenes eutrophus was grown by adding 1 mM valine to 1% glucose medium, growth ceased and upto 2.5% of the incorporated monomers were HV; upto 4% were HV when 1 mM threonine was added as well. The novel growth conditions were useful for the production of heteropolymeric PHA in the recombinant E. coli strain from a single carbon source [121].Wheat bran was hydrolysed by a crude enzyme preparation from Aspergillus oryzae NM1 to provide a mixture of reducing sugars composed mainly of glucose, mannose, xylose and arabinose. Growth of Halomonas boliviensis using a mixture of glucose (0·75% w/v) and xylose (0·25% w/v) in the medium led to a PHB content and concentration of 45 wt% and 1 g l−1, respectively, after 30 h. Butyric acid and sodium acetate for PHB production could also be provided by anaerobic digestion of solid potato waste [122].

Effect of nitrogen limitation during acclimatization period of biomass on production of polyhydroxyalkanoate was investigated. Polymer yields for both biomasses decreased with substrate shift however, biomass enriched with nitrogen deficiency adapted well to acetate–propionate mixture. The results presented in this study showed that polymer storage ability of biomass was improved more under dynamic conditions with nitrogen deficiency when compared to that without nitrogen deficiency. Limiting ammonia availability during batch experiments also caused higher polymer production by suppressing growth, as well as during enrichment of biomass [123].

IV.   PHA RECOVERY PROCESS

In addition to the costs of maintaining pure cultures and the high costs of organic substrates, polymer recovery process is another factor that contributes to the overall high cost of PHA production. In the past two decades, several recovery processes have been investigated and studied in order to find an economic way to isolate and purify PHA. Several methods have been used as a recovery process for PHA. These methods include solvent extraction, sodium hypochlorite digestion, and enzymatic digestion [124] [125] [126] [127].

V.   CONCLUSION

Currently, European consumption of biodegradable polymers is roughly estimated at 50 000 tonne year. Both government and industries have intensified their efforts in the development of biodegradable polymers. However, the production of biodegradable polymers still accounts for less than 1% of the world annual production of polymers (>100 million tonnes), with maximum usage in low-grade applications such as

food packaging. This slow growth in production is attributed to the high production costs and inferior thermo-mechanical, physical and processing properties of biodegradable polymers compared with petrochemical types. Therefore, intensive work is needed to both reduce costs and improve properties of PHA.Today, a broad range of PHA covering a spectrum of physical properties can be synthesized by a large number of microbial species. Many different products and applications ranging from everyday used products to medical applications are now being explored. The challenge for the future application of the PHA materials depends mostly on the increase in the level of production of these PHA with desired properties in an economical fashion.

Although, the cost of production of PHA is still quite high (4–6 USD kg−1), current advances in fermentation, extraction and purification technology as well as the development of superior bacterial strains are likely to lower the price of PHA, close to that of other biodegradable polymers such as polylactide and aliphatic polyesters. The isolation and development of bacterial strains that can utilize cheap carbon substrates need to be pursued intensively. The isolation of bacterial strains that can synthesize P (3HB-co-3HV) from simple sugar substrates and waste materials is a good example of reducing the substrate cost by eliminating the necessity for supplementing with the more expensive propionic acid. Several of the bacteria described earlier can be employed to enhance PHA production over the next few years. However, metabolically engineered recombinant bacterial strains are more likely to surpass the wild type strains currently in use. In this case, the stability of recombinant bacteria is an important factor for successful PHA production. A combination of more efficient metabolically engineered strains capable of utilizing cheap carbon sources and efficient fermentation strategies is certainly the way forward for increased efficiency of PHA production. It is possible that PHA will become one of the leading biodegradable polymers in the next decade, once the advances mentioned above are in place.

VI. ACKNOWLEDGMENT

REFERENCES

[1]   M. Koller, I. Gasser, F. Schmid, and G. Berg, "Linking ecology with economy: insights into polyhydroxyalkanoate-producing microorganisms," Engineering in Life Sciences, 11(3), 2011, 222–237.

[2]   Belova LL, Sokolov AP, Sidorov IA and Trotsenko YA, Purification and characterization of NADPH-dependent acetoacetyl – CoA reductase from Methylobacterium extorquens. FEMS Microbiol. Lett. 156,1997, 275-279.

[3]   Ayub ND, Pettinari MJ, Ruiz JA and Lopez NI , A polyhydroxybutyrate-producing Pseudomonas sp. isolated from Antarctic environments with high stress resistance. Current. Microbiol. 49,2004,170-174.

[4]   Doi Y, Microorganisms and poly (3-hydroxyalkanoates). In: Microbial Polyesters. New York: VCH,1990.

[5]   Belova LL, Sokolov AP, Sidorov IA and Trotsenko YA , Purification and characterization of NADPH-dependent acetoacetyl – CoA reductase from Methylobacterium extorquens. FEMS Microbiol. Lett. 156, 1997, 275-279.

[6]   Bourque D, Ouellette B, Andre G and Groleau D, Production of poly-β- hydroxybutyric acid from methanol: characterization of a new isolate of Methylobacterium extorquens. Appl. Microbiol. Biotechnol.37, 1992, 7-12.

[7]   Chen GQ, Zhang G, Park SJ and Lee SY, Industrial production of poly (3- hydroxybutyrate-co-3-hydroxyhexanoate). Appl. Microbiol. Biotechnol. 57, 2001, 50-55.

[8]   De Koning GJM, van Bilsen HMM, Lemstra PJ, Hazenberg W, Witholt B, Preusting H, van der Galiën JG, Schirmer A and Jendrossek D, A biodegradable rubber by crosslinking poly(hydroxyalkanoate) from Pseudomonas oleovorans. Polym. 35, 1994, 2090-2097.

[9]   Choi GG, Kim MW, Kim JY and Rhee YH, Production of poly(3-hydroxybutyrate- co-3-hydroxyvalerate) with high molar fractions of 3- hydroxyvalerate by a threonine-overproducing mutant of Alcaligenes sp. SH-69. Biotechnol. Lett 25, 2003, 665-670.

[10]   Cromwick AM, Foglia T and LenzRW , The microbial production poly (hydoxyalkanoates) from tallow. Appl. Microbiol. Biotechnol. 46, 1996, 464-469.

[11]   Choi J, and Lee SY, Process analysis and economic evaluation for poly(3- hydroxybutyrate) production by fermentation. Bioprocess. Eng. 17, 1997, 335-342.

[12]   Chanprateep S and Kulpreecha S, Production and characterization of biodegradable terpolymer Poly (3-hydroxybutyrate-co-3-hydroxyvalerate-co-4hydroxybutyrate) by Alcaligenes sp. A-04. J. Biosci. Bioeng. 101(1), 2006, 51-56.

[13]   Arun A, Arthi R , Shanmugabalaji V , Eyini M. Microbial production of poly-β- hydroxybutyrate by marine microbes isolated from various marine environments Bioresource Technology .100, 2009, 2320–2323.

[14]   Anupama S, Sanjiv KM, Imran P, Deepti J, Sourish B, Sheetal P, Sandhya M. Biodegradability studies of polyhydroxyalkanoate (PHA) film produced by a marine bacteria using Jatropha biodiesel byproduct as a substrate.World J Microbiol Biotechnol. 27, 2011, 1531–1541.

[15]   Choi MH and Yoon SC. Polyester biosynthesis characteristics of Pseudomonas citronellosis grown on various carbon sources, including 3-methyl-branched substrates. Appl. Environ. Microbiol. 60, 1994, 3245-3254.

[16]   De Koning G. Physical properties of bacterial poly ((R)-hydroxyalkanoates). Can. J.Microbiol. 41, 1995, 303-309.

[17]   Chung YJ, Cha HJ, Yeo JS and Yoo YJ. Production of poly (3-hydroxybutyric-c o-3-hydroxyvaleric) acid using propionic acid by pH regulation. J. Ferment. Bioeng.83, 1995, 492-495.

[18]   Clemente T, Shah D, Tran M, Stark D, Padgette S, Dennis D, Bruckener K, Steinbüchel A andMitsky T. Sequence of PHA synthase gene from two strains of Rhodospirillum rubrum and in vivo substrate specificity of four PHA synthases across two heterologous expression systems.   Appl. Microbiol. Biotechnol. 53, 2000, 420-429.

[19]   Chen G, Qiong W, Jianzhong X and Yu H. Microbial production of biopolyesters- poly hydroxyalkanoates. Prog. Natl. Sci. 10,2000, 843-850.

[20]   Chavez GS, Ramirez MA and Sanchez R. The Pseudomonas aeruginosa RhIA enzyme is involved in rhamnolipid and polyhydroxyalkanoate production. J. Ind. Microbiol.Biotechnol.32, 2005, 675-677.

[21]   Brandl H and Puchner P. Biodegradation of plastic bottles made from 'Biopol' in an aquatic ecosystem under in situ conditions. Biodegrad. 2, 1992, 237-243.

[22]   Chen GQ, Wu Q. Microbial   production   and   applications   of   chiral hydroxyalkanoates. Appl Microbiol.Biotechnol.67, 2005b,592–9.

[23]   Lee SY. Plastic bacteria? Progress and prospects for polyhydroxyalkanoate production in bacteria. Trends.Biotechnol. 14, 1996a, 431–438

[24]   Anderson AJ and Dawes EA. Occurrence, metabolism, metabolic role and industria l uses of bacterial polyhydroxyalkanoates. Microbiol. Rev. 54, 1990, 450-472.

[25]   Steinbuechel A . Polyhydroxyalkanoic acids. In: Byrom D, editor. Biomaterials. Basingstoke: MacMillan. 1991, 125-213.

[26]   Haywood GW, Anderson AJ, Williams GA, Dawes EA and Ewing DF. Accumulation of a poly (hydroxyalkanoate) copolymer containing primarily3- hydroxyvalerate from simple carbohydrate substrates by Rhodococcus sp. NCIMB 40126. Int. J. Biol. Macromol. 13,1991, 83-88.

