Proceeding
Of
3rd International Conference on Computer Science and Information Technology (ICCIT 2015),

3rd International Conference on Progress in Production, Mechanical and Automobile Engineering (ICPMAE-2015),

3rd International Conference on Innovations in Electrical and Electronics Engineering (ICIEEE 2015),

3rd International Conference on Biotechnology, Civil and Chemical Engineering (ICBCCE 2015)

Date: 1st February 2015
Goa

Editor-in-Chief

Dr. Rajeev Agrawal
Assistant Professor,
Department of Production Engineering
Birla Institute of Technology
Ranchi, Jharkhand

Organized by:

TECHNICAL RESEARCH ORGANISATION INDIA
Website: www.troindia.in

ISBN: 978-93-85225-02-4

About Conference

Technical Research Organisation India (TROI) is pleased to organize the 3rd International Conference on Computer Science and Information Technology (ICCIT 2015), 3rd International Conference on Progress in Production, Mechanical and Automobile Engineering (ICPMAE-2015),3rd International Conference on Innovations in Electrical and Electronics Engineering (ICIEEE 2015) & 3rd International Conference on Biotechnology, Civil and Chemical Engineering (ICBCCE 2015).

ICCIT & ICPMAE is a comprehensive conference covering the various topics of Engineering & Technology such as Computer Science, Mechanical and IT. The aim of the conference is to gather scholars from all over the world to present advances in the aforementioned fields and to foster an environment conducive to exchanging ideas and information. This conference will also provide a golden opportunity to develop new collaborations and meet experts on the fundamentals, applications, and products of Computer science, IT and Mechanical. We believe inclusive and wide-ranging conferences such as ICIEEE can have significant impacts by bringing together experts from the different and often separated fields of Electrical & Electronics. It creating unique opportunities for collaborations and shaping new ideas for experts and researchers. This conference provide an opportunity for delegates to exchange new ideas and application experiences, we also publish their research achievements. ICIEEE & ICBCCE shall provide a plat form to present the strong methodological approach and application focus on Electrical, Electronics, civil & chemical engineering that will concentrate on various techniques and applications. The ICBCCE conference cover all new theoretical and experimental findings in the fields of Civil, Chemical and Biotechnology engineering or any closely related fields.

Topics of interest for submission include, but are not limited to:

Computer Science & Engineering
Information Technology
Electrical Engineering
Electronics Engineering
Instrumentation Engineering
Industrial Engineering
Mechanical Engineering
Chemical Engineering
Aeronautical Engineering
Environmental Engineering
Nano-Technology,
Genetic Engineering
Materials and Metallurgical Engineering
Soft computing
Aeronautical Engineering
Agricultural engineering
Civil engineering
Engineering Science
Network Engineering
Software Engineering
Structural Engineering
Telecommunication Engineering
And many more....

Organizing Committee

Prof. Shravani Badiganchala

Assistant professor, Shiridi sai institute of science and engineering

Prof. Surjan Balwinder Singh
Associate Professor in the Electrical Engineering Department,
PEC University of Technology, Chandigarh.

Dr. Shilpa Jindal ,
PEC University of Technology (Deemed University), Chandigarh
ji_shilpa@yahoo.co.in

Prof. S. V. Viraktamath
Dept. of E&CE S.D.M. College of Engg. & Technology Dhavalagiri, Dharwad

Subzar Ahmad Bhat
Assistant Professor, Gla University
Dr. G.Suresh Babu
Professor,Dept. of EEE,CBIT, Hyderabad

Prof .Ramesh
Associate Professor in Mechanical Engineering,
St.Joseph's Institute of Technology

Prof.Amit R. Wasnik
Sinhgad Institute of Technology, Pune, Maharashtra

IIT KHARAGPUR
Prof. Rajakumar R. V.
DEAN Acadedemic, rkumar @ ece.iitkgp.ernet.in
Prof. Datta D., ddatta @ ece.iitkgp.ernet.in
Prof. Pathak S S,r,ssp @ ece.iitkgp.ernet.in

XIMB,BHUBANESWAR
Prof Dr. Subhajyoti Ray.M-Stat, (ISI); Fellow, IIM(A),
Dean academic,XIMB-subhajyoti@ximb.ac.in ,

Dr. Hansa Jeswani
Asso. Professor.,
Sardar Patel College of Engineering, Mumbai
Prof. Sunil agrawal

TABLE OF CONTENTS

SL NO	TOPIC	PAGE NO

Editor-in-Chief

Dr. Rajeev Agrawal

1. **INFORMATION RETRIEVAL FROM ONTOLOGY USING NATURAL LANGUAGE INTERFACE**
- [1]Sudarshan Awale, [2]S.J.Karale 01-05

2. **REGENERATIVE BRAKING PRINCIPLE BY USING KINETIC ENERGY RECOVERY SYSTEM –A REVIEW**
- Sameer.G. Patil[1], Rithwik M Singh[2], Suryakant Tripathi[3], Rajkumar Jakhar 06-12

3. **AUTO RECOMMENDATION ENGINE USING HADOOP**
- [1]Mandar Puranik, [2]Sunetra Kanade, [3]Kalyani Raut, [4]Nikita Dange, [5]Prof. Nishigandha Wankhade 13-17

4. **ELECTRONIC EQUIPMENTS COOLING THROUGH RECTANGULAR FIN ARRAY BY USING NATURAL CONVECTION: A REVIEW**
- Sandip S. Kale[1], V. M. Bhatkar[2] 18-22

5. **SEISMIC PERFORMANCE EVALUATION AND RETROFITTING OF RC MEMEBERS AND JOINTS**
- [1]Dr. G.S Suresh, [2]Mr. Sachin V 23-36

6. **BUDGET MONITORING OF RESIDENTIAL BUILDING**
- [1]Ingle Prachi Vinod 37-41

7. **DIVINE NONI – A POTENTIAL NUTRACEUTICAL TO PREVENT OXIDATIVE STRESS INDUCED CATARACT FORMATION IN CHICK LENS EPITHELIAL CELLS**
- Sudhakar Konada[1], Sarvamangala Dhurjeti[2], Satyanarayana Rentala[3], and USN Murthy[4] 42-45

8. **STRESS ANALYSIS OF 4STROKE DIESEL ENGINE PISTON**
- Lanka Tata Rao* [1] , Katakam Satyanarayana[1] , M.S.S.Srinivasa Rao[1,] T.V. Hanumanta Rao[1], S.V.UmamaheswaraRao[2] 46-50

9. **STRESS ANALYSIS OF CRANE HOOK USING FEA**
- B Nagaraju [1], M RajaRoy[1] , P Venkatesh Reddy[1] , K Satyanarayana[1] 51-56

10. **VLSI DESIGN OF FULL SUBTRACTOR USING MULTI-THRESHOLD CMOS TO REDUCE THE LEAKAGE POWER AND GROUND BOUNCE NOISE**
- [1]Pawar Chander, [2]Pokala Santhosh, [3]Prasad Kurhe 57-62

11. **STUDY OF FUZZY LOGIC CONTROLLER AND ITS APPLICATION TO PH NEUTRALIZATION PLANT**
- Mrs.Gayatri K Palnitkar 63-68

12. **SLIDING MODE CONTROLLER DESIGN FOR CONTROLLING THE SPEED OF A DC MOTOR**
- [1]Vyoma Singh, [2]Dr. Veena Sharma 69-73

13. **COLOR IMAGE COMPRESSION USING HIERARCHICAL PREDICTION OF PIXELS**
- [1]P.LOHITHA, [2]T.RAMASHRI 74-77

14. **SLOTTED PIER AS A SCOUR CONTROL MEASURE**
- Dr. Pankaj Goswami[1], Miss Manisha Barua[2] 78-82

Editorial

The conference is designed to stimulate the young minds including Research Scholars, Academicians, and Practitioners to contribute their ideas, thoughts and nobility in these two integrated disciplines. Even a fraction of active participation deeply influences the magnanimity of this international event. I must acknowledge your response to this conference. I ought to convey that this conference is only a little step towards knowledge, network and relationship.

The conference is first of its kind and gets granted with lot of blessings. I wish all success to the paper presenters.

I congratulate the participants for getting selected at this conference. I extend heart full thanks to members of faculty from different institutions, research scholars, delegates, TROI Family members, members of the technical and organizing committee. Above all I note the salutation towards the almighty.

Editor-in-Chief:
Dr. Rajeev Agrawal
Assistant Professor,
Department of Production Engineering
Birla Institute of Technology
Ranchi, Jharkhand

INFORMATION RETRIEVAL FROM ONTOLOGY USING NATURAL LANGUAGE INTERFACE

[1]Sudarshan Awale, [2]S.J.Karale
Dept. of Computer Technology, Yeshwantrao Chavan College of Engg.
Nagpur (Maharashtra), India
Email: [1]sudarshan_awale@yahoo.com, [2]sjkarale@gmail.com

***Abstract*— Information retrieval from triple based ontological database play important role for many organizations. General search engines use keyword based search mechanisms. They retrieve huges amount of data from which sometimes it becomes difficult for users to identify relevant information. Semantic approach can be used to retrieve relevant information from ontological database. Here we have proposed and implemented an information retrieval system based on NL triplet extraction algorithm.**

Index terms — RDF, SPARQL, Ontology, OWL

I. INTRODUCTION

Domain specific question answering systems play significan role in many organizations. General search engines are based on keyword searching mechanisms. It retrieves huge amount of data from which sometimes it become difficult for the users to recognize relevant information. Semantic approach searches information by understanding the intent of user and meaning of words in user query. It uses semantics to produce highly relevant results.

This technique can be used to retrieve information for knowledge bases like ontology. Ontology is a technology used to enable the domain knowledge at a high level and improve the information retrieval time used in question answering system.

User can use ontological concept to search conceptual and semantic information. Ontology plays a significant role to access information, exchange of information, use and reuse of knowledge, sharing of information. Ontology can describe things and their properties and interrelations in a way that computers can process and automate. Ontology provides a knowledge-sharing infrastructure that supports the representation and sharing of domain knowledge. An increasing number of ontologies are being developed, and their reuse and sharing offer several benefits. One important advantaget is that we can subatantially save time and effort by reusing existing ontologies instead of building new ones. Another benefit is that heterogeneous systems and resources can interoperate seamlessly by sharing a common ontology.

II.SEMANTIC APPROACH

Semantic web is an extension of World Wide Web. It allows user to find, share and combine information more easily and efficiently. Ontologies form an important component of semantic web which is used to improve understanding the intent of user and meaning of words.

To retrieve information related to semantics, ontologies are one of the main approaches used for knowledge management. Ontologies are defined as conceptualization which contain set of concepts, their interrelations and rules that govern these concepts to be interpreted by machines. Most ontologies describe individuals (instances), classes (concepts), attributes, and relations.