[27]   D. P. Tamboli, A. N. Kagalkar, M. U. Jadhav, J. P. Jadhav, and S. P. Govindwar, "Production of polyhydroxyhexadecanoic acid by using waste biomass of Sphingobacterium sp. ATM generated after degradation of textile dye Direct Red 5B," Bioresource Technology. 101(7), 2010, 2421–2427.

[28]   J. Dalal, P. M. Sarma, M. Lavania, A. K. Mandal, and B. Lal, "Evaluation of bacterial strains isolated from oil-contaminated soil for production of polyhydroxyalkanoic acids (PHA)," Pedobiologia. 54, (1),2010, 25–30.

[29]   J. Teeka, T. Imai, A. Reungsang et al., "Characterization of polyhydroxyalkanoates (PHAs) biosynthesis by isolated Novosphingobium sp. THA_AIK7 using crude glycerol," Journal of Industrial Microbiology and Biotechnology. 39(5), 2012, 749–758.

[30]   B. S. Saharan and P. Ranga, "Enhanced decolourization of congo red dye under submerged fermentation (SMF) process by newly isolated Bacillus subtilis SPR42," Journal of Applied and Natural Science. 3(1), 2010, 51–53.

[31]   B. S. Saharan and P. Ranga, "Optimization of cultural conditions for decolourization of textile azo dyes by Bacillus subtilis SPR42 under submerged fermentation," International Journal of Advanced Biotechnology and Research. 2(1), 2011, 148–153.

[32]   Cheng HR and Jiang N. Extremely rapid extraction of DNA from bacteria and yeasts. Biotechnol. Lett. 28, 2006,55-59.

[33]   Braunegg G, Lefebvre G and Genser KF. Polyalkanoates, Biopolyester from Renewable Resources: Physiological and Engineering Aspects. J. Biotech. 65,1998, 127-161.

[34]   Chau H, Yu PHF, Xing S and Ho LY. Potential of biodegradable plastics as environmentally friendly substitute for conventional plastics in Hong Kong, Presented in the 17th Symposium on Biotechnology for Fuels and Chemicals, May1995, Colarado, USA.

[35]   Doi Y. Microorganisms and poly (3-hydroxyalkanoates). In: Microbial Polyesters. New York: VCH.1990.

[36]   Curley JM, Hazer B, Lenz RW and Fuller RC (1996) Production of poly(3- hydroxyalkanoates) containing aromatic substituents by Pseudomonas oleovorans. Macromolecules.29,1996, 1762-1766.

[37]   Bormann EJ, Leibner M, Roth M, Beer B and Metzner K. Production of polyhydroxybutyrate by Ralstonia eutropha from protein hydrolysates. Appl. Microbiol. Biotechnol. 50, 1998, 604-607.

[38]   Bohmert K, Balbo I, Kopka J, Mittendorf V, Nawrath C, Poirier Y, Tischendorf G, Trethewey RN and Willmitzer L. Transgenic Arabidopsis plants can accumulate polyhydroxybutyrate to up to 4 % of their fresh weight. Planta 211, 2000, 841-845.

[39]   Lafferty RM, Korsatko B and KorsatkoW. Microbial Production of Poly- β - hydroxybutyric Acid. In: Biotechnology, Rehm, H.J.and Reed, G. (eds.), VCH Publishers, New York, 1998,135-176.

[40]   Sasikala CH, and Ramana CHV. Biodegradable Polyesters. In: Advances in Applied Microbiology, Volume 42, Neidleman, S. L. and Laskin, A. I. (eds.), Academic Press, California,1996, 97-218.

[41]   N. Mokhtarani, H. Ganjidoust, and E. V. Farahani, "Effect of process variables on the production of Polyhydroxyalkanoates by activated sludge," Iranian Journal of Environmental Health Science and Engineering, 9, (1),2012,1–7.

[42]   N. A. Aziz, C. S. Sipaut, and A. A.-A. Abdullah, "Improvement of the production of poly(3-hydroxybutyrate-co-3-hydroxyvalerate-co-4-hydroxybutyrate) terpolyester by manipulating the culture condition," Journal of Chemical Technology and Biotechnology, 87, 2012, 1607–1614.

[43]   Preiss J. Bacterial Glycogen Synthesis and Its regulation. Ann. Rev. Microbiol.38, 1984, 419-458.

[44]   H. Chen, H. Meng, Z. Nie, and M. Zhang, "Polyhydroxyalkanoate production from fermented volatile fatty acids: effect of pH and feeding regimes," Bioresource Technology, 128, 2013, 533–538, 2013.

[45]   M. Venkateswar Reddy and S. Venkata Mohan, "Influence of aerobic and anoxic microenvironments on polyhydroxyalkanoates (PHA) production from food waste and acidogenic effluents using aerobic consortia," Bioresource Technology, 103 (1), 2012, 313–321.

[46]   Steinbüchel A and Valentin HE. Diversity of bacterial polyhydroxyalkanoic acids. FEMS Microbiol.Lett. 128, 1995, 219-228.

[47]   Ojumu TV, Yu J and Solomon BO. Production of polyhydroxyalkanoates,a bacterial biodegradable polymer. Afr.J.Biotechnol.3,2004,18–24.

[48]   Anderson AJ and Dawes EA. Occurrence, metabolism, metabolic role and industria l uses of bacterial polyhydroxyalkanoates. Microbiol. Rev. 54, 1990, 450-472.

[49]   Steinbuechel A. Polyhydroxyalkanoic acids. In: Byrom D, editor. Biomaterials. Basingstoke: MacMillan. 1991, 125-213.

[50]   Byrom D. Polymer Synthesis by Microorganisms: Technology and Economics. TIBTECH. 5,1997, 246-250.

[51]   Elías R. Olivera, Mario Arcos, Germán Naharro and José M. Luengo. Unusual PHA BiosynthesisMicrobiology Monographs. 14, 2010,133-185.

[52]   Everest A, Keshavarz T and Roy I. Production of polyhydroxyalkanoates the future green materials of choice. J Chem Technol Biotechnol .85, 2010, 732–743.

[53]   Casini E, de Rijk TC, de Waard P and Eggink G. Synthesis of poly(hydroxyalkanoate) from hydrolyzed linseed oil. J.Environ.Polym.Degrad.5,1997,153–158.

[54]   Holmes PA. Biologically produced (R)-3-hydroxyalkanoate polymers and copolymers. In: Bassett DC, editor.Developments in crystalline polymers. 2, 1998,1-65.

[55]   Lee MY, Park WH and Lenz RW. Hydrophilic bacterial polyesters modified with pendanhydroxyl groups. Polymer. 41, 2000, 1703-1709.

[56]   Kim YB and Lenz RW. Polyesters from microorganisms. Adv. Biochem. Eng. Biotechnol. 71, 2001, 51-79.

[57]   Madison LL, Huisman GW. Metabolic engineering of poly (3-hydroxyalkanoates): From DNA to plastic. Microbiol. Mol. Biol Rev. 63, 1999, 21-53.

[58]   Reddy CSK, Ghai R, Rashmi and Kalia VC. Polyhydroxyalkanoates: an overview. Bioreso. Technol. 87, 2003, 137-146.

[59]   Steinbüchel A. Non-biodegradable biopolymers from renewable resources: perspectives and impacts. Curr.Opin.Biotechnol.16, 2005, 607–13.

[60]   Steinbüchel A, Schlegel HG. Physiology and molecular genetics of poly(hydroxyalkanoic acid) synthesis in Alcaligenes eutrophus. Mol. Microbiol. 5,1991,535-542.

[61]   Rehm BH. Polyester synthases: natural catalysts for plastics. Biochem. 376,2003, 15-33.

[62]   Anderson AJ and Dawes EA. Occurrence, metabolism, metabolic role and industria l uses of bacterial polyhydroxyalkanoates. Microbiol. Rev. 54, 1990, 450-472.

[63]   Moskowitz GJ and Merrick JM. Metabolism of poly-β-hydroxybutyrate. II. Enzymatic synthesis of D-(-)-β-hydroxybutyryl coenzyme A by an enoyl hydrase from Rhodospirillum rubrum, 1969.

[64]   Aid A, Koller M, Scherzer D, Kutschera C, Fernandes EG, Horvat P, Chiellini E and Braunegg G. Continuous production of poly ([R]-3-hydroxybutyrate) by Cupriavidus necator in a multistage bioreactor cascade Appl Microbiol Biotechnol. 91, 2011, 295–304.

[65]   Clemente T, Shah D, Tran M, Stark D, Padgette S, Dennis D, Bruckener K, Steinbüchel A andMitsky T. Sequence of PHA synthase gene from two strains of Rhodospirillum rubrum and in vivo substrate specificity of four PHA synthases across two heterologous expression systems.   Appl. Microbiol. Biotechnol. 53, 2000, 420-429.

[66]   Adrian DA, Winston A, Anderson, Folahan O, Ayorinde and Broderick EE. Biosynthesis and characterization of copolymer poly (3HB-co-3HV) from saponiWed Jatropha curcas oil by Pseudomonas oleovorans.J Ind Microbiol Biotechnol. 37, 2010, 849–856.

[67]   Taguchi K, Aoyagi Y, Matsusaki H, Fukui T and Doi Y. Co-expression of 3- ketoacyl-ACP reductase and polyhydroxyalkanoate synthase genes induces PHA production in Escherichia coli HB101 strain. FEMS Microbiol.Lett.176, 1999, 183–90.

[68]   Sun Z, Ramsay JA, Guay M and Ramsay BA. Carbon-limited fed-batch production of medium-chain-length polyhydroxyalkanoates from   nonanoic   acid   by Pseudomonas putida KT2440. Appl. Microbiol. Biotechnol. 74, 2007, 69-77.

[69]   Marsudi S, Unno H and Hori K. Palm oil utilization for the simultaneous production of polyhydroxyalkanoates and rhamnolipids by Pseudomonas aeruginosa. Appl. Microbiol. Biotechnol. 78(6), 2008, 955-961.

[70]   Simon CC, Raguenes G, crassous P, Moppert X and Guezennec J. A novel mcl- PHA produced On coprah oil by Pseudomonas guezennei biovar. Tikehau, isolated from a 'kopara' mat of French Polynesia. Int J BiolMacromol. 43, 2008, 176–181.

[71]   Adrian DA, Winston A, Anderson, Folahan O, Ayorinde and Broderick EE. Biosynthesis and characterization of copolymer poly (3HB-co-3HV) from saponiWed Jatropha curcas oil by Pseudomonas oleovorans.J Ind Microbiol Biotechnol. 37, 2010, 849–856.

[72]   Xiao WS, Zhen YS, Ge S, Zheng JL and Guo Q Chen. Engineering of polyhydroxyalkanoate (PHA) synthase PhaC2Ps of Pseudomonas stutzeri via site- specific mutation for efficient production of PHA copolymers. Appl Microbiol Biotechnol. 91, 2011, 655–665.

[73]   Moskowitz GJ and Merrick JM. Metabolism of poly-β-hydroxybutyrate. II. Enzymatic synthesis of D-(-)-β-hydroxybutyryl coenzyme A by an enoyl hydrase from Rhodospirillum rubrum, 1969.

[74]   Fukui T and Doi Y. Cloning and analysis of the poly (3-hydroxybutyrate-c o-3- hydroxyhexanoate) biosynthesis genes of Aeromonas caviae. J. Bacteriol. 179, 1997, 4821-4830.

[75]   Fukui T, Shiomi N and Doi Y. Expression and characterization of (R)-specific enoyl coenzyme A hydratase involved in polyhydroxyalkanote biosynthesis by Aeromonas caviae. J. Bacteriol. 180, 1998, 667-673.

[76]   Mothes G and Babel W. Methylobacterium rhodesianum MB 126 possesses two acetoacetyl-CoA reductases. Arch. Microbiol. 161, 1994, 277-280.

[77]   Valentin HE and Dennis D. Metabolic pathway for poly (3-hydroxybutyrate-c o-3- hydroxyvalerate) formation in Nocardia coallina: Inactivation of mutB by chromosomal integration of a kanamycin resistance gene. Appl. Environ. Microbiol.62, 1996, 372-379.

[78]   Aid A, Koller M, Scherzer D, Kutschera C, Fernandes EG, Horvat P, Chiellini E and Braunegg G. Continuous production of poly ([R]-3-hydroxybutyrate) by Cupriavidus necator in a multistage bioreactor cascade Appl Microbiol Biotechnol. 91, 2011, 295–304.

[79]   Slepecky RA and Law JH. Synthesis and degradation of poly-β-hydroxybutyric acid in connection with sporulation of Bacillus megaterium. J. Bacteriol. 86, 1961, 37-42.

[80]   Labuzek S and Radecka I. Biosynthesis of PHB terpolymer by Bacillus cereus UW85. J.Appl. Microbiol 90,2001, 353-357.

[81]   Valappil SP, Boccaccini AR, Bucke C and Roy I. Polyhydroxyalkanoates in Gram-positive bacteria: insights from the genera Bacillus and Streptomyces. Antonie.Van. Leeuwenhoek.91, 2007a, 1–17.

[82]   Emeruwa AC and Hawirko RZ. Poly-b-hydroxybutyrate metabolism during growth and sporulation of Clostridium botulinum.J Bacteriol.116, 1973, 989-93.

[83]   Haywood GW, Anderson AJ, Williams GA, Dawes EA and Ewing DF. Accumulation of a poly (hydroxyalkanoate) copolymer containing primarily3- hydroxyvalerate from simple carbohydrate substrates by Rhodococcus sp. NCIMB 40126. Int. J. Biol. Macromol. 13, 1991, 83-88.

[84]   Valentin HE and Dennis D. Metabolic pathway for poly (3-hydroxybutyrate-c o-3- hydroxyvalerate) formation in Nocardia coallina: Inactivation of mutB by chromosomal integration of a kanamycin resistance gene. Appl. Environ. Microbiol.62, 1996, 372-379.

[85]   Haywood GW, Anderson AJ, Williams GA, Dawes EA and Ewing DF. Accumulation of a poly (hydroxyalkanoate) copolymer containing primarily3- hydroxyvalerate from simple carbohydrate substrates by Rhodococcus sp. NCIMB 40126. Int. J. Biol. Macromol. 13, 1991, 83-88.

[86]   Verma S, Bhatia Y, Valappil SP and Roy I. A possible role of poly-3- hydroxybutyric acid in antibiotic production in Streptomyces. Arch. Microbiol. 179, 2002, 66–69.

[87]   Szewcyk E   and Mikucki J. Poly-b-hydroxybutyric acid in Staphylococci. FEMS Microbiol.Lett. 61, 1989, 279–284.

[88]   Alvarez HM, Kalscheuer R and Steinbuchel A. Accumulation and, mobilization of storage lipids by Rhodococcus opacus PD630 and Rhodococcus rubber NCIMB 40126. Appl Microbiol Biotechnol: 54, 2000, 218–223.

[89]   Vishnuvardhan Reddy S, Thirumala M and Mahmood SK. Production of PHB and P (3HB-co-3HV) biopolymers by Bacillus megaterium strain OU303A isolated from municipal sewage sludge.World J Microbiol Biotechnol. 25, 2009, 391–397.

[90]   Nisha V. Ramadas, Carlos R. Soccol and Ashok Pandey (2010) A Statistical Approach for Optimization of Polyhydroxybutyrate Production by Bacillus sphaericus NCIM 5149 under Submerged Fermentation Using Central Composite Design Appl Biochem Biotechnol. 162:996–1007.

[91]   Lemoigne M. Produit de déshydratation et de polymérization de l'acide β- oxybutyrique. Bull.Soc.Chim.Biol.8, 1926, 770–82.

[92]   Macrae RM, Wilkinson JF. Poly-beta-hydroxybutyrate metabolism in washed suspensions of Bacillus cereus and Bacillus megaterium. J.Gen.Microbiol.19, 1958, 210–222.

[93]   Otari SV and Ghosh JS. Production and Characterization of the Polymer Polyhydroxy Butyrate-copolyhydroxy Valerate by Bacillus Megaterium NCIM 2475 Current Research Journal of Biological Sciences. 2, 2009, 23-26.

[94]   Paramjit Singh and Nitika Parmar. Isolation and characterization of two novel polyhydroxybutyrate (PHB)-producing bacteria African Journal of Biotechnology. 10, 2011, 4907-4919.

[95]   Bee-Yong T, Lokesh BE, Yang Lee C and Sudesh K. Polyhydroxyalkanoate (PHA) accumulating bacteria from the gut of higher termite Macrotermes carbonarius World J Microbiol Biotechnol. 26, 2010, 1015–1024.

[96]   Emeruwa AC and Hawirko RZ. Poly-b-hydroxybutyrate metabolism during growth and sporulation of Clostridium botulinum.J Bacteriol.116, 1973, 989-93.

[97]   Haywood GW, Anderson AJ, Williams GA, Dawes EA and Ewing DF. Accumulation of a poly (hydroxyalkanoate) copolymer containing primarily3- hydroxyvalerate from simple carbohydrate substrates by Rhodococcus sp. NCIMB 40126. Int. J. Biol. Macromol. 13,1991, 83-88.

[98]   Valentin HE and Dennis D. Metabolic pathway for poly (3-hydroxybutyrate-c o-3- hydroxyvalerate) formation in Nocardia coallina: Inactivation of mutB by chromosomal integration of a kanamycin resistance gene. Appl. Environ. Microbiol.62, 1996, 372-379.

[99]   Warhust AM, Fewson CA. Biotransformation catalyzed by the genus Rhodococcus. Crit Rev Biotechnol.14, 1994, 29-73.

[100]   Williams DR, Anderson AJ, Dawes EA and Ewing DF. Production of a copolyester of 3-hydroxybutyric acid and 3-hydroxyvaleric acid from succinic acid by Rhodococcus ruber: biosynthetic considerations. Appl. Microbiol. Biotechnol. 40, 1994, 717-723.

[101]   Anderson AJ, Williams DR, Dawes EA and Ewing DF. Biosynthesis of poly(3- hydroxybutyrate-co-3-hydroxyvalerate) in Rhodococcus ruber. Can. J. Microbiol. 41, 1995, 4–13.

[102]   Bappaditya R, Rajat B and Sumana C. Isolation and identification of Poly beta hydroxyl accumulating bacteria of Staphylococcal sp.and characterization of biodegradable polymer. Indian journal of Experimental bilogy.47, 2009, 250-256.

[103]   Szewcyk E   and Mikucki J. Poly-b-hydroxybutyric acid in Staphylococci. FEMS Microbiol.Lett. 61, 1989, 279–284.

[104]   Renner G, Haage G, and Braunegg G. Production of Short-Side-Chain Polyhydroxyalkanoates by Various Bacteria from the rRNA Superfamily III. Appl. Microbiol. Biotechnol. 46, 1996, 268-272.

[105]   Liangqi Z, Jingfan X, Tao F and Haibin W. Synthesis of poly (3-hydroxybutyrate- co-3-hydroxyoctanoate) by a Sinorhizobium fredii strain. Letts. Appl. Microbiol. 42, 2006, 344-349.

[106]   Sudesh K, Abe H and Doi Y. Synthesis, structure and properties of polyhydroxyalkanoates: biological polyesters. Prog. Polym Sci.25, 2000, 1503–1555.