For creating ontologies Web Ontology Language (OWL) is used. OWL is based on W3C standards and help in defining ontologies which contain information representation features. OWL us built on XML and allows users to provide machine readable semantic annotations for specific communities of interest. OWL is used to describe classes, properties and individuals.

III.TRIPLES BASED MODEL

To translate NL query to intermediate triple-based representation linguistic components are used. Linguistic components consist of *English tokenizer*, *sentence splitter*, *POS tagger* and *VP chunker*. The annotations returned after the sequential execution of these resources include information about sentences, tokens, nouns and verbs. These annotations are used to query ontology. It is preprocessing step which help in precise classification of query. It is needed to understand particular NL query and also guide NL query in creating equivalent triple based representation.

Tokenizer is used to break a stream of text up into words, phrases, symbols or other meaningful elements called tokens These tokens becomes input for further processing such as POS tagging, parsing etc. Automatically assigning descriptors to given tokens is called tagging. Tag may indicate one of the parts of speech, semantic information and so on. The process of assigning one of the parts of speech to the given word is called Parts Of Speech tagging. Parts of speech include nouns, verbs, adverbs, adjectives, pronouns, conjunction and their sub-categories. Here off the shelf Stanford NL parser can be used to get triples from a natural language query.

IV.PROPOSED WORK

When user enters question in natural language, that question is first processed to get query triples. Triples are in the form of {Subject, Object & Predicates). Linguistic components are used to classify query in triples. The result we get is "Query Triples". There are two main reasons for adopting a triple-based data model. First of all, although not all possible queries can be represented in the binary relational model, in practice these exceptions occur less frequently. Secondly, RDF-based knowledge representation (KR) formalisms for the semantic web, such as OWL also subscribe to this binary relational model and express statements as <subject, predicate, object>. Hence, it makes sense for a query system targeted at the semantic web to adopt a triple-based model that shares the same format as many millions of other triples on the Semantic Web. Here a triplet extraction algorithm is used.

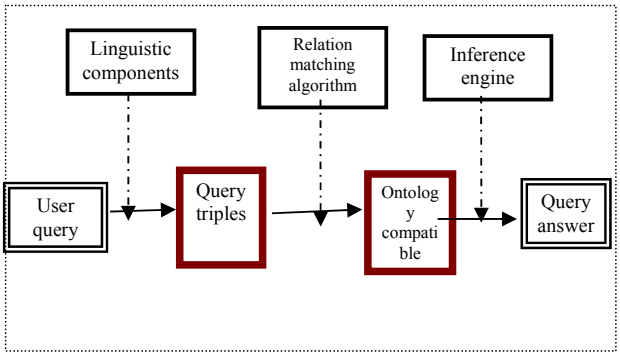


Fig 1: Natural language query processing

After getting Query Triples next step is to map these triples to onto compatible triples using relation matching algorithm. The purpose of this algorithm is to match these query triples against an existing knowledge base, consisting of semantically described words or phrases.

While trying to classify parts of the user input, a comparison between user input and knowledge base must eventually be made. Because of user input being an infinite set, either a reduction of input words or expansion

of the knowledge base must be made. Popular approaches that solve this problem include stemming, lemmatization and various distance functions. Stemming is based upon a set of rules, which determine word morphing, and is therefore limited to weakly inflected languages, where such rule collections exist. Lemmatization is used in conjunction with large language specific dictionaries, which are used to expand the knowledge base dictionary. This knowledge is then used to derive morphed words into their lemma. For measuring the results we have to create a test set, which would allow us to compare sequences against each other and would at the same time contain the information about the closest match.

Fig 1 shows user's NL query gets convetyed into "Query Triples" using linguistic components. Then these triples are mapped to ontology compatible triples using relation matching algorithm to get desired efficient and relevant answer to user query.

V.IMPLEMENTATION

Implementation of this propoed system includes various steps that have been shown in Fig 2. *Normalization, interpretation, query strings and finally the answer finding mechanism.*

Normalization process gives the "would be" condition where the answer can be specific to the question. For example as shown in the example, the question is "who is the hod of computer department?" and the normalization would be like "who be the hod of computer department". Here it is normalization that took us to next step in order to find the answer.

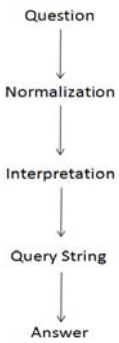


Fig 2: Implementation flow

Interpretation is process of finding objectives of the question, for example Property, target and context. It gives where to focus in order to find the answer. For example the question is "who is the hod of computer department?" and the interpretation will be "Property: Name, Target: hod and Context: computer department". Target shall give the actual attribute which have to be looked up.

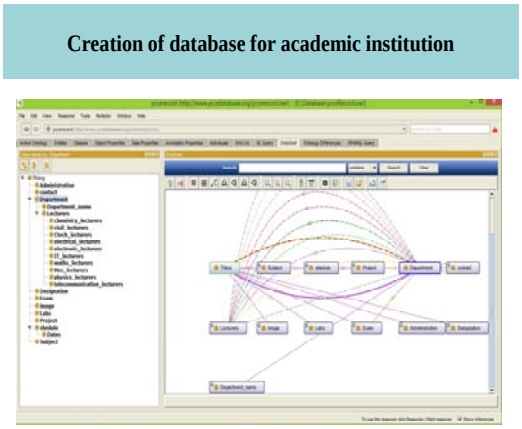


Fig 3: Current screenshot for Question Answering System giving relevant answer

Fig 3 shows current screenshot of the system.

VI.CONCLUSION

Currently our question answering system is under construction. It works for small domain specific ontology only. We are trying to create large ontology which will be capable of answering all possible question for particular domain specific ontology.

VII.REFERENCES

[1] Borut Gorenjak, Marko Ferme, and Milan Ojsteršek, "A Question Answering System on Domain Specific Knowledge with Semantic Web support", *International journal of computers*, vol. 5, no. 2, 2011.

[2] I. Čeh, and M. Ojsteršek, "Developing Question Answering System for the Slovene Language", *WSEAS transactions on information science and applications*, vol. 6, no. 9, Sep. 2009.

[3] N. Shadbolt, W. Hall, and T. Berners-Lee, "The Semantic Web Revisited", *IEEE Intelligent Systems*, vol. 21, no. 3, 2006.

[4] G.Madhu, A.Govardhan, and T.V.Rajinikanth, "Intelligent Semantic Web Search Engines: A Brief Survey", *International journal of Web & Semantic Technology (IJWesT),* vol.2, no.1, Jan. 2011.

[5] Tim Berners-Lee, James Hendler, and Ora Lassila, "The Semantic Web," *Scientific American,* May 2001.

[6] Ramprakash et al., "Role of Search Engines in Intelligent Information Retrieval on Web," in *Proc. 2nd National Conference: INDIACom-2008.*

[7] F. F. Ramos, H. Unger, and V. Larios (Eds.), "Semantic search engines", *LNCS 3061 Springer-Verlag Berlin Heidelberg* , pp. 145–157, 2004.

[8] Sara Cohen et al.,"XSEarch: A Semantic Search Engine for XML,"in *Proc. International conference on very large databases*, 2003, pp. 45-56.

[9] D. Bhagwat and N. Polyzotis, "Searching a file system using inferred semantic links,"in *Proc. HYPERTEXT '05* ,Salzburg, 2005, pp. 85-87.

[10] H. L. Wang et al.,"Semantic search on Internet tabular information extraction for answering queries,"in *Proc. CIKM '00,* McLean, 2000, pp. 243-249.

[11] 11. E. Kandogan et al., "Avatar semantic search: a database approach to information retrieval,"in *Proc. SIGMOD '06,* Chicago, 2006, pp. 790-792.

[12] Gauri Rao et al., " Natural language query processing using semantic grammar", *International journal on computer science and engineering*, vol. 2, no. 2, 2010, pp. 219-223

[13] Rashmi Chauhan, Rayan Goudar, Robin Sharm, Atul Chauhan," *Domain Ontology based Semantic Search for Efficient Information Retrieval through Automatic Query Expansion"*, Dept. of Computer Science and Engineering GEU Dehradun, India, 2013 International Conference.

[14] Hany M. Harb,Khaled M. Fouad, Nagdy M. Nagdy,*"Semantic Retrieval Approach for Web Document"*,Inrwenational Journal of Advance Computer Science and Application 2011.

[15] Lakshmi Tulasi R., Goudar R.H., Sreenivasa Rao M., Desai P.D." *Domain Ontology Based Knowledge Representation for Efficient Information Retrieval*", Journal Of Information Systems And Communication Issn: 0976-8742 & E-Issn: 0976-8750, 2012.

[16] Miriam Fernández , Iván Cantador , Vanesa López , David Vallet , Pablo Castells , Enrico Motta ,*"Semantically enhanced Information Retrieval: An ontology-based approach"*Web Semantics: Science, Services and Agents on the World Wide Web (2011).

[17] J.Uma Maheswari, Dr. G.R.Karpagam, *"A Conceptual Framework For Ontology Based Information Retrieval"*, Professor, Department of Computer Science and Engineering, PSG College of Technology, Coimbatore, Tamilnadu, International Journal of Engineering Science and Technology , 2010.

[18] Latifur Khan, Dennis McLeod, Eduard Hovy, "*Retrieval Effectiveness of an Ontology-Based Model for Information Selection"* Department of Computer Science University of Texas at Dallas Richardson.

[19] Liu Xinhua, Zhang Xutang, Li zhongkai , *"A Domain Ontology- based Information Retrieval Approach for Technique Preparation"* International Conference on Solid State Devices and Materials Science 2012.

[20] *IT .Kanimozhi, Dr.A.Christy, "Incorporating Ontology and SPARQL for Semantic Image Annotation"* Proceedings of 2013 IEEE Conference on Information and Communication Technologies (ICT 2013).

[21] *Xiangsheng Yang, Ruoman Zhao, Chuan Zhang, "An Ontology-based Framework for the Construction of Teaching Resource Library"*, Ningbo University.

[22] Swathi Rajasurya , Tamizhamudhu Muralidharan , Sandhiya Devi, Nwe Ni

Aung, Thinn Thu Naing, *"Sports Information Retrieval with Semantic Relationships of Ontology*", University of Computer Studies, Yangon , 3rd International Conference on Information and Financial Engineering IPEDR (2011).

[23] Swathi Rajasurya , Tamizhamudhu Muralidharan , Sandhiya Devi,Dr.S.Swamynathan*,"Semantic Information Retrieval Using Ontology In University Domain",* Department of Information and Technology,College of Engineering,Guindy, Anna University,Chennai.

[24] Christian Paz-Trillo , Renata Wassermann, "*An Information Retrieval application using Ontologies*", Departament of Computer Science Institute of Mathematics and Statistics University of Paulo, Brazil, 3, 2005.