[107]   Choi MH, Yoon SC and Lenz RW. Production of poly(3-hydroxybutyric acid-co-4- hydroxybutyric acid) and poly(4-hydroxybutyric acid) without subsequent degradation by Hydrogenphaga pseudoflava. Appl. Environ. Microbiol. 65, 1999, 1570-1577.

[108] Cerrone, Federico, Maria DMS, Juárez-Jimenez B, González-López J, and Pozo C. Biological Treatment of Two-Phase Olive Mill Wastewater (TPOMW, alpeorujo): Polyhydroxyalkanoates (PHAs) Production by Azotobacter Strains. J. Microbiol. Biotechnol. 20, 2010, 594–601.

[109] Fernanda LP, Eliana G ,Macedo Lemos and Maria C Alves. Polyhydroxybutyrate in Rhizobium and Bradyrhizobium: quantification and phbC gene expressionWorld J Microbiol Biotechnol. 27, 2011, 773–778.

[110] Harriet L, Rachel LS, Peter MM, Hewitt CL, Yong P, Beedle MP, Redwood MD, Stamboulis A, Kashani M, Jenkins M and Macaskie LE. Polyhydroxy butyrate accumulation by a Serratia sp. Biotechnol. Lett. 30, 2008, 481-491.

[111] Boyandin AN, Kalacheva GS, Rodicheva EK and Volova TG. Synthesis of reserve polyhydroxyalkanoates by luminescent bacteria. Microbiol. 77(3), 2008, 318-323.

[112] Vincenzini M, Silli C, de Philippis R, Ena A, and Materassi R. Occurrence of poly-β-hydroxy butyrate in Spirulina species. J. Bacteriol.172, 1990,2791-2792.

[113] Wang F and Lee SY. Poly (3-hydroxybutyrate) production with high productivity and high polymer content by a Fed-batch culture of Alcaligenes latus under nitrogen limitation. Appl. Environ. Microbiol. 63, 1997, 3703-3706.

[114] Kusaka S, Abe H, Lee SY and Doi Y. Molecular mass of poly[(R)-3-hydroxybutyric acid] produced in a recombinant Escherichia coli. Appl. Microbiol. Biotechnol. 47, 1997, 140–143.

[115] Madison LL, Huisman GW. Metabolic engineering of poly (3-hydroxyalkanoates): From DNA to plastic. Microbiol. Mol. Biol Rev. 63, 1999, 21-53.

[116] Attia R, Jamil N, Naheed N and Hasnain S. Bacteria from contaminated urban and hilly areas as a source of polyhydroxyalkanoates production. African Journal of Biotechnology. 9 (13), 2010,1919-1925.

[117] Leaf TA, Peterson MS, Stoup SK, Somers D and Srienc F. Saccharomyces cerevisiae expressing bacterial polyhydroxybutyrate synthase produces poly-3- hydroxybutyrate.Microbiol .142, 1996, 1169-1180.

[118] Poirier Y, Erard N and Petetot JMC. Synthesis of polyhydroxyalkanoates in the peroxisome of Saccharomyces cerevisiae by using intermediates of fatty acid β- oxidation. Appl. Env. Microbiol. 67, 2001, 5254-5260.

[119] Poirier Y, Erard N and Petétot JM. Synthesis of polyhydroxyalkanoate in the peroxisome of Pichia pastoris. FEMS Microbiol.Lett.207,2002,97–102.

[120] Doi Y. Microorganisms and poly (3-hydroxyalkanoates). In: Microbial Polyesters. New York: VCH, 1990.

[121] Eschenlauer, A.C. stoup, S.K., srienc, F. and somers, D.A. Production of heteropolymeric polyhydroxyalkonates in Escherchia coli from a single carbon source. International jounal of biological macromolecules. 19, 1996, 121-130.

[122] Van-Thuoc D, Quillaguaman J, Mamo G and Mattiasson B. Utilization of agricultural residues for poly(3-hydroxybutyrate) production by Halomonas boliviensis LC1. J Appl Microbiol 104, 2008,420–428.

[123] Bertan B, Ince O, Artan N, Yagci N and Kasapgil IB. Effect of nitrogen limitation on enrichment of activated sludge for PHA production. Bioprocess Biosyst Eng, 2011, DOI 10.1007/s00449-011-0551.

[124] Doi Y. Microorganisms and poly (3-hydroxyalkanoates). In: Microbial Polyesters. New York: VCH,1990.

[125] Lee SY, Plastic bacteria? Progress and prospects for polyhydroxyalkanoate production in bacteria. Trends.Biotechnol. 14, 1996a, 431–438.

[126] Steinbüchel A, Füchtenbush B . Bacterial and other biological systems for polyester production. Trends.Biotechnol.16, 1998, 419–427.

[127] Braunegg G, Lefebvre G and Genser KF. Polyalkanoates, Biopolyester from Renewable Resources: Physiological and Engineering Aspects. J. Biotech. 65, 1998, 127-161.

Polymer producing bacteria showing siderophore activity with chrome azurol S (CAS) agar plate assay

Chaitanya.K[1], Mahmood.S.K[2], Ranakausar[3], Sunil Kumar.N[4]

[1]Research scholar, University College of Science, India.
[2]Head, Dept of botany, Nizam College, India
[3,]Head, Board of studies, Dept of Botany, Osmania University, India.
[4]Head, Dept of Biotechnology, GRIET, India.

Abstract- Biological waste water are characterized by the exposure of microorganism to transient conditions, where biomass is submitted to alternating periods of high and low substrate concentration and aerobic and anaerobic environments which make some microorganisms respond the production of polymers and various biochemical agents. Bacteria utilize siderophores to help the process of ferric iron uptake in environment. This process can found across three domains and is necessary for microorganisms to obtain iron needed for essential process. The present investigations were undertaken to check the siderphore producing activity of bacteria which produces polymer. A total of 640 bacteria were isolated from waste water pond. Among them 198 bacterial strains showing polymer production wee isolated. Out of which 12 potential strains were selected and investigated for siderphore activity. The result showed that out of 12 bacteria some of them showed siderophore activity.

Index Terms- Bacteria; polymer; Siderophore

I. INTRODUCTION

Iron is most essential microelements for virtually all living cells and is usually abundant in the environment, particularly in soils and natural aquifers. However, its bioavailabitily is relatively low and with a dramatically decreased solubility of ferric species under physiological pH values owing to their complete hydrolysis. This results in the development of special biological regulated mechanism of Fe (III) solubilization e.g., involving specific naturals low-molecular weight chelating agents such as siderophore, which transport Fe (III) to the cell surface in the form of a complex with further Fe (III) release from the latter in the course of its reductive assimilation (kamnev et al., 2000). Many microorganism possess high affinity iron uptake system mediated by the action of low molecular weight iron chellators termed as siderophores (lankford, 1973; neilands 1981). Bacteria utilize siderophores to help the process of ferric iron uptake present in environment. This process is found in all three domains and is necessary for many microorganisms to obtain the environmental iron needed for various processes.

Dissolution of Fe minerals liberate two soluble forms of iron these are Fe^{2+} and $Fe^{3+,}$ which can be used by microorganism and plants. Dissolution occurs depending upon water redox potential and PH. Under aerobic conditions at a neutral to alkaline PH, iron is present in the form of Fe(III) mineral, $Fe(OH)_3$, which is essentially insoluble. (Lindsay and schwab 1982). Under these conditions, organism that depend on the soil and water as their sole source of mineral nutrients are susceptible to Fe deficiency. Siderophores are classified by ligands used to chelate ferric iron. These include catecholates, hydroxamates, and carboxylates ([6]). Various assays has been developed to detect different phenotypes of siderophores ([2]–[4]). These assays are useful for the identification of various siderophores, numerous assays would has to be performed to detect all possible forms of siderophores. Schwyn and Neiland ([8]) developed a universal siderophore assay using chrome azurol S(CAS) and hexadecyltrimethylammonium bromide (HDTMA) as indicators. chrome azurol S (CAS) agar effectively differentiated bacteria that are capable of exereting large amounts of siderophore. In the current investigation, we focused on performing siderophore activity for the all 12 isolates which were isolated based on polymer character.

II. MATERIALS AND METHODS

Sampling

The present investigation was under taken with an objective to select a promising native polymer producing strains. The samples were collected at four different sites of polluted pond and screened for potential PHA accumulators. The collection of samples and survey for PHA accumulating bacteria was done for two consecutive years. The screening was done regularly on monthly intervals to determine the variation in bacterial flora and the PHA accumulators simultaneously.

Isolation, screening and maintenance of bacteria

The water samples 1 ml, were measured and mixed vigorously for 10 min. Samples were serially diluted ten folds before plating. A 0.1 ml sample of each dilution was surface spread on sterile Luria Bertani agar medium. After incubation of 48 h at room temperature, the colony forming units (CFU) were counted to check the total viable count. After the initial sampling, the incubated plates were used to estimate CFU/ ml sample. The colonies formed on these plates were also checked for pigment production. These pigments have much value due to their natural origin and industrial use.

All isolates accumulating PHA were maintained on Luria Bertani agar slopes as working cultures. Culture stocks were also maintained on Luria Bertani agar slopes, by sealing the tubes with paraffin wax. Preservation of cultures at 4°C was achieved by growing the isolates in 0.5 ml half strength Luria Bertani

broth in sterile capped vials. Glycerol was sterilized and 0.5 ml was added to the grown culture as a cryoprotectant and the vials were preserved at 4°C.

Morphological characterization and microscopic observation

The selected bacterial isolates were examined for their morphological features. The morphological characteristics were examined on their respective agar plates. The pure cultures from the slants were placed on the agar plates. After the growth of colonies morphological characters of the colonies like the colour, shape, size, surface, pigment production and gram staining etc. were recorded. All the 196 bacterial isolates were screened for their biochemical and enzymatic activities. Out of which 12 prominent PHA producers are accumulated.

Preparation of glassware

All the glassware used was cleaned with 3mol/L HCl to remove iron and rinsed in deionized water without exception (Cabaj and Kosakowska, 2007).