[25] Thinn Mya Mya Swe*," Intelligent Information Retrieval Within Digital Library Using Domain Ontology",* Computer University, Mandalay, Myanmar. International Conference on Applied Computer Science.

[26] *Tang Lijun,Chen Xu,"The Study of Semantic Retrieval Based on the Ontology of Teaching Management"*,Advanced in Control Engineering and Information Science CEIS 2011.

[27] Sandhya Revuri, Sujatha R Upadhyaya , P Sreenivasa Kumar," *Using Domain Ontologies for Efficient Information Retrieval",* Department of Computer Science and Engineering Indian Institute of Technology Madras Chennai - India.

[28] Ayesha Ameen, Khaleel Ur Rahman Khan, B. Padmaja Rani*,"Construction of University Ontology"*, IEEE conference 2012.

[29] Anatoly Gladun, Julia Rogushina, Victor Shtonda*," Ontological Approach To Domain Knowledge Representation For Information Retrieval In Multiagent Systems"*, International Journal "Information Theories & Applications" Vol.13.

[30] Zeng Dan, *"Research on Semantic Information Retrieval Based on Ontology"*, Library of Wuhan University of Technology, Wuhan, P.R. China, 430070.

[31] LIU Xiaoming, XU Jinzhong,LI Fangfang, *"Domain-specific Ontology Construction from Hierarchy Web Documents"*, School of Computer Science and Technology, Beijing Institute of Technology, China.

REGENERATIVE BRAKING PRINCIPLE BY USING KINETIC ENERGY RECOVERY SYSTEM –A REVIEW

Sameer.G. Patil[1], Rithwik M Singh[2], Suryakant Tripathi[3], Rajkumar Jakhar[4]
[1] Assistant Professor, [2,3,4]B.E. - Student ,Dept. of Mechanical Engineering, SIT, Lonavala, India,
Email:*[1]patilgsameer@gmail.com,*[2]kms_rithwik@rediffmail.com, [3]suryask008@gmail.com
[4]rajkumar8802@gmail.com,

***Abstract*- Natural resources conservation has become a requirement in today's world, mainly in the new technology. In many of the rolling applications maximum energy is lost during deceleration or braking. This problem has been fixed with the introduction of regenerative braking. Kinetic Energy Recovery Systems (K.E.R.S.) is a type of regenerative braking system which has different approaches to store and reuse the lost energy. This paper gives an idea about a flywheel based mechanical regenerative braking system (R.B.S.) concept by showing the application of the same on a bicycle to improve the performance and/or efficiency of the bicycle. Thus taking this point of view of such K.E.R.S. application based on the principle of R.B.S. on a bicycle can be seen as a human power generator. By keeping this point, the electricity generated can be used in day to day life like charging your smart phone. The ever increasing energy demand and increased alertness of people towards the healthiness in developing countries like India, are some of the driving forces for the development of such humanly powered machines. Flywheel rotor design is the key of researching and developing flywheel energy storage system. Thus this paper presents a literature report reviewing the human power flywheel motor as well as the flywheel design.**

Keywords- Bicycle, Flywheel, KERS, Regenerative braking.

I. INTRODUCTION

Since ever increasing fuel crises, energy crises, busy schedules of load shedding, unemployment justify the need of human powered machines, the constants efforts are being continuously made to optimize the various parameters of these machines so as to provide the ease for the operator and consequently make efficient use of human energy [1].

In the human power generator, it works on the principle to convert muscular or physical energy of human being into the electrical energy by means of applying pulley arrangement. The pulley arrangement converts the efforts which is applied by human being into the rotating motion which is used to generate electricity and this electricity will be used as a preliminary requirement of electricity. A dynamo machine replicating alternator consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. The motion of the wire within the magnetic field causes the field to push on the electrons in the metal, creating an electric current in the wire. On small machines the constant magnetic field may be provided by one or more permanent magnets; larger machines have the constant magnetic field provided by one or more

electromagnets, which are usually called field coils. Thus by the above mechanism alternator charges the battery [2].

In actual bicycle the kinetic energy obtained from the pedalling power is utilized and is not recovered. By designing and fabricating the flywheel bicycle, recovery of the kinetic energy produced from the pedalling power is possible. It can recover and store frictional energy produced by braking and releasing of this stored energy in the flywheel which can be converted to electricity by the help of an alternator. Now-a-days, our country and human life is mostly affected by load shedding. It has badly affected the daily human life.

Once we make this cycle which is enough capable of generating electricity which can charge a mobile with help of a mechanical system. All we have to do is spread words about this innovation and market it in a right direction, for example, if a student in pune starts using this bicycle he will be able to charge his own phone every day without using the conventional electrical source instead he'll be using all his energy with help of which he pedalled and at the same time he can be able to charge his parents phone in home. A phone charging uses at least 4-5 units of electricity per day per phone. So by saving this electricity per day we'll be ultimately saving the electricity by reducing its usage in conventional way and thus reducing the carbon footprints. So we just need to do the marketing of such product on a large scale.

A. Regenerative braking system

In order to understand the concept of R.B.S. and its impact on vehicle energy performance, a simple example is presented:
Consider a 300 kg (~ 661lbs) vehicle moving at an initial speed of 72 km/h(~ 45mph).Now, on braking the vehicle to a speed of 32 km/h(~ 20 mph) the amount of energy spent is around 47.8 kJ using the equation given below,

$$E_K = \frac{1}{2}mv^2 \qquad (1)$$

Where, E_k: Kinetic Energy of the vehicle; m: Mass of the vehicle and v: Velocity of the vehicle. Ideally, this is the amount of energy available for capturing at each instance of braking. If regenerative braking was used on such a vehicle it would be able to capture this amount of energy and reuse this same energy which would otherwise have been lost in the form of heat, sound etc. Now, even if we suppose that the efficiency of the brake is 25% of this, there would still be an amount of 11.85 kJ (25% of 47.8kJ) of energy available at each braking instance, which shows the amount of energy that can be utilized for beneficial causes. This energy is roughly, neglecting all losses, enough to accelerate a car from 0 km/h to around 32 km/h). This stored energy using R.B.S. can be reutilized for different purposes, either to help improve performance or fuel efficiency, in either case assisting in 'Load Sharing' [3].

In this whole process, R.B.S. also essentially functions as a brake system. But due to heavy torque demands at emergency braking situations R.B.S. alone would not be sufficient; hence it needs to be a system supplemental to existing proven friction braking [4].

II. COMPONENTS

A. Electrical components of flywheel bicycle

1. Alternator

It is the device by which mechanical energy is converted into electrical energy. It is D.C. generator for generating D.C. voltage at output.

2. Rectifier circuit

It is a device which converts A.C. voltage into D.C. voltage. Some A.C. harmonics produced by D.C. generator with pulsating modulation of waves which is not in regular modulation, so for getting regular modulation of waves, rectifier circuit is used.

3. Filter circuit

At the output of rectifier, D.C. voltage is not in pure form some A.C. components are in there so for purification of it, Shunt capacitor filter circuit is used. Filter is a circuit which minimizes of removed the undesirable A.C. component of the rectifier output & allows only the D.C. component to reach at output.

4. Charging circuit
It is the circuit which is used for charging the discharged battery.

5. Battery
It is the source of D.C. voltage. It is the device where we want to store the D.C. voltage or it gives the D.C. source whenever we want.

6. Inverter
This project requires electronic inverter. The function of electronic inverter is to convert D.C. to A.C. [6]

B. Flywheel- Mechanical component

The first class of flywheels uses steel as the main structural material. The second class of flywheels uses a metallic hub and composite rim made up of an advanced composite material such as carbon-fibre or graphite. The metal hub of composite flywheels had the same geometrical shape and work condition with the steel flywheels. This section mainly determines their maximum outer radius. The design method is similar in composite rim [7].

1. Flywheel as mechanical energy storage device

A flywheel such as the one illustrated in Figure is a mechanical device that is commonly used to store kinetic energy associated with its rotation at high speed. The stored energy is then released to the intended application such as described in Section II after the supplied energy is either discontinued or reduced in the magnitudes.

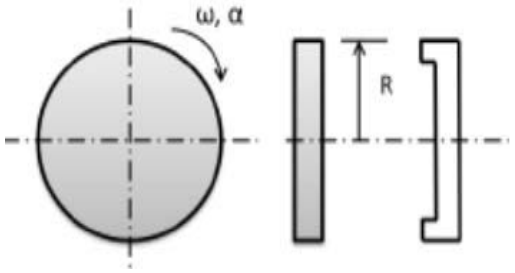


Fig. 1 Flywheel

Fig. 1 shows two popular geometry of flywheels: the uniform cross-section wheels in the middle and the thick-rim flywheels to the right. The kinetic energy that can be stored in a flywheel spinning at an angular velocity ω may be computed by the following expression:

$$KE = \frac{1}{2} I\omega^2 \quad (2)$$

Where, I is the mass moment of inertia of the spinning wheel. Below Equation is used to compute the mass moment of inertia for flywheel with uniform thickness:

$$I = \frac{1}{2} MR^2 \quad (3)$$

With M and R being the mass and the radius of the wheel respectively.

The angular velocity of the spinning flywheel ω is maintained by applying torques that is equal to $T = I\alpha$, in which α is the angular acceleration of the spinning wheel [8].

The flywheel is where the energy is stored from the brake regeneration. A 20 inch diameter bike wheel rim will be used as the flywheel since it will be smaller than the 26 inch wheels on the bike, is an off the shelf part that is easy to get, has most of its mass on the outer edge, would be easy to add weight to if necessary, and has a hub that will be easy to attach to the axle [9].

Instability in voltage can lead to quick wear and tear of the energy storage device. Fig. 2 shows that in comparison with other storage systems, flywheels offer maximum steady voltage and power level, which is independent of load, temperature and state of charge. Second being Lithium ion (Li-ion) battery followed by Nickle metal hydride NiMH and Lead-acid batteries. Super-capacitors / ultra-capacitors being the lowest with 30% stability. Reason being that super-capacitors have self-discharge properties [10].

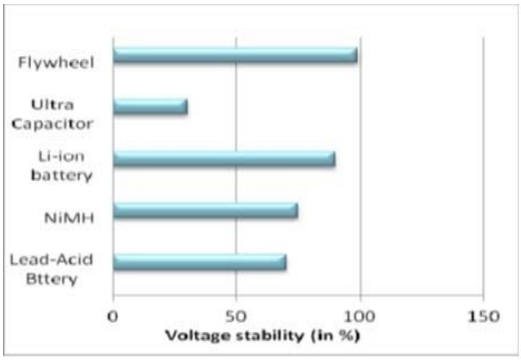


Fig.2 Energy comparison

Cost is the main drawback of every Hybrid vehicle. Causes of high cost are the materials used in making these vehicles and their storage technologies. Fig. 3 shows that flywheel- system is the cheapest after batteries with 15% and 6%. However, flywheels are currently use because of the efficiency they give in this low cost. Batteries cannot store enough energy and hence charge and discharge quickly. Hydraulic systems are the most expensive of them all followed by super-capacitors with 47% and 32% respectively [10].

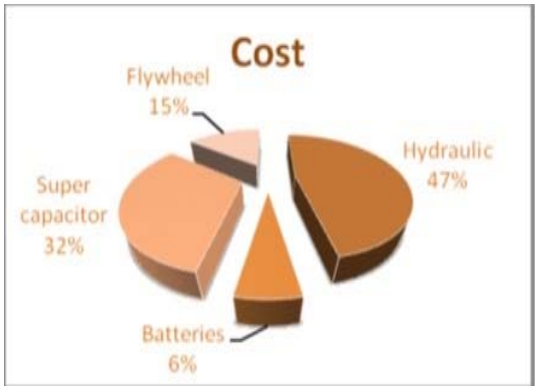


Fig.3 Cost comparison

III. WORKING

Any machine, to power it by human energy, the maximum power requirement should be 75 Watts. Any machine or process requiring more than 75 Watts and if process is intermittent without affecting and product, can also be operated by human energy. This is possible with the provision of intermediate energy storing unit which stores the energy of human and supply periodically at re-quire rate to process unit, this is called as "human powered flywheel motor."[1]

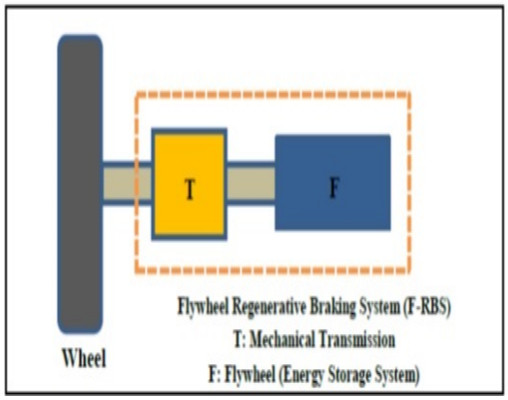


Fig. 4 F-R.B.S.

The electrical Energy Supply System (E.S.S.) has been extensively researched and is an excellent choice due to its high specific energy, compactness and operational/implementation simplicity. But it was found lacking in storage/recharging efficiency and the transmission losses associated with energy conversion from mechanical energy to electrical energy. So, on an exploratory basis, a flywheel with a mechanical transmission was selected with the aim of overcoming these particular shortcomings of an Electrical R.B.S. system. With a flywheel E.S.S., high specific power can be achieved and depending on the design, high specific energy can be obtained as well. Additionally, flywheels have excellent recharge efficiencies and very long cycle lives. On coupling this with a mechanical transmission the conversion losses are eliminated as the mechanical braking energy is transmitted and stored in the same form. The other advantages being the system can be cost effective (depending on the design) and simple to recreate. The problems associated with flywheel systems are high weight addition and safety issues. Therefore most of the design goals are met with a Flywheel based Mechanical System [3].

While pedalling the bicycle, the flywheel also rotates by the mode of chain arrangement which in turn slightly increases the speed of the bicycle. This setup is more applicable while riding bicycle on the highways. Hence the back wheel

rotates while pedalling the bicycle and the kinetic energy produced is recovered as the extra movement of the back wheel of the bicycle by the rotation of the flywheel [9].

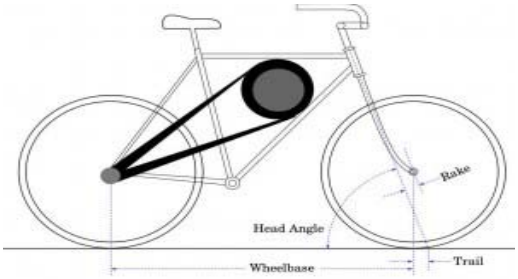
A. Gear Ratio used in transmission with clutch

The gear ratio will determine the speed and torque power of the mechanical bicycle. Gear Ratios are a ratio between the numbers of teeth found on the gear. Using a smaller gear in front, by the pedals, and a larger gear placed in the back of the bike that is connected to the wheel, will allow for a power ratio, and will increase the amount of cycles needed per full rotation of the wheel, which increases the torque. Which could be thought of as peddling up a hill. By placing the larger gear in front and the smaller gear in the back, a speed ratio is enacted. This means that the peddler will be put under a stronger force and will require more energy input to turn the wheel powering the mechanical appliance [8].

B. Efficiency of the whole mechanism

Using (2),

$$E=\frac{1}{2}cmr^2\omega^2 \quad (4)$$



The gain you get from a flywheel must be measured against the extra power required to move the bicycle from the extra weight of the flywheel. Extra work is needed to accelerate the bike because of the flywheel. Therefore the efficiency gained from the flywheel can be shown as:

$$\varepsilon_{TOTAL} = \varepsilon_{GAINED} + \varepsilon_{LOST} \quad (5)$$

The efficiency gained can be expressed as the energy stored in the flywheel (from the above section) over the total energy in the bike. The efficiency lost can be expressed as the energy required to push the extra weight of the bike over the total energy in the bike.

$$\varepsilon_{TOTAL} = \frac{\varepsilon_{FLYWHEEL}}{\varepsilon_{TOTAL}} - \frac{\varepsilon_{FLYWHEEL\ ACCELERATION}}{\varepsilon_{TOTAL}}$$

(6)

After plugging in (4), we get,

$$\varepsilon_{TOTAL} = \frac{\frac{1}{2}\eta cm_f\omega^2r^2}{\frac{1}{2}m_{total}v^2} - \frac{\frac{1}{2}m_fv^2}{\frac{1}{2}m_{total}v^2}$$

(7)

Where ε_{TOTAL} is the efficiency, η is the efficiency of the transmission, m_f is the mass of the flywheel, and v is the velocity of the bike. Cancelling like terms we get,

$$\varepsilon_{TOTAL} = \frac{\eta cm_f\omega^2r^2}{m_{total}v^2} - \frac{m_f}{m_{total}}$$

(8)

With this in mind the flywheel design should minimize the mass of the flywheel in favour of a larger radius or faster speed, since the total efficiency will be much higher [13].

C. Critical stress in flywheel

Another design consideration to take into account is the stress experienced by the flywheel. This is given by

$$\sigma = \frac{1}{2}\rho r^2\omega^2$$

(9)

Where, ρ is the density of the material. Usually the key for material selection of a flywheel is the highest possible tensile strength over density. The maximum stress a bike can handle is the tensile strength, so

$$\sigma_{max} > \frac{1}{2}\rho r^2\omega^2 \quad (10)$$

For a bike flywheel, the size and speed are not likely to even approach a higher enough value to create a stress above the tensile strength of a material, so this consideration is not so important. The tensile strength of standard steel is 250 MPa.Since the bike radius will be less than one, and the angular velocity will be less than 100, the tensile strength will not be reached. Since bikes are light, it is much more important to the overall efficiency to minimize the mass of the flywheel. With this in mind the flywheel should have as large of a radius as possible, and spin as fast as possible. The limit to the radius is the physical limitations of the size of the bike and the practicality of fixing the flywheel to the bike. The issue with a high radial speed is the friction losses over time [13].

IV. CONCLUSION

Flywheel technology is on the rise across many kinds of technology and rightly so. It is a pollution free method of storing energy that has many current and potential applications. In the case of road vehicles there is much to be desired in terms of energy efficiency, especially when considering pollution per unit of energy. Any system of brake regeneration can help that, but flywheels have the potential to increase the efficiency of road vehicles without direct or indirect negative effects on the environment. The batteries used in hybrids do not last the cars lifetime and can have costly environmental effects. A flywheel has environmental impact only at its time of production, and has the potential to heavily outweigh those costs through its use. Bikes do not have the pollution problems cars and other modes of transportation have, but they can serve as a good analogy for how a kinetic energy recovery system can increase the efficiency of a vehicle.

REFERENCE

[1] P.A. Hatwalne, Flywheel motor-an update, International Journal of Advanced Technology&Engineering Research, Volume 2, Issue 6, Nov. 2012,pp: 98-100

[2] Manisha.S.Lande. Optimum Utilization of a Bicycle, International Journal of Latest Trends in Engineering and Technology, Vol. 1 Issue 3 September 2012, pp: 156-164.

[3] Anirudh Pochiraju. Design principles of a flywheel regenerative braking system, SAE, pp:1-90.

[4] Ryouichi Takahata. Compact Flywheel Energy Storage System, Registration number: 2001EF001, 3/April/2004, pp:1-10.

[5] C.Sadhasivam. Design and Fabrication OF Flywheel Bicycle with Mobile Charger, IJSR - International Journal Of Scientific Research, Volume : 3 | Issue : 11 | November 2014, pp:230-231.

[6] A.K.Pitale . Flywheel Motor. International Journal of Engineering Science and Innovative Technology, Volume 1, Issue 2, November 2012, pp:190-193.

[7] Yongjie Han. General design method of flywheel rotor for energy storage system, www.sciencedirect.com, 2012 International Conference on Future Energy, Environment, and Materials, Energy Procedia 16 (2012), pp: 359 – 364.

[8] Prof. A.K. Pitale. Human Powered Flywheel Motor. International Journal of Engineering Trends and Technology, Volume 8 Number 1- Feb 2014,pp:5-8.

[9] J. P. MODAK. Human powered flywheel motor concept, design, dynamics and applications, pp:1-50.

[10] Radhika Kapoor. Comparative Study on Various KERS, Proceedings of the World Congress on Engineering 2013

Vol III, WCE 2013, July 3 - 5, 2013, pp:1-5.

[11] P.B.Khope .Development and Performance Evaluation of A Human Powered Flywheel Motor Operated Forge Cutter. International Journal Of Scientific & Technology Research Volume 2, Issue 3, March 2013, p:146-149.

[12] Tai-Ran Hsu. On a Flywheel-Based Regenerative Braking System for Regenerative Energy Recovery, Proceedings of green energy and conference, 25-Nov-2012, pp:1-7.

[13] Kevin Ludlum. Optimizing Flywheel Design for use as a Kinetic Energy Recovery System for a Bicycle, 3-july-2013,pp:1-24.

[14] Chwukwuneke J.L. Analysis of a laboratory bicycle ergometer system using grand canonical ensemble, International Journal Of Multidisciplinary Sciences And Engineering, Vol. 3, No. 5, May 2012,pp:58-65.