Preparation of chrome (CAS)
The procedure given for making CAS agar by Schwyn and Neiland's original paper was followed:

CAS agar plates were prepared by mixing a dye made of CAS, Fe, and hexadecyl-trimethyl-ammonium bromide (HDTMA) with M9-based growth media. For 1 L of CAS-agar, 100 mL of CAS-Fe-HDTMA dye was mixed with 900 mL of freshly prepared growth media. The CAS-Fe-HDTMA dye was prepared in advance as follows, for 1L: 10 mL of a 10 mM ferric chloride ($FeCl_3$) in 100 mM hydrochloric acid (HCl) solution was mixed with 590 mL of a 1-mM aqueou solution of CAS. The Fe-CAS solution was then added to 400 mL of a 2-mM aqueous solution of HDTMA. The resulting CAS-Fe-HDTMA solution was autoclaved for 25 min in a polycarbonate bottle that had previously been soaked overnight in 10% (vol/vol) HCl then rinsed five times with MilliQ water. The CAS-Fe-HDTMA dye was stored at room temperature covered from light until use.

The growth media was prepared as follows, for 1L of CAS-agar: 30.24 g of 1,4-piperazine-diethanesulfonic acid (Pipes), together with 1 g of ammonium chloride (NH_4Cl), 3 g potassium phos- phate (KH_2PO_4), and 20 g sodium chloride (NaCl) was dissolved into MilliQ water by adjusting the pH with 10 M NaOH to 6.8. As a solidifying agent, 9 g of agar noble (Difco) were added to the solution. We found that the more commonly used solidifying agents, agarose, and agar also led to a discoloration of the CAS dye, likely owing to higher phosphate content. The volume was adjusted to 860 mL, and the solution was autoclaved. After cooling, 30 mL of a sterile 10% (wt/vol) Casamino acids (Difco) aqueous solution and 10 mL of a sterile 20% (wt/vol) glucose aqueous solutions were added. Finally, the 100 mL of CAS-Fe- HDTMA were added to the growth media. The final concentrations of the CAS-agar components are as follows: 100 mM pipes,18mm NH_4Cl, 22mm KH_2PO_4. 2% (wt/vol) glucose, 10mm $FeCl_3$, 58mm CAS, 80mm HDTMA.

Conventional paper-disc agar diffusion assays were used for investigating, Sterilized filter paper discs, 10 mm in diameter, were placed on overnight agar plate in sterile conditions. A 10

μL supernatant achieved by centrifuging of fermentation broth of strain QM3 at 11,000 g for 15 min was diffused onto a paper disc. The uninoculated plates of CAS-agar as control were incubated under the same conditions as described previously. All these experiments were made at least three times with three replicates for each one. The CAS reaction was determined by measuring the position or distance of the advancing color-change front (in centimeter) in the CAS-blue agar, starting from the center of the paper-disc after incubation times. The clone diameter (CD) of strain QM3 (growth reaction) and orange halo diameter (HD) (CAS reaction) .

III.   RESULTS AND DISCUSSION

Twelve isolates were selected to check the siderophore activity, the strains were grown in LB media. These isolates were then sub-cultured for isolation in pure culture form and CAS assay was performed using these different strains.

When the strains were incubated on CAS agar plates the following three responses were observed: no growth, growth but no halos surrounding colonies, and growth and small to large orange halos surrounding the colonies illustrated in figure-1. Results were visually distinct in terms of halo formation, because there was a contrast of orange halos against the blue medium. Very few polymer bacteria showed siderophore activity, Consequently in the presence of HDTMA, CAS is competitive in chelating the metal below neutral pH, while ferric hydroxide seems to have a higher stability at pH values above 7. When orange halos from isolates were compared with pure strain of Rhizobium meliloti it was found that the diameter of orange halos from all isolates were less than the pure strain.

Figure 1: Isolates showing siderophore activity by producing orange colour.

Since the assay is based on the competitive exchange of iron (III), potential chelators are detectable corresponding to their affinity for the metal i.e., strong chelators like siderophores react in a 1: 1 ratio, while weaker ones need to be present in an excess. Hence, it is conceivable that, at least at higher concentrations, transition metal binding metabolites, especially antitumor antibiotics such as bleomycin, Adriamycin, and streptonigrin could also be detected.

However, it is difficult to grow fastidious microorganisms on the CAS agar plate and some ingredients of the CAS agar have innate antibacterial activity. The detergent HDTMA used in the preparation of CAS medium proved to be toxic to some bacteria as indicated by small halo formation in case of mixed rhizobial culture.

IV.   CONCLUSION

In conclusion, the CAS assay on solid medium can be a useful tool for screening siderophore producer microorganisms. Although very little polymer bacteria showed siderophore production. It is simpler and cheaper but can offset the effect of inoculation on siderophore by using paper-disc diffusion. We have shown that the choice of substrate is crucial for the evaluation of siderophore production of microorganisms.

Particularly, strain QM3, a potential use in biocontrol, is evaluated to improve of siderophore production.

REFERENCES

[1] Kamnev.A.A., Vander Lelie. D., 2000. Chemical and biological parameters as tools to evaluate and improve heavy metal phytoremediation. Biosci. Rep. 20, 239-258.

[2] Lankford, C.E. (1973). Bacterial assimilation of iron. Critical reviews in Microbiology, 2, 273-331.

[3] Neilands, J.B. (1981). Iron adsorption and transport in microorganisms. Annu. Rev. N utr. 1, 27-46.

[4] Soil Sci. Soc. Am. 42, 421-428. Lindsay, W.L., and Schwab, A.P. (1982).

AUTHORS

First Author – Chaitanya.K, Research scholar, University College of Science, India.
Second Author – Mahmood.S.K, Head, Dept of botany, Nizam College, India
Third Author – Ranakausar, Head, Board of studies, Dept of Botany, Osmania University, India.
Fourth Author – Sunil Kumar.N, Head, Dept of Biotechnology, GRIET, India.
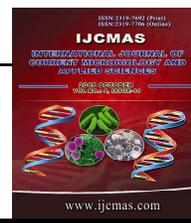
Original Research Article

Extracellular Lignocellulolytic Enzymes by *Phanerochaete chrysosporium* (MTCC 787) Under Solid-State Fermentation of Agro Wastes

Sai Prashanthi Govumoni[1], Jahnavi Gentela[1], Sravanthi Koti[1], V. Haragopal[3], S.Venkateshwar[2] and L.Venkateswar Rao[1]*

[1]Department of Microbiology, Osmania University, Hyderabad, Telangana State, India
[2]Methodist College of Engineering & Technology, Hyderabad, Telangana State, India
[3]Department of Statistics, Osmania University, Hyderabad, Telangana State, India
*Corresponding author

A B S T R A C T

Keywords

Lignocellulosic
substrate,
Laccase,
Xylanase,
Cellulase,
Solid state
fermentation,
*Phanerochaete
chrysosporium*

The aim of this work is to study the production of lignocellulolytic enzymes by *Phanerochaete chrysosporeum* (MTCC 787) during solid state fermentation using five lignocellulosic substrates like wheat straw, rice straw, sorghum straw, corn cobs and *Prosopis juliflora*. This is the first report demonstrating the production of laccase, xylanase and cellulase simultaneously using various substrates by *P. chrysosporium*. The enzyme activities were observed in a medium containing 10 g of each substrate, moistened with malt extract broth and incubated for 13 days at 30°C. Among the five agro-residues used, the maximum laccase activity of 10.5 ± 0.4 IU/ml was achieved on 11th day of fermentation using wheat straw when compared with rice straw, *Prosopis*, sorghum and corn cobs. The maximum xylanase activity of 28.5 ± 1.1 IU/ml was obtained on 9th day using corn cobs, with wheat straw it was 20.4 ± 0.9 IU/ml and sorghum showed lowest xylanase activity. Rice straw was found to be most effective for cellulase production resulting in 1.6 ± 0.06 IU/ml on 5th day of fermentation compared to other five substrates. The data when analyzed by three-way ANOVA showed that the enzyme activities were significant for all substrates.

Introduction

There are numerous organisms that rely on biomass degradation for their survival. Current commercial products for biomass treatment are derived from fungi as these organisms produce a complex mixture of enzymes at high productivity and catalytic efficiency, both of which are required for low-cost enzyme supply (Sandra T. Merino, and Joel Cherry, 2007).

Among the microbial populations, fungi are recognized as the prominent source by the researchers, due to their extreme facility in producing a large variety of extracellular enzymes and easy handling; among them wood-rotting Basidiomycete fungi are identified as the best degrader of lignocellulosic materials (Arrivukkarasan Sanjeevirayar *et al.,* 2014-15).

Fungi have two types of extracellular enzymatic systems; the hydrolytic system, which produces hydrolases that are responsible for polysaccharide degradation and a unique oxidative and extracellular ligninolytic system, which degrades lignin and opens phenyl, rings (Carmen Sánchez, 2009). The White rot fungi have the ability to produce laccase, xylanase and cellulase that act together to degrade the components of lignocelluloses. The role of laccase is in lignin degradation (Tien and Kirk, 1984) while xylanase and cellulase are involved in hemicellulose and cellulose degradation. The hyphae of the white rot fungi penetrates inside the lignocellulosic wood and its extracellular enzymatic activity effectively catalyses the degradation. Therefore their application in the bioconversion of agricultural by-products rich in lignocellulose has attracted much attention (Agosin *et al.,* 1985). The white-rot basidiomycete *Phanerochaete chrysosporeum* has been studied widely because of its ability to degrade lignocelluloses as reviewed by Kirk and Farrell (1987). Recent works have shown that the enzyme production has increased using basidiomycetes on lignocellulosic substrates.