AUTO RECOMMENDATION ENGINE USING HADOOP

[1]Mandar Puranik, [2]Sunetra Kanade, [3]Kalyani Raut, [4]Nikita Dange,
[5]Prof. Nishigandha Wankhade
[1,2,3,4,5]Department of Computer Engineering, Marathwada Mitra Mandal Institute of Technology, Pune, India.
Email: [1]mandarmpuranik@gmail.com, [2]sunetra.kanade13@gmail.com,
[3]rautkalyani1992@gmail.com, [4]nikita.dange45@gmail.com, [5]n.wankhade@mmit.edu.in .

Abstract— The Prototypical application of Hadoop is using Apriori algorithm. However, Apriori is efficient to generate and mine association rules form larger database or repository. Apriori algorithm generates interesting frequent or infrequent candidate itemsets with respect to support and confidence count. Apriori algorithm requires to produce vast number of candidate sets and to generate these, it needs several scans over database. While it requires more memory space and scans for candidate generation process we will improve Pruning strategy as it will reduce the scans required to generate frequent item sets and accordingly and a valence or weightage to strong association rule. And hence Apriori will get more effective and efficient. Previously various improved versions of apriori algorithm were used. This paper actually presents an idea of improved version of Apriori algorithm along with Association Rules and their performance comparison with Apriori algorithm..

***Index Terms*— Apriori algorithm, frequent itemsets, data mining, hadoop, candidate itemset, support and confidence.**

I. INTRODUCTION

THE Apriori algorithm is a seminal algorithm proposed by R. Agarwal and R. Shrikant. Many researches were done in order to make mining frequently used itemsets scalable and efficient.

Basically the name of apriori based on the algorithm uses prior knowledge to find frequent itemset. Any subset of a large itemset must be large is its motto. Two major subsets of apriori algorithm are join and prune. The itemsets are being compared with a fixed minimum support and they are less than the minimum support are being deleted from L_k(set of k-itemset) and C_k,(Candidate k-itemset) a superset is formed. Apriori algorithm due to too many scans over database and generation of huge number of candidate set suffers many deficiencies. To overcome these deficiencies we use techniques like mapping, reducing in hadoop, transaction reduction, improved version of apriori algorithm is proposed.

Association Rule Mining (ARM) is technique used for data mining. ARM extracts interesting correlation, frequent patterns, association or casual structures among set of database or other repositories. Support and Confidence are two pillar criteria used by association rule. ARM needs to satisfy both a user specified min support and confidence at the same time.

II. PROBLEM STATEMENT

Compare different itemsets in Apriori algorithm and find how much efficiency they improve. Efficiency depends upon various factors like minimum support value accuracy, number of records.

III. UNITS

- BIG DATA(HADOOP)

As data sets continue to grow, the potential of a failure impacting a customer grows with it. As more business groups, applications, and jobs leverage the same infrastructure, a failure can have a dramatic impact on overall system performance. This concern falls in line with ESG research, which shows that reliability is top of mind for businesses considering a business intelligence, analytics, and big data solution. When it comes to Hadoop, customers want a highly available solution that has no single point of failure and can sustain multiple failures while self-healing where able to. Traditional Hadoop distributions cannot reliably support these demands, especially comprehensively across the entire Hadoop ecosystem.

With a no single point of failure architecture, Map Reduce can reliably and comprehensively minimize data loss during minor or major cluster failures, including support for projects ranging from Impala, Hive, and Oozie, to Storm, MySQL, and Kafka. When selecting a Hadoop platform to store, manage, and analyze big data, it is crucial to select a platform that can meet the scalability, high availability, reliability, and performance needs of a dynamic organization. Though numerous vendors and solutions can meet most of those requirements, almost all of them rely on add-on, customized point solutions, minimizing deployment flexibility and adding additional management tasks for an already busy IT administrator ground up, bringing together the innovative Map Reduce architecture with the comprehensive projects in the Hadoop ecosystem to deliver enterprise-grade features and functions on low-cost commodity hardware. The distributed Map Reduce architecture offers high levels of availability and reliability with no single points of failure, helping to drastically reduce the mean time to data loss .

- MAP REDUCE

The computation takes a set of input key/value pairs, and produces a set of output key/value pairs. The user of the MapReduce library expresses the computation as two functions: Map and Reduce. Map, written by the user, takes an input pair and produces a set of intermediate key/value pairs. The MapReduce library groups together all intermediate values associated with the same intermediate key I and passes them to the Reduce function.The Reduce function, also written by the user, accepts an intermediate key I and a set of values for that key. It merges together these values to form a possibly smaller set of values. Typically just zero or one output value is produced per Reduce invocation. The intermediate values are supplied to the user's reduce function via an iterator. This allows us to handle lists of values that are too large to fit in memory.

- ASSOCIATION RULES

The associative rule mining concept inherits the Map Reduce scalability to huge datasets and to thousands of processing nodes. For finding frequent item sets, it uses hybrid approach between miners that uses counting methods. Association rule mining finds interesting associations and correlation relationships among large set of data items. Association rules show attribute value conditions that occur frequently together in a given dataset. A typical and widely-used example of association rule mining is Market Basket Analysis. Association rules provide information in the form of "if-then" statements. These rules are computed from the data and, unlike the if-then rules of logic, association rules are probabilistic in nature. In addition to the antecedent (the "if" part) and the consequent (the "then" part), an association rule has two numbers that express the degree of uncertainty about the rule. In association analysis the antecedent and consequent are sets of items (called itemsets) that are disjoint. The first term is called the support for the rule. The Support is the number of transactions that include all items in the antecedent and consequent parts of the rule. The support is also expressed as a percentage of the total number of records in the database. The other term is known as the confidence of the rule. Confidence is the ratio of the number of transactions that include all items in the consequent as well as the antecedent (namely, the support) to the number of transactions that include all items in the antecedent.

For example, if a supermarket database has 100,000 point-of-sale transactions, out of which

2,000 include both items A and B and 800 of these include item C. The association rule "If A and B are purchased then C is purchased on the same trip" has a support of 800 transactions (alternatively 0.8% = 800/100,000) and a confidence of 40% (=800/2,000). One way to think of support is that it is the probability that a randomly selected transaction from the database will contain all items in the antecedent and the consequent, whereas the confidence is the conditional probability that a randomly selected transaction will include all the items in the consequent given that the transaction includes all the items in the antecedent.

Association rule mining has a wide range of applicability such market basket analysis, medical diagnosis/ research, website navigation analysis, homeland security, education, financial and business domain and so on. Association rule mining is easy to use and implement and can improve the profit of companies. The computational cost of association rule mining represents a disadvantage and future work will focus on reducing it.

• Steps for Association:

Association Rule Mining is to find out association rules that satisfy the predefined minimum support and confidence from a given database. Association rules are typically generated in stepwise process.

1. Minimum support is used to generate the set of all frequent itemsets for the data set. Frequent itemsets are itemsets which satisfy the minimum support constraint.

2. Then each frequent itemsets is used to generate all possible rules from it and all rules which do not satisfy the minimum confidence constraint are removed.

3. Analyzing this process, it is easy to see that in the worst case we will generate 2n - n - 1 frequent itemsets with more than two items from a database with n distinct items.

4. Each frequent itemset in the worst case generate at least two rules, we will end up with a set of rules in the order of O(2n).

5. Increasing minimum support is used to keep the number of association rules found at a manageable size. However, this also removes potentially interesting rules with less support. Therefore, the need to deal with large sets of association rules is unavoidable when applying association rule mining in a real setting.

IV. Helpful Hints

A. Figures and Tables

• APRIORI ALGORITHM

Apriori algorithm is very famous algorithm used for finding the frequent items from the itemset. For finding the frequent itemset Apriori uses prior knowledge. It uses a property ‘Any subset of a large itemset must be large’ [2]. Data Processing is the very important area of research in the industry. There are many effective algorithms which are used for it. Apriori algorithm is used for the large amount of data. As the data set increases the apriori algorithm gives the more accurate results.

Apriori algorithm in carried out in two main steps: Join and Prune. In join the large itemsets sets are found and in prune these itemsets are compared with support values which is fixed and the less itemsets than that of minimum support are deleted. And then set candidate itemsets are formed.

For the generation of candidate set Apriori have to scan the database for too many times. To overcome this problem we are using map-reduce technique.

• Generation steps

Input items to the map reduce.

Map reduce will provide the large itemset required for the apriori.

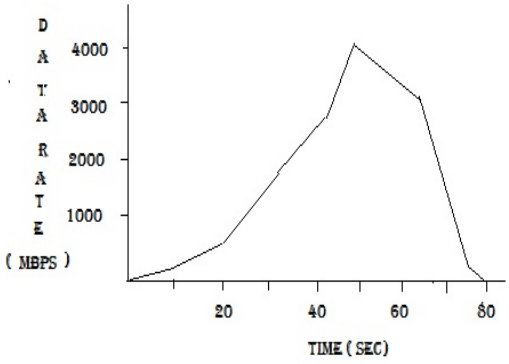
Apriori algorithm will compare each itemset with the support value.

If the value is greater than support then only it will be taken by the apriori and this process is performed till the last itemset.

The itemsets with value less than support value then it will be deleted.

Then the apriori will return the frequent itemset from the given input.

• Graph



B. Abbreviations and Acronyms

ARM means Association Rule Mining is the technique used for data mining.

L_k is the set of k-itemset and C_k, is the Candidate k-itemset.

sup stands for support and conf stands for confidence.

C. Equations

• Support

Support gives total number of transaction of any particular item are occurring in datasets. The rule holds with support sup in T (the transaction data set) if sup% of transactions contain X Y.

sup = Pr(X Y).

• Confidence Graph

Confidence gives strength of a data in a dataset. The rule holds in T with confidence conf if conf% of transactions that contain X also contain Y.

conf = Pr(Y | X)

An association rule is a pattern that states when X occurs, Y occurs with certain probability.

• Support Count:

The support count of an itemset X, denoted by X.count, in a data set T is the number of transactions in T that contain X. Assume T has n transactions. Then,

$$\text{support} = \frac{(X \cup Y) . \text{count}}{n}$$

$$\text{confidence} = \frac{(X \cup Y) . \text{count}}{X.\text{count}}$$

V. CONCLUSION

This Paper helps to understand the enormous variation of Apriori algorithm. Apriori algorithm is beneficial for finding the subsets of frequent itemset. Still Apriori has drawbacks of more time, space for candidate generation process .Apriori algorithm has a wide range of application like market and risk management, market basket analysis, inventory control, Telecommunication network, etc. Hence we conclude that the Apriori algorithm using map-reduce is the most efficient way to get the frequent data set from the large data set.

REFERENCES

[1] Margaret H. Dunham, Yongqiao Xiao Le Gruenwald, Zahid Hossain, "A Survey of Association Rules", Southern Methodist University, University of Oklahoma Dallas, Texas 75275-0122 Norman.