Laccases (E.C. 1.10.3.2, *p*-benzenedial: oxygen oxido reductases) are able to catalyze the oxidation of various aromatic compounds with the concomitant reduction of oxygen to water. There have been reports on the production of extracellular laccases by many species of white rot fungi when grown on natural substrates such as cotton stalk (Ardon *et al.,* 1996), molasses waste (Kahraman and Gurdal, 2002), wheat bran and barley bran. Laccase has received much attention because of its relatively low substrate specificity in comparison to most of the enzymes. Xylanases (E.C.3.2.l.8) are inducible enzymes which are responsible for

complete hydrolysis of xylan, the major component of the hemicellulosic complex. Different lignocellulosic substrates, such as wheat bran and other agro-wastes, have been used as substrates to produce high yields of xylanolytic enzymes using solid state fermentation (Dobrev *et al.,* 2007). Cellulases, a group of hydrolytic enzymes, hydrolyse the β-glycosidic bonds of native cellulose and related cello-oligosaccharides. It is the key enzyme of potential use for industrial saccharification of cellulosic materials into simple sugars.

The interest towards lignocellulolytic enzymes has been dictated by their wide applications in various fields of industries (Godfrey and West, 1996), particularly in bioremediation, biosensor developments (Nelson and Elisa, 2000; Nelson *et al.,* 2002) and also bioethanol production (Govumoni *et al.,* 2013). However, for effective lignocellulolytic enzyme production it is very important to exploit efficient microorganism with suitable fermentation methods using cheap and abundantly available substrates.

Solid substrate fermentation is a promising technique for the production of industrially-relevant enzymes from large numbers of agro-industrial wastes using different organisms (Rodriguez Couto and Sanroman, 2005). Solid substrate fermentation has gaining importance in enzyme production because of its higher product titers, reduced energy requirements, simpler fermentation media and operating expenses as compared with submerged fermentation (Pandey *et al.,* 2001).

Some species could produce laccase and xylanase while having low activity of cellulase. This property will be beneficial for the removal of xylan from lignin-carbohydrate complexes which will facilitate

the separation of lignin from the fiber cell wall (Maheshwari *et al.,* 2000). Therefore, the present work is focused on the production of lignocellulolytic enzymes (Laccase, xylanase and cellulase) by *Phanerochaete chrysosporeum* (MTCC 787) using low cost lignocellulosic agro-based residues such as wheat straw, rice straw, corn cobs, sorghum straw and *Prosopis juliflora* under solid state fermentation.

Materials and Methods

Organism

The white rot fungi *Phanerochaete chrysosporeum* (MTCC 787) was procured from Institute of Microbial Technology, Chandigarh, India.

Media and growth conditions

P. chrysosporium culture was cultivated on malt extract agar. The medium contained (g/l): glucose, 5.0; malt extract, 2.0; yeast extract, 2.0; NH_4NO_3, 1; KH_2PO_4, 0.8; Na_2HPO_4, 0.2 and $MgSO_4.7H_2O$, 0.5 was autoclaved and the tubes were inoculated and incubated at 37°C for 3 days to allow the spores to germinate.

Substrates used for fermentation process

Wheat straw, rice straw, sorghum straw, corn cobs and *Prosopis juliflora* were screened to identify the suitable substrate for production of lignocellulolytic enzymes in solid-state fermentation. Substrates were oven dried at 50ºC.

Solid state fermentation using different substrates

Fermentation was carried out by mixing 10 g of each substrate with malt extract broth to attain the required moisture. The moisture content was optimized and 80% was chosen

for experimentation. The flasks were autoclaved prior to inoculation with five agar plugs (8mm in diameter) of fungal colony grown on malt extract agar. After mixing, all flasks were incubated at 30 °C, maintained in triplicate and harvested on alternate day from 3rd day onwards till 13th day.

Enzyme extraction

A 0.05M acetate buffer (pH- 4.8) was added in each flask (1:20) and kept on a shaker at 150 rpm for 1 h. The content was filtered through filter paper and centrifuged at 10,000 rpm at 4 °C for 30 min and the supernatant was used to perform enzyme assays.

Analytical methods

Laccase activity was determined as described by Vasdev and Kuhad (1994). The reaction mixture contained 1.8 ml of 10 mM guaiacol in 0.05M acetate buffer (pH 5.0), and 0.2 ml crude enzyme solution. The reaction mixture was incubated at 26 °C for 30 min in dark and the absorbance was read at 470 nm. The buffer devoid of guaiacol was treated as blank. One unit of laccase activity was defined as the change in absorbance of $0.01mL^{-1}$ min^{-1}. Xylanase activity was measured with method described by Bailey *et al.* (1992). The reaction mixture contains 1.8 ml of 1.0% (w/v) birch wood xylan in 0.05M acetate buffer (pH 4.8) and 0.2 ml of appropriately diluted crude enzyme solution, were incubated at 50°C for 10 min and the reducing sugars were assayed by dinitrosalicyclic acid (DNSA) method of Miller (1959). One unit of xylanase was defined as the amount of enzyme to release 1 µmol of xylose per ml per minute. Cellulase activity (FPase) was determined in accordance with the International Union of Pure and Applied Chemistry procedures as

reported by Ghosh (1987). FP cellulase activity was assayed by measuring the release of reducing sugars in a reaction mixture containing Whatman No. 1 filter paper (50.0 mg) as substrate in 50 mM sodium citrate buffer (pH 4.8) at 50°C, after 60 min. Reducing sugars were assayed by dinitrosalicyclic acid (DNSA) method of Miller (1959). One unit of enzyme corresponds to the amount of enzyme to release 1 μmol of glucose per ml per minute.

Statistical analysis

All the experiments were performed in triplicates and the results were represented as mean ± standard deviation. Data was subjected to three-way Analysis of Variance (ANOVA) using the Statistical Package for Social Sciences (SPSS) version 19.

Results and Discussion

Chemical composition of lignocellulosic substrates

The main components of the feed stocks listed in table 1 are lignin, cellulose and hemicellulose. The highest content of lignin (24.6%), cellulose (45.5%) was found in *Prosopis juliflora* and hemicelluloses (37%) in corn cobs when compared with other substrates. In general lignocelluloses can be utilized by fungi as support nutrient and also as an inducer for enzyme production.

The enzyme activities on the lignocellulosic substrates were monitored for a period of 13 days. The results of enzyme activities varied markedly with the substrates, in the range of 10.5–0.04 IU/ml for laccase (Table 2), 28.5–2.55 IU/ml for xylanase (Table 3) and 1.61–0.01 IU/ml for cellulase (Table 4) at different incubation periods.

Laccase enzyme activity was less on 3rd day of incubation and increased up to 11th day,

thereafter showing a declining trend. Decrease in laccase activity may be due to the toxicity of lignin degradation products such as phenolic compounds, located in polymer structure of lignin, which probably reduces the growth of the organism and the production of laccase. Similar result was observed by Chmelova *et al.* (2011) using the organism *Ceriporiopsis subvermispora*. Jasmina Cilerdzic *et al.* (2011) reported laccase activity of 2500 IU/L and 910 IU/L with corn stalks and wheat straw using *Tramatus hirusta*. In the current study, maximum laccase activity of 10.5± 0.4 IU/ml was achieved on 11th day using wheat straw as the substrate (Figure 1), it was reduced to 4.41 ± 0.2 IU/ml on 13th day of incubation. It is also evident from the graphical depiction that the organism exhibited greater activities of the enzyme on wheat straw as compared with other substrates at all incubation periods. In the present work, rice straw was found to produce laccase activity of 6.89 ± 0.31 IU/ml on the 11th day of fermentation, whereas according to Abdul Kareem Jasim Hashim (2012) laccase activity of 0.55 U/ml was obtained with sawdust using *Pleurotus ostreatus* on 15th day of fermentation. Sorghum straw, corn cobs and *Prosopis juliflora* showed high laccase activity of 3.88 ± 0.106 IU/ml, 3.47 ± 0.14 IU/ml and 6.23m ± 0.23 IU/ml on 9th day of fermentation respectively. Massimiliano Fenice *et al.* (2003) reported the laccase activity of 1309 ± 20 IU/L on 9th day of fermentation from white-rot fungus *Panustigrinus* using olive-mill wastewater.

In the current study, *P. chrysosporium* produced maximum xylanase activity of 28.58 ± 1.11 IU/ml on 9th day of fermentation using corn cobs as a substrate (Figure 2), the same organism when used by Broda *et al.* (1996), resulted in the xylanase activity of 0.669 IU/ml on 15th day using paddy straw. From the above study it can be

concluded that corn cobs was found to be potential substrate for xylanase production. Christakopoulos *et al.* (1996); Singh *et al.* (2000) also considered corn cobs to be an ideal substrate for xylanase production. In a study conducted by Uma Gupta and Rita Kar (2009) xylanase production was done using corncobs with *Bacillus* sp., however, the xylanase activity of 9.88 IU/ml was obtained after 48 h, it was found to be less when compared with the present study.

After corn cobs, wheat straw and rice straw showed enzyme activity of 20.49 ± 0.98 IU/ml and16.11 ± 0.75 IU/ml on 9th day of fermentation. *Penicillium oxalicum* produced xylanase activity of 2.52 IU/ml using rice straw as a substrate under SSF (Muthezhilan *et al.,* 2007). The xylanase activity with sorghum straw and *Prosopis juliflora* were 13.35 ± 0.54 IU/ml and 15.09 ± 0.59 IU/ml on 11th day of fermentation.