[2] Sana Irfan, "A Comparative Analysis of Improved Version of Apriori Algorithm of Data Mining," Meerut, Uttar Pradesh, India.

[3] Nilesh.S.Korde, Prof.Shailendra Shende, " Parallel Implementation of Apriori Algorithm" IOSR Journal of Computer Science (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727 PP 01-04.

[4] Jeffrey Dean and Sanjay Ghemawat "MapReduce: Simplified Data Processing on Large Clusters" .

[5] Bing Liu, Wynne Hsu, Yiming Ma, " Integrating Classification and Association Rule Mining ", KDD-98 Proceedings. Copyright © 1998, AAAI (www.aaai.org).

[6] Rakesh Agarwal, Ramkrishnan Srikant "Fast Algorithms for Mining Association rules", IEEE Trans. on Data Mining, vol. 4, pp. 570-578, July 2013.

[7] Rakesh Agrawal, Tomasz Imielinski, Arun Swami, " Mining Association Rules between Sets of Items in Large Databases".

[8] Irina Tudor, " Association Rule Mining as a Data Mining Technique", User's Guide and Reference Manual, Addison-Wesley 2008.

[9] Maur ice Houtsma, Arun Swami, " Set-oriented mining for association rules in relational databases".

ELECTRONIC EQUIPMENTS COOLING THROUGH RECTANGULAR FIN ARRAY BY USING NATURAL CONVECTION: A REVIEW

Sandip S. Kale[1], V. M. Bhatkar[2]
[1]M E Heat Power Engineering, Genba Sopanrao Moze College of Engineering, Balewadi, Pune,
2Assistant Professor, MMCOE, Karve Nagar, Pune, Maharashtra

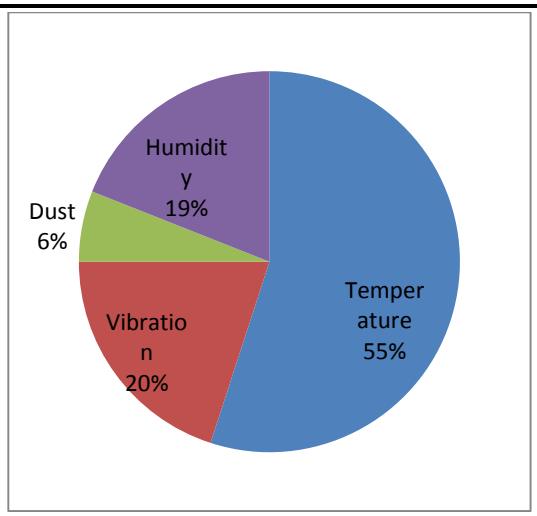
Abstract: High power density electronic equipments during operation generate heat causing temperature rise of the system and if these heat is not dissipated may cause serious overhaeating problem leading to system failure. The design of efficient cooling strategies is essential for reliable performance of high power density electronics. The present paper reviews the literature dealing with various aspects of cooling methods. Among heat transfer augmentation techniques, passive cooling technique found more suitable for electronic cooling than active technique. In this paper, natural convection heat transfer analysis through rectangular fins is reviewed. The paper focus on the various experimental studies has been made to investigate effect of fin height, fin spacing, fin length and fin thickness over convective heat transfer.

Keywords: Rectangular fins, convective heat transfer, heat sink

I. INTRODUCTION

Electornic systems during their operation generate heat. If this generated heat is not dissipated rapidly to its surrounding atmosphere, this may cause rise in temperature of the system Components. This by-product cause serious overheating problems in system and leads to system failure, so the generated heat within the system must be rejected to its surrounding to maintain the system at recommended temperature for its efficient working. The design of efficient cooling strategies is essential for reliable performance of high power density electronics. A number of failure mechanisms in electronic devices, such as inter-metallic growth, metal migration, and void formation, are related to thermal effects. In fact, the rate of such failures nearly doubles with every 10°C increase above the operating temperature (~80°C) of high power electronics. The thermal design of the system is influenced by the key drivers like chip size, power dissipation, junction temperature and ambient air temperature.

It has been found that for every 2 ºC temperature rise, the reliability of a silicon chip will be decreased by about 10 %. The major cause of an electronic chip failure is due to temperature rise (55%) as against other factors which accounts 20 % vibration, 19 % humidity and 6 % dust Fig.(1.1). So it's a great challenge for the packaging engineers to remove the heat from the electronics chips very effectively.



1.1 Major cause of electronic failure

Throughout the past 50 years, cooling and thermal management have played a key role in accommodating increases in power while maintaining component temperatures at satisfactory levels to satisfy performance and reliability objectives. Thermal management will play a pivotal role in the coming decade for all types of electronics products. Increased heat fluxes at all levels of packaging from chip to system to facility pose a major cooling challenge. To meet the challenge, significant cooling technology enhancements will be needed.

II. COOLING TECHNIQUE

In general thermal management is categorized into active cooling techniques and passive cooling techniques. Mechanically assisted cooling sub systems provide active cooling. Active cooling technique offer high cooling capacity. They allow temperature control that can cool below ambient temperatures. In most cases active cooling techniques eliminate the use of cooling fans or they require less cooling. Air/liquid jet impingement, forced liquid convection, spray cooling thermoelectric coolers and refrigeration systems are the examples of active cooling techniques.

Passive cooling methods are widely preferred for electronic and power electronic devices since they provide low-price, noiseless, and trouble free solutions. Some passive cooling techniques include: heat pipes, natural convection air cooling, and thermal storage using phase change materials (PCM). Heat pipes can efficiently transfer heat from heat sources in high power density converter components to a heat sink based on phase change of a working fluid [1, 2]. Air-cooling also is recognized as an important technique in the thermal design of electronic packages, because besides its availability, it is safe, does not contaminate the air and does not add vibrations, noise and humidity to the system in which it is used [3]. Such features of natural convection stimulated considerable research on the development of optimized finned heat sinks and enclosures [4, 5, 6]. Using fins is one of the most inexpensive and common ways to dissipate unwanted heat and it has been successfully used for many engineering applications.

Fins come in various shapes; such as rectangular, circular, pin fin rectangular, pin fin triangular, etc., see Fig. 1.2, depending on the application. Rectangular fins are the most popular fin type because of their low production costs and high thermal effectiveness.

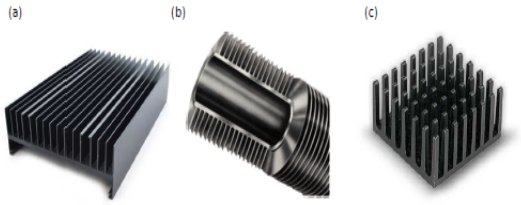


Fig 1.2- Fin Types, a) Rectangular b) Radial c) Pin Fins

Heat sinks are the most common thermal management hardware used in electronics. They improve the thermal control of electronic components, assemblies, and modules by enhancing their surface area through the use of fins. Applications utilizing fin heat sinks for cooling of electronics have increased significantly during the last few decades due to an increase in heat flux densities and product miniaturization. Todays advanced electronic circuits disperse substantially heavier loads of heat than ever before. At the same time, the premium associated with miniaturized applications has never been greater, and space allocated for cooling purposes is on the decline. These factors have forced design engineers to seek more efficient heat sink technologies. Air-cooling also is accepted as an important

technique in the thermal design of electronic packages, because besides its availability, it is safe, does not contaminate the air and does not add Vibrations, noise and humidity to the system in which it is used. Using fins is one of the most inexpensive and common ways to dissipate unwanted heat and it has been successfully used for many engineering applications. Rectangular fins are the most popular fin type because of their low production costs and high thermal effectiveness.

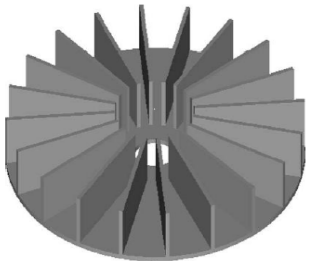


Fig 1.3 Radial heat sink with circular base and rectangular fins

III. REVIEW OF PREVIOUS WORK

F. Harahap, H. Lesmana [7] studied heat dissipation from miniaturized vertical rectangular fin arrays. Experiment was conducted under steady state heat dissipation and dominant natural convection condition for 3mm and 11mm fin spacing. They concluded that effect of the parameter W/L on heat dissipation rate is relatively less for the vertically base array. Also, higher heat dissipation rate was observed for non-square base, same base area and orientation with fins parallel to short side of the base plate than fin parallel to longer side ($W/L \leq 1$) of the base.

H. Yuncu [8] performed experiments over thirty different fin configurations with 250 and 340 mm fin length. Optimum fin spacing of aluminum rectangular fins on vertical base was examined. The range of base-to-ambient temperature was kept quiet wide from 30 to 150K for fin height and fin spacing from 5 to 25mm and 4.5 to 85.5 mm, respectively. It was found that optimum fin spacing varies for each fin height which is between 6.1 and 11.9mm. They developed Eq.1 to evaluate the optimum fin spacing value and corresponding maximum heat transfer rate at given fin length and base-to-ambient temperature difference for vertical base fin array. They commented that the larger fin height results in higher convective heat transfer from fin array but for low base-to-ambient temperature difference it was insignificant.

Yongping Chen et al. [9] developed and analyzed numerically a three-dimensional model of heat transfer and fluid flow in noncircular microchannel heat sinks. It is found that Nusselt number has a much higher value at the inlet region, but quickly approaches the constant fully developed value. The temperature both in solid and fluid increases along the flow direction. In addition, the comparison of thermal efficiencies is conducted among triangular, rectangular and trapezoidal microchannels. The result indicates that the triangular microchannel has the highest thermal efficiency.

Abdullatif Ben-Nakhi and Ali J. Chamkha[10] focused on the numerical study of steady, laminar, conjugate natural convection in a square enclosure with an inclined thin fin of arbitrary length. The inclined fin is attached to the left vertical thin side of the enclosure while the other three sides are considered to have finite and equal thicknesses of arbitrary thermal conductivities. The left wall of the enclosure to which the fin is attached is assumed heated while the external sides of the other three surfaces of the enclosure are cooled. The inclined thin fin is perfectly conductive and is positioned in the middle heated surface of the enclosure. Three different finlengths equal to 20, 35 and 50 percent of the heated surface are considered. The problem is formulated in terms of the vorticity-stream function procedure. A numerical solution based on the finite-volume method is obtained. Representative results illustrating the effects of the thin fin inclination angle and length and the thermal conductivity of the thick surfaces on the streamlines and temperature contours within the enclosure are reported. In addition, results for the local and average Nusselt numbers are presented and discussed for various parametric conditions.

Reng-Tsung Huang et. al. [11] experimentally carried out the natural convection heat transfer from square pin fin heat sinks subject to the influence of orientation. A flat plate and seven square pin fin heat sinks with various

arrangements are tested under a controlled environment. Test results indicate that the downward facing orientation yields the lowest heat transfer coefficient. However, the heat transfer coefficients for upward and sideward facing orientations are of comparable magnitude.

Hussam Jouhara [12] investigated the comprehensive description of the thermal conditions within a heat sink with rectangular fins under conditions of cooling by laminar forced convection. The analysis, in which increasing complexity is progressively introduced, uses both classical heat transfer theory and a computational approach to model the increase in air temperature through the channels formed by adjacent fins and the results agree well with published experimental data.

Sanjeev D. Suryawanshi et. al. [13] investigated normal and inverted notched fin arrays (INFAs) experimentally and numerically using Commercial CFD software and reported that the values of ha are 50–55% higher for INFAs giving better performance. For smaller spacing, increment in ha is small due to the flow constriction effect. The value of ha increases with spacing giving an optimum value at about S=6 mm. This is in agreement in other investigators. Single chimney flow pattern is retained in INFAs also with a wider chimney zone, which is the possible reason for heat transfer enhancement. When single chimney flow pattern is present, in midchannel stagnant bottom portion becomes ineffective. The modified array is designed in inverted notched form and that has proved to be successful retaining single chimney together with the removal of ineffective fin flat portion. CFD solutions obtained are in good agreement with experimental work.

Seung-HwanYu et.al. [14] experimentally and numerical investigated the natural convection in a radial heat sink, composed of a horizontal circular base and rectangular fins. The general flow pattern is that of a chimney; i.e., cooler air entering from outside is heated as it passes between the fins, and then rises from the inner region of the heat sink. Parametric studies are performed to compare the effects of three geometric parameters.

S.C. Haldar [15] studied numerically the laminar free convection about a single pin fin attached to a horizontal base plate has been reported in this article. Fluid at the far field moves horizontally towards the fin and then rises almost vertically along the fin and finally leaves through the top. With the increase in fin diameter heat transfer increases while the heat flux at fin base decreases establishing the advantage of large number of small diameter fins over fewer fins of bigger diameter.

S.A. Nada [16] investigated experimentally the heat transfer and fluid flow characteristics in horizontal and vertical narrow closed enclosures having a heated finned base plate. The effects of fin length and fin spacing have been studied for both orientations at a wide range of Rayleigh number. It has been found that insertion of fins with any fin array geometries increases the rate of heat transfer. Quantitative comparisons of heat transfer rate and surface effectiveness for both enclosure orientations have been reported. Optimization of fin-array geometries for maximum Nusselt number and finned surface effectiveness has been conducted. It was found that: For a high range of Ra, increasing Ra increases Nusselt number and decreases fin effectiveness.For a small range of Ra and at large S/H, increasing Ra increases both of Nusselt number and finned surface effectiveness. Nusselt number and finned surface effectiveness increases with decreasing S/H until S/H reaches a certain value beyond which the Nusselt number and finned surface effectiveness start to decrease with further decreasing of S/H. The maximum value of Nusselt number and finned surface effectiveness occurs at S/H = 1 for both enclosure orientations. The Nusselt number and finned surface effectiveness increased with increasing fin length. Useful design guidelines and correlations were developed for both enclosure orientations. The predictions of these correlations were compared with the present and previous experimental data and good agreement was found.

IV. CONCLUSION

The high heat flux cooling of electronic equipments and devices with various methods is reviewed. Particularly heat sinks which are used for natural convection and forced convection as

passive device is studied. Fins is one of the most inexpensive and common ways to dissipate unwanted heat hence its study is very important for improved design and also improving the heat dissipation rate performance of the plate by using different fin geometry and fin array also by other parameters such as fin height, fin spacing. The challenges of cooling electronic equipments may be expected to continue through the remaining of this decade. As the size of semiconductor is reducing day by day and power dissipation is increasing rapidly, so a breakthrough is needed in advanced cooling to reduce cost without sacrificing effectiveness of cooling.

REFERENCES

1 R. J. McGlen, R. Jachuck and S. Lin, " Integrated thermal management techniques for high power electronic devices," Applied thermal engineering, vol. 24, no. 8, pp. 1143-1156 , 2004.

2 Y. Wang and K. Vafai, "An experimental investigation of the thermal performance of an asymmetrical flat plate heat pipe," International journal of heat and mass transfer, vol. 43, no. 15, pp. 2657-2668, 2000.

3 R. Chu and R. Simons, "Recent development of computer cooling technology," International symposium on transport phenomena in thermal engineering, vol. 5, pp. 17-25, 1993.

4 H. Yuncu and G. Anbar, "An experimental investigation on performance of fins on a horizontal base in free convection heat transfer," Journal of heat and mass transfer, vol. 33, no. 5-6, pp. 507-514, 1998.

5 B. Yazicioglu and H. Yuncu, "Optimum fin spacing of rectangular fins on a vertical base in free convection heat transfer," Journal of heat and mass transfer, vol. 44, no. 1, pp. 11-21, 2007.

6 F. Harahap and H. McManus, "Natural convection heat transfer from horizontal rectangular fin arrays," Journal of heat transfer, vol. 89, no. 1, pp. 32-39, 1967.

7 F. Harahap, H. Lesmana, Measurements of heat dissipation from miniaturized vertical rectangular fin arrays under dominant natural convection conditions, Heat Mass Transfer 42 (2006) 1025–1036.

8 B. Yazicioglu, H. Yuncu, Optimum fin spacing of rectangular fins on a vertical base in free convection heat transfer, Heat Mass Transfer 44 (2007) 11–21

9 Yongping Chen, Chengbin Zhang, Mingheng Shi, Jiafeng Wu Three-dimensional numerical simulation of heat and fluid flow in noncircular microchannel heat sinks International Communications in Heat and Mass Transfer 36 (2009), pp. 917–920

10 Abdullatif Ben-Nakhi , Ali J. Chamkha, Conjugate natural convection in a square enclosure with inclined thin fin of arbitrary length, International Journal of Thermal Sciences 46 (2007) 467–478

11 Reng-Tsung Huang, Wen-JunnSheu,Chi-Chuan Wang, "Orientation effect on natural convective performance of square fin heat sinks", International journals of Heat and Mass Transfer 51 (2008) 2368-2376.

12 Hussam Jouhara, "Modelling and Simulation Techniques for Forced Convection Heat Transfer in Heat Sinks with Rectangular Fins", School of Engineering and Design, Brunel University, Uxbridge, Middlesex, UB8 3PH, UK.

13 Sanjeev D. Suryawanshi, Narayan K. Sane Natural Convection Heat Transfer From Horizontal Rectangular Inverted Notched Fin Arrays Journal of Heat Transfer AUGUST 2009, Vol. 131

14 Seung-HwanYu, Kwan-Soo Lee, Se-Jin Yook, "Natural convection around radial heat sink", International journals of Heat and Mass Transfer 53(2010) 2935-2938.

15 S.C. Haldar, "Natural convection about a cylindrical pin element on a horizontal plate", International Journal of Thermal Sciences 49 (2010) 1977-1983.

16 S.A. Nada Natural convection heat transfer in horizontal and vertical closed narrow enclosures with heated rectangular finned base plate International Journal of Heat and Mass Transfer 50 (2007) pp. 667–679.

SEISMIC PERFORMANCE EVALUATION AND RETROFITTING OF RC MEMEBERS AND JOINTS

[1]Dr. G.S Suresh, [2]Mr. Sachin V
[1]Professor, National Institute of Engineering, Mysore, Karnataka, India
,[2] Post Graduate Student, National Institute of Engineering, Mysore, Karnataka, India

ABSTRACT: In the present work, structure designed and constructed for only gravity loads is considered for evaluation and retrofitting work. Finite element software ETABS is used to determine the seismic demand of each element. Retrofitting to increase the capacity of elements is suggested for the elements having ratio of Demand to Capacity more than 1. Pushover analysis is used to determine the performance of the structure before and after retrofitting. In the present work, deficient columns are retrofitted and re-analyzed to check performance of the structure in non-linear analysis. Performance of this retrofitted structure is then compared with the existing reinforcement structure and it is found that structure after retrofit have more base shear capacity and displacement capacity, storey drift of the retrofitted structure has decreased thereby ensuring a maximum safety of the structure even to the zone3 level of seismic intensity. From the present study it is brought out that structural elements designed only for gravity loads have less vulnerability to collapse in zone 2 level of seismic intensity, and for zone 3 level of seismic intensity itself structural elements fails to perform both serviceability limit state as well as ultimate-strength limit state.

KEY WORDS: Evaluation, Performance evaluation, Pushover analysis, RC joints, Demand Capacity Ratio, Retrofitting, Non-linear analysis, Performance point,

1. INTRODUCTION

In the conventional limit state design approach, the designer normally takes into account the self-weight of the structure (dead load), imposed loads (live load), and depending on the location of the building, seismic, and climate related loads (wind and snow loads) are considered. While the vast proportion of the existing buildings experience only the types of loads mentioned above during their lifetimes, but building has to be designed to resist seismic load or lateral load which is assumed to occur once its life-time. In these conventional design method only two levels of design is considered, that is, ultimate-strength limit state and service-operational limit state for a building. But performance based design can be viewed as multi level design approach which has definite concern on performance of a building at intermediate limit states related to such issues as occupancy and life-safety standards. Hence we need to adopt a convenient analysis tool to analyze and design for performance-based approach. A structural analysis tool gives a number of analysis methods. For performance based analysis of structures a hierarchy of

structural analysis may be made. In which higher level procedure gives more accurate method of the actual performance of building subjected to earthquake loads, but interpretation of the results requires greater efforts and time consuming.

However in this work, existing reinforcement of the building is compared with linear static analysis result obtained as per the IS1893:2002(PART-1), structural elements which ever found deficient will be identified in this process and retrofitting methods are suggested. The performance of the building is checked using Non-Linear static procedure. Pushover analysis is a simplified, static, non linear procedure where a predefined pattern of earthquake loads is applied incrementally to the structure until a collapse mechanism is reached. The use of inelastic analysis procedure is an attempt to understand how structures will behave when subjected to earthquake load; it is assumed that the elastic capacity of the structure will be exceeded.

2. LITREATURE REVIEW

A detailed review has been carried out on the past research work on the behavior of joints both on experimental and analytical sides to focus on recent and past efforts related on seismic evaluation. A few research work done on the above mentioned area's are summarized below.