Table.1 Chemical composition of lignocellulosic substrates

Lignocellulosic substrate	Lignin (%)	Cellulose (%)	Hemicellulose (%)	Reference
Wheat straw	20.6	32.6	24.7	Govumoni *et al.* (2013)
Rice straw	12	35	22	Srilekha Yadav *et al.* (2011)
Sorghum straw	11	30	31	Theander and Aman (1984)
Corn cobs	16.4	39.1	37	Mingjia Zhang *et al.* (2010)
Prosopis juliflora	24.6	45.5	20.3	Rishi Gupta *et al.* (2009)

Table.2 Laccase production under solid state fermentation using *P. chrysosporium* 787

Lignocellulosic Substrate	Laccase activity (IU/ml)					
	3rd Day	5th Day	7th Day	9th Day	11th Day	13th Day
Wheat straw	0.31±0.015	0.78±0.040	1.28±0.046	3.22±0.104	10.5±0.40	4.41±0.20
Rice straw	0.08±0.004	0.16±0.007	0.27±0.015	0.98±0.041	6.89±0.31	1.39±0.06
Sorghum straw	0.18±0.007	0.32±0.010	1.26±0.061	3.88±0.106	0.22±0.008	0.17±0.007
Corn cobs	0.04±0.002	0.16±0.006	0.92±0.036	3.47±0.14	0.12±0.004	0.11±0.004
Prosopis juliflora	0.06±0.003	0.08±0.003	1.19±0.054	6.23±0.23	2.2±0.055	0.84±0.030

Analyses were carried out in triplicate, Values are mean± standard deviation

Table.3 Xylanase production under solid state fermentation using *P. chrysosporium* 787

Lignocellulosic Substrate	Xylanase activity (IU/ml)					
	3rd Day	5th Day	7th Day	9th Day	11th Day	13th Day
Wheat straw	8.33±0.38	17.91±0.20	18.55±0.90	20.49±0.98	16.55±0.71	2.55±0.11
Rice straw	5.33±0.26	3.47±0.09	11.52±0.47	16.11±0.75	11.99±0.57	6.52±0.20
Sorghum straw	6.15±0.26	8.12±0.33	10.64±0.42	6.66±0.29	13.35±0.54	5.64±0.28
Corn cobs	8.77±0.44	9.41±0.30	12.06±0.48	28.58±1.11	17.87±0.74	10.13±0.3
Prosopis juliflora	8.24±0.27	7.24±0.27	12.67±0.58	10.87±0.43	15.09±0.59	9.65±40. 5

Analyses were carried out in triplicate, Values are mean± standard deviation

Table.4 Cellulase production under solid state fermentation using *P. chrysosporium* 787

Lignocellulosic Substrate	Cellulase activity (IU/ml)					
	3rd Day	5th Day	7th Day	9th Day	11th Day	13th Day
Wheat straw	0.13±0.021	0.45±0.02	0.22±0.009	0.14±0.007	0.02±0.001	0.01±0.002
Rice straw	0.19±0.007	1.61±0.065	0.91±0.025	0.08±0.004	0.05±0.002	0.04±0.002
Sorghum straw	0.02±0.012	0.14±0.005	0.11±0.006	0.02±0.002	0.01±0.002	0.01±0.002
Corn cobs	0.04±0.009	0.12±0.186	0.09±0.005	0.04±0.002	0.02±0.001	0.01±0.001
Prosopis juliflora	0.08±0.008	0.13±0.007	0.09±0.006	0.05±0.002	0.04±0.002	0.03±0.002

Analyses were carried out in triplicate, Values are mean± standard deviation

Table.5 Analysis of variance for lignocellulosic substrates, enzymes and days

	SS	df	MS	F	Sig.
Day	54.610	5	10.922	2279.502	.000
Substrate	32.081	4	8.020	1673.871	.000
Enzyme	146.160	2	73.080	15252.188	.000
Day * Substrate	84.808	20	4.240	884.994	.000
Day * Enzyme	156.607	10	15.661	3268.482	.000
Substrate * Enzyme	49.189	8	6.149	1283.258	.000
Day * Substrate * Enzyme	179.272	40	4.482	935.375	.000
Error	.862	180	.005		
Corrected Total	703.589	269			

*p ≤0.05
SS – sum of squares; df – degrees of freedom; MS – mean square

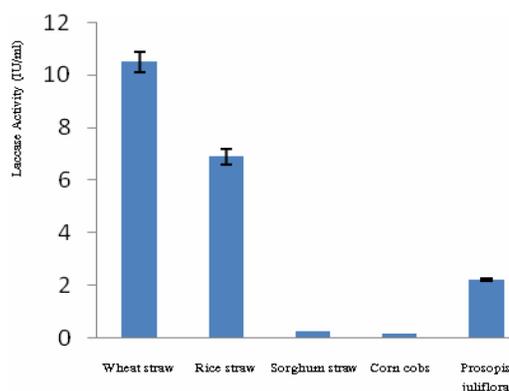**Figure.1** Laccase production of *P. Chrysosporium* 787 incubated on 11th day of fermentation

Figure.2 Xylanase production of *P. Chrysosporium* 787 incubated on 9th day of fermentation
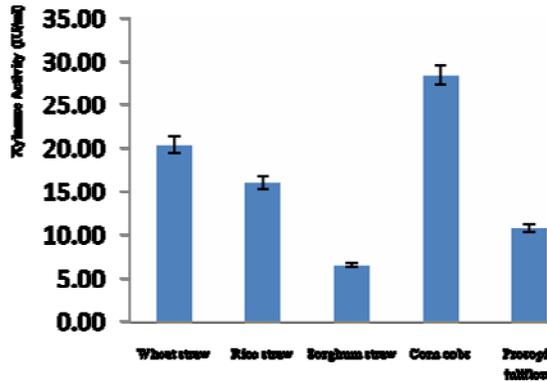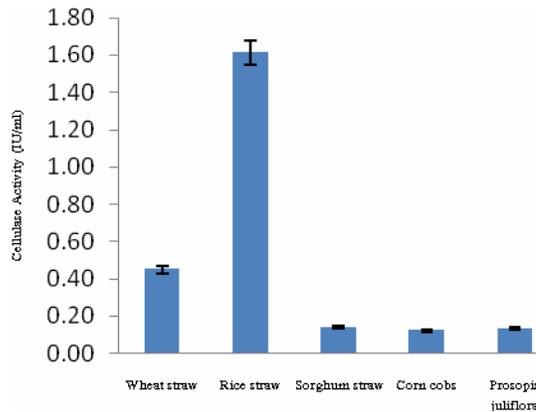

Figure.3 Cellulase production of *P. Chrysosporium* 787 incubated on 5th day of fermentation

The maximum cellulase production was obtained on 5th day of incubation and decreased on further incubation for all the five lignocellulosic substrates. Among the five agro-residues used, rice straw was found to be the most effective for cellulase production resulting in 1.61 ± 0.06 IU/ml (Figure 3), similar result was obtained during solid state fermentation of rice straw using *P. chrysosporium* which produced the highest cellulase enzyme of 1.43 IU/ml on 4th day (Munir *et al.,* 2007). After rice straw, wheat straw showed an activity of 0.45 ± 0.02 IU/ml on 5th day of fermentation, similar result was reported by Ashish vyas and Deepak vyas (2005) with the combination of *Aspergillus terreus* and *Tramatus viride* using ground nut shell as substrate. According to Mohammad Rizwan Pervez (2011), *Rhizopus* sp. gave maximum cellulase activity of 1.58 IU/ml in 120 h of incubation under solid state fermentation using sugarcane bagasse. Cellulase activity of other substrates were found to be 0.14 ± 0.005 IU/ml, 0.12 ± 0.018 IU/ml and 0.13 ± 0.009 IU/ml on 5th day of fermentation using sorghum straw, corn cobs and *Prosopis juliflora* respectively. Though the cellulose content is in low amounts in rice straw, the cellulase activity was high when compared with *Prosopis* and corn cobs. According to Krishna (2005) the type and composition of the carbohydrates present in rice straw are suitable for the induction of cellulases in filamentous fungi under solid-state fermentation. The cellulase production by *P.*

chrysosporeum was found to be low when grown on other lignocellulosic materials like corncobs and *P. juliflora*.

It is suggested that *P. chrysosporeum* utilizes cellulose and hemicellulose as carbon source during the initial growth phase which results in the production of cellulase on 5th day and xylanase on 9th day of fermentation. As the level of carbon source decreases, induction of laccase synthesis initiates, which finally results in the increase of laccase production on 11th day (Machuca and Ferraz 2001). In comparison between laccase, xylanase and cellulase, it is evident that the production of xylanase was approximately two times higher than laccase and eighteen times higher than cellulase. Similar result was achieved by Souza-Cruz *et al.* (2004) and Heidorne *et al.* (2006).

Statistical analysis

This study accentuates the necessity of screening of substrate having different structural constituents to disclose the actual potential of the white rot fungus expressing the lignocellulolytic enzymes. ANOVA was used to analyze the results of the experiment and to determine the variation. The statistical analysis revealed that the substrates were highly significant for the production of three enzymes. Jeffries (1994) stated that the composition and percentages of polymers vary from one plant species to another.

Multiple comparisons was performed between the three enzymes, substrates and days to know their pair wise effect, it was found that all the pairs differ significantly, indicating that they have no similarities among them. From table 5, the F value shows that the model is significant at a 95% confidence level. The p-value being less than 0.05 (<0.0001) indicates that the model

is significant. This means that the variables had a significant effect on the response. The outstanding ability of secreting the varieties of hydrolytic and oxidative enzymes by White rot fungi makes them to grow efficiently on the lignocellulosic substrates and they are very indispensable for lignin, cellulose and hemicellulose degradation. Moreover, their secretion pattern depends upon the nature of substrates, organisms employed and nature of the cultivation mode (Arrivukkarasan Sanjeevirayar *et al.,* 2014-15). When laccase production was performed with five different substrates, the activity of laccase in all substrates was significant except in pair of sorghum straw and corncobs. This shows that laccase production is highly affected even by the nature and composition of the lignocellulosic substrate. As far as the production of xylanase is concerned, the pair wise combinations of all five different substrates were found to be significant. In the production of cellulase, no significant difference can be observed in the pair wise combination of sorghum straw, corncobs and *prosopis juliflor*a. The combinations between other substrates were observed to be significant.

In conclusion, most researchers have investigated the effect of lignocellulosic materials on individual enzymes using solid-state fermentation. As per our literature survey, this is the first report showing the production of laccase, xylanase and cellulase using various lignocellulosic substrates by *P. chrysosporeum*.

The organism can be grown on low cost agricultural wastes and was found to be a promising strain for the production of commercial enzymes. It is evident from experimental and statistical analysis in the present study that, among five different substrates used, wheat straw, corn cobs and

rice straw can serve as the best solid substrates for production of laccase, xylanase and cellulase enzymes respectively by *P. chrysosporeum.*

Reference

Abdul Kareem Jasim Hashim, 2012. Determination of optimal conditions for laccase production by *Pleurotus ostreatus* using sawdust as solid medium and its use in phenol degradation. *J. Baghdad. Sci.,* 9(3).

Agosin, E., Daudin, J.J., Odier, E. 1985. Screening of white-rot fungi on (14C) lignin-labelled wheat straw and (14C) whole-labelled wheat straw. *Appl. Micro. Boil. Biotechnol.,* 22: 132–138.

Ardon, O., Kerem, Z., Hadar, Y. 1996. Enhancement of the laccase activity in liquid cultures of the ligninolytic fungus *Pleurotus ostreatus* by cotton stalk extract. *J. Biotechnol.,* 51: 201–207.

Arrivukkarasan Sanjeevirayar, Bakkiyaraj Selvaraj, Aravindan Rajendran, 2014-15. Laccase production using mixed substrates containing lignocellulosic materials by *Pleurotus ostreatus* in submerged liquid culture. *Int. J. Chem. Tech. Res.,* 07(01): 355–368.

Ashish vyas, Deepak vyas, 2005. Production of fungal cellulases by solid state bioprocessing of ground nut shell wastes. *J. Sci. Ind. Res.,* 64: 767–770.

Bailey, M.J., Biely, P., Poutanen, K. 1992. Inter laboratory testing of methods for assay of xylanase activity. *J. Biotechnol.,* 23: 257–270.

Broda, P., Brich, P.R.J., Brooks, P.R., Sims, P.F.G. 1996. Lignocelluloses degradation by *phanerochaete chrysosporium*: gene families. *Mol. Microbiol.,* 19: 923–932.

Carmen Sánchez, 2009. Lignocellulosic residues: Biodegradation and bioconversion by fungi. *Biotech. Adv.,* 27: 185–194.

Chmelova, D., Ondrejovic, M., Ondas, V., Sturdik, E. 2011. Influence of cultivation conditions on production of lignocellulolytic enzymes by *Ceriporiopsis subvermispora. Biol.,* 66: 748–754.

Christakopoulos, P., Mamma, D., Nerinckx, W., Kekos, D., Macris, B.J., Claeyssens, M. 1996. Production and partial characterization of xylanase from *Fusarium oxysporum. Bioresour. Technol.,* 58: 115–119.

Dobrev, G.T., Pishtiyski, I.G., Stanchev, V.S., Mircheva, R. 2007. Optimization of nutrient medium containing agricultural wastes for xylanase production by *Aspergillus niger* B03 using optimal composite experimental design. *Bioresour. Technol.,* 98: 2671–2678.

Ghosh, T.K. 1987. Measurement of cellulase activities. *Pure. Appl. Chem.,* 59: 257–268.

Godfrey, T., West, S. 1996. Textiles. In: Industrial enzymology, 2nd edn. Macmillan Press, London, UK. Pp. 360–371.

Govumoni, S.P., Sravanthi, Koti, Srilekha Yadav, Kothagouni, Venkateshwar, S., Venkateswar Rao, Linga, 2013. Evaluation of pretreatment methods for enzymatic saccharification of wheat straw for bioethanol production. *Carbohydr. Polymers,* 91: 646– 650.

Heidorne, Magalhaes, F.O., Ferraz, P.O., Milagres, A.L. 2006. Characterization of hemicellulases and cellulases produced by *Ceriporiopsis*

subvermispora grown on wood under biopulping conditions. *Enzyme Microb. Technol.,* 38: 436–442.

Jasmina Cilerdzic, Mirjana stajic, Jelena Vukojevic, Sonja Duletic-Lausevic, Aleksandar Knezevic, 2011. Potential of *tramatus hirusta* to produce lignolytic enzymes during degradation of agricultural residues. *Bioresources,* 6(3): 2885–2895.

Jeffries, T.W. 1994. Biodegradation of lignin and hemicelluloses. *Biochem. Microb. Degrad.,* Pp. 233–277.

Kahraman, S.S., Gurdal, I.G. 2002. Effect of synthetic and natural culture media on laccase production by white rot fungi. *Bioresour. Technol.,* 82: 215–217.

Kirk, T.K., Farrell, R.L. 1987. Enzymatic combustion: the microbial degradation of lignin. *Ann. Rev. Microbiol.,* 41: 465–505.

Krishna, C. 2005. Solid state fermentation systems - an overview. *Crit. Rev. Biotechnol.,* 25: 1–30.

Machuca, A., Ferraz, A. 2001. Hydrolytic and oxidative enzymes produced by white- and brown rot fungi during *Eucalyptus grandis* decay in solid medium. *Enzyme Microb. Technol.,* 29: 386–391.

Maheshwari, R., Bharadwaj, G., Bhat, M.K. 2000. Thermophilic fungi: their physiology and enzymes. *Micro. Boil. Mol. Biol. Rev.,* 64(3): 461–488.

Massimiliano Fenice, Giovanni Giovannozzi Sermanni, Federico Federici, Alessandro D'Annibale, 2003. Submerged and solid-state production of laccase and Mn-peroxidase by Panustigrinus on olive mill wastewater-based media. *J. Biotechnol.,* 100: 77–85.

Miller, G.L. 1959. Use of dinitrosalicylic acid reagent for determination of reducing sugar. *Anal. Chem.,* 31(3): 426–428.

Mingjia Zhang, Wei Qi, Rui Liu, Rongxin Su, Shaomin Wu, Zhimin He, 2010. Fractionating lignocellulose by formic acid: Characterization of major components. *Biomass Bioenergy,* 34: 525–532.

Munir, H.M.D., Khani, S., Ali, A., Fakhru-Razi, M.D., Alam, Z. 2007. Use of fungi for the bioconversion of rice straw into cellulase enzyme. *J. Environ. Sci. Health. B.,* 42: 381–386.

Muthezhilan, R., Ashok, R., Jayalakshmi, S. 2007. Production and optimization of thermostable alkaline xylanase by *Penicillium oxalicum*in solid state fermentation. *Afr. J. Microbiol.,* Pp. 020–028.

Nelson, D., Elisa, E. 2000. Potential applications of oxidative enzymes and Phenol oxidase-like compounds in wastewater and soil treatment. *Appl. Catalysis. B. Environ.,* 28: 83–99.

Nelson, D., Maria, A.R., Alessandro, D., Liliana, G. 2002. Applications of laccases and tyrosinases (phenoloxidases) immobilized on different supports. *Enzyme Microb. Technol.,* 31: 907–931.

Pandey, A., Soccol, C.R., Rodriguez-Leon, J.A., Nigam, P. 2001. Solid-state fermentation in biotechnology. Asiatech Publishers. 221 Pp.

Rishi Gupta, Krishna Kant Sharma, Ramesh Chander Kuhad, 2009. Separate hydrolysis and fermentation (SHF) of *Prosopis juliflora*, a woody substrate, for the production of cellulosic ethanol by *Saccharomyces cerevisiae* and *Pichia stipitis*-NCIM 3498. *Bioresour. Technol.,* 100(3): 1214–1220.

Rizwan Pervez, M. 2011. Optimization of Cellulase production under Solid state fermentation (SSF) from an isolated strain of *Rhizopus sp*. JBT. *Aian. J. Biotechnol. Res.,* 2(6): 767–774.

Rodriguez Couto, S., Sanroman, M.A. 2005.

Application of solid state fermentation to ligninolytic enzyme production. *Biochem. Eng. J.,* 22: 211–219.

Sandra, T. Merino, Joel Cherry, 2007. Progress and Challenges in Enzyme Development for Biomass Utilization. *Adv. Biochem. Eng. Biotechnol,* 108: 95–120.

Singh, S., Pillay, B., Dilsook, V., Prior, B.A. 2000. Production and properties of hemicellulases by a *Thermomyces lanuginosus* strain. *J. Appl. Microbiol.,* 88: 975–982.

Souza-Cruz, P., Freer, J., Siika-Aho, M., Ferraz, 2004. Extraction and determination of enzymes produced by *Ceriporiopsis subvermispora* during biopulping of Pinus taeda wood chips. *Enzyme Microb. Technol.,* 34: 228–234.

Srilekha Yadav, K., Shaik Naseeruddin, Sai Prashanthi, G., Lanka Sateesh, Venkateswar Rao, L. 2011. Bioethanol fermentation of concentrated rice straw hydrolysate using co-culture of *Saccharomyces cerevisiae* and *Pichia stipitis*. *Bioresour.Technol.,* 102: 6473–6478.

Theander, O., Aman, P. 1984. Straw and other fibrous by-products as feed. Sundstal, Owen (Ed). Elsevier, Amsterdam. Pp. 45–78.

Tien, M., Kirk, T.K. 1984. Lignin-degrading enzyme from *Phanerocheate chrysosporium*: purification, characterization, and catalytic properties of a unique H_2O_2-requiring oxygenase. *Proc. Natl. Acad. Sci. U. S. A.,* 81: 2280–2374.

Uma Gupta, Rita Kar, 2009. Xylanase production by a thermo-tolerant *Bacillus* species under solid-state and submerged fermentation. *Braz. Arch. Boil. Technol.,* 52(6): 1363–1371.

Vasdev, K., Kuhad, R.C. 1994. Induction of laccase production in *C. bulleri* under shaking and static culture conditions. *Folia. Microbiol.,* 39(4): 326–330.