- **Umesh Dhargalkar. (2002) [16],** mainly dealt with the seismic assessment for the seismic retrofitting of the structures constructed with or without the seismic effect. The standard and comprehensive assessment involves data collection, compilation of data and assessing possible guidelines. Based on the data collected possible schemes of retrofitting can be checked by modelling an exact replica of the building. The best fit method is selected based on cost and convenience of implementation.
- **Pradip Sarkar, Rajesh Agarwal, and Devdas Menon (2007) [17],** revised the relevant features of shear design of joints under seismic loads given in international codes of practice (ACI, NZS, EN) highlighting requirements of the various parameters. According to this paper shear transfer mechanism categorized into 2 mechanism viz. diagonal strut mechanism and truss mechanism. Assessment of shear strength, design and detailing of shear reinforcement has been covered. It is seen NZS is very conservative recommendation followed by Euro code and ACI give many practical recommendations. Whereas IS 13920:1993 is silent on many issues related to the design of RC beam column joints under seismic loading. Hence it is necessary to upgrade IS 13920 keeping with international trends.
- **G.Appa Rao, M.Mahajan, M.Gangaram, and Rolf Eligehausen (2008) [19]**, dealt with the method of strengthening non-seismically designed RC beam-column joints to seismic loading. Typical reinforcement details of joints in pre-seismic design have been explained. Review of strengthening method and features, advantages and test results of FRP in rehabilitation of RC structures have been discussed. Hence in this paper merits and demerits of the strengthening of joints have been highlighted.
- **S. R. Uma, and Sudhir K. Jain. (2006) [21],** presented critical review of recommendations of well established codes regarding design and detailing aspects of beam column joints. The codes of practice considered are ACI 318M-02, NZS 3101: Part 1:1995 and the Euro code 8 of EN 1998-1:2003. All three codes aim to satisfy the bond and shear requirements within the joint. It is observed that ACI 318M-02 requires smaller column depth as compared to the other two codes based on the anchorage

conditions. Significant factors influencing the design of beam-column joints are identified and the effect of their variations on design parameters is compared. The variation in the requirements of shear reinforcement is substantial among the three codes.

- **Sudhir K. Jain, and T. Srikant (2002) [22],** discussed Pushover analysis for deficient buildings, new buildings or to make existing building perform well in future earthquake. In this work a four storey building with flat slab designed for wind load but not for seismic load is considered for the study. 2D frame of this building is modelled and Pushover analysis is performed in SNAP-2DX. Jacketing of column, providing additional beams and providing both columns jacketing and additional beams are the various retrofit schemes adopted. This scheme is studied at 4 different cases, i.e., at first storey only, first two storey, first three storey and all the four storeys. They found significant increase of strength and drift capacity when both jacketing of column and addition of beam.

3. PUSHOVER ANALYSIS

The Pushover analysis of a structure is a static non-linear analysis under permanent vertical loads and monotonically increasing lateral loads. The equivalent static loads approximately represent earthquake induced forces. A plot of total base shear versus top displacement in a structure is obtained by this analysis (Figure1) that would indicate any premature failure or weakness. The analysis is carried out up to failure, thus it enables determination of collapse load and ductility capacity. On a building frame, load/displacement is applied incrementally. The formation of plastic hinges, stiffness degradation and plastic rotation is monitored, and lateral inelastic force versus displacement response for the complete structure is analytically computed. This type of analysis enables weakness in the structure to be identified. There are different methods followed for pushover analysis. Basically it has been classified into two ways they are Force controlled and displacement controlled. In force control, the structure is subjected to lateral forces and the displacements are calculated. In displacement control, the structure is subjected to a displacement profile and the lateral forces are calculated.

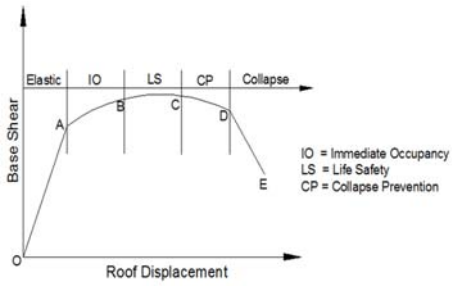


FIGURE.1. IDEALIZED PUSHOVER CURVE

4. PROBLEM STATEMENT

In the present work structural components of the building (Figure.2) are previously designed and constructed without considering the seismic effect. Structure is analyzed using ETABS by considering linear static analysis in x and y direction and Non linear static analysis along x direction only. ETABS design for seismic effect is compared with existing reinforcement and discussed. Capacity of each component with existing reinforcement in this building is compared with demand posed by the analysis results with consideration of lateral force for both Zone 2 and Zone 3 earthquake regions. This comparison is represented in the form of Demand and capacity ratios (DCR). Any structural elements found deficient in this DCR check will be retrofitted. For columns concrete jacketing and for beams Fiber Reinforced Polymer (FRP) wrapping is suggested. These analytical models (Zone2 and Zone3 ETABS designed models, existing reinforcement in Zone2 and Zone3 analysis, column retrofitted

models in Zone2 and Zone3) are subjected to PUSHOVER analysis, results obtained from this analysis are (Base shear versus Displacement curve, S_a versus S_d curve, Performance point and Hinge formation at performance point) discussed.

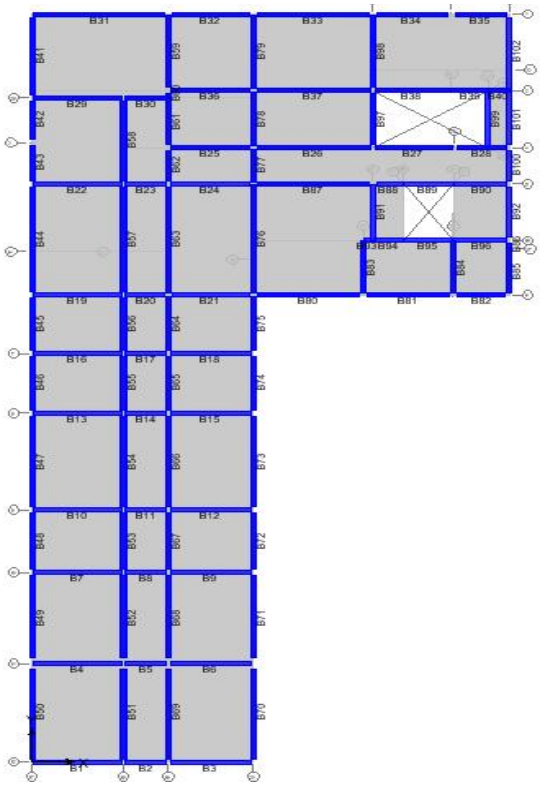


FIGURE.2 PLAN OF THE BUILDING CONSIDERED IN CASE STUDY**5.**

5. RESULTS AND DISCUSSION

I. EVALUATION OF BEAMS.

The capacity (flexural or shear) of the beam is obtained from the following derivation.

1. Moment of resistance of the beam (M_{ur}): For a given cross section of the beam and for the existing reinforcement, Moment of resistance is calculated by finding Neutral axis (X_u) and determining stress and strain at the level of X_u. This is derived as follows.

STEP1: Stress at the level of neutral axis (X_u) is

$$\varepsilon_{se}=\left(\frac{0.0035\times(X_u-d')}{X_u}\right)$$

For the calculated stress, strain is obtained using stress-strain curve given in SP16.

STEP2: Based on the ideology, Compression (C) and Tension (T) are equal at X_u. Then C and T are calculated by;

$$\mathbf{C} = (0.36\times f_{ck}\times b\times X_u)+Asc\times(f_{sc}-0.45f_{ck})\ ;\ \mathbf{T}=(f_{sc}\times A_{st});$$

Where

b = breadth of the beam,

f_{ck}= flexural strength of concrete.

STEP3: After determining C & T moment of resistance is determined by

$$\mathbf{M_{ur}}= (0.36f_{ck}bX_u)\times(d-0.42X_u)+A_{sc}(d-d')\times(f_{sc}-0.45f_{ck}).$$

STEP4: This Moment of resistance M_{ur} must be greater than Flexural demand M.

After determining the flexural capacity of the beam elements, it is compared with the demand obtained by ETABS linear static analysis with Zone2 and Zone3 seismic intensity and following results are obtained. And typical graphical representation is shown in Figure 3, 4 & 5.

1. 39 elements in left end of the beam, 82 elements in mid-span of the beam, 34 elements in right end of the beam have DCR value 1to2 in seismic Zone2. Where as in seismic zone 3 it is found that 83 elements in left end, 88 elements in mid-span, 89 elements in right end are deficient.
2. 12 elements in left end of the beam, 14 elements in mid-span of the beam, 6 elements in right end of the beam have DCR value 2to3 in seismic Zone2.

ISBN: 978-93-85225-02-4,1st February, 2015, Goa

Where as in seismic zone 3 it is found that 27 elements in left end, 16 elements in mid-span, 17 elements in right end are deficient.

3. 2 elements in left end of the beam, 1 element in mid-span of the beam, 3 elements in right end of the beam have DCR value 3to4 in seismic Zone2. Where as in seismic zone 3 it is found that 7 elements in left end, 10 elements in right end are deficient.
4. 4 elements in left end of the beam, 4 elements in mid-span of the beam have DCR value above 4 in seismic Zone2. Where as in seismic zone 3 it is found that 5 elements in left end, 5 elements in mid-span, 5 elements in right end are deficient.

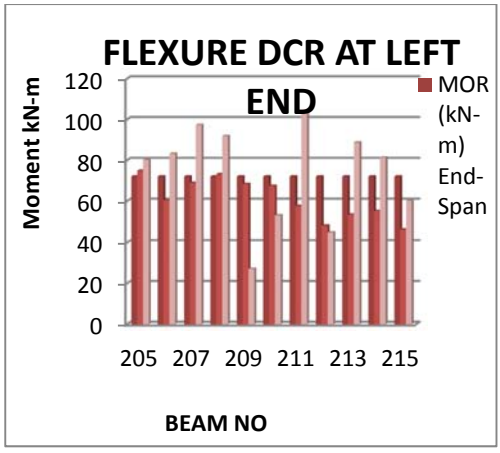


FIGURE.3. COMPARISON OF FLEXURAL DEMAND AND CAPACITY OF BEAM AT LEFT END

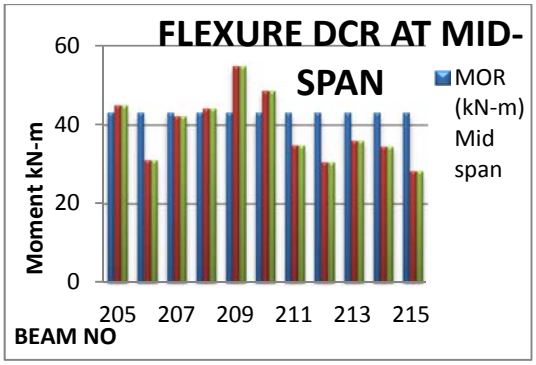


FIGURE.4. COMPARISON OF FLEXURAL DEMAND AND CAPACITY OF BEAM AT MID-SPAN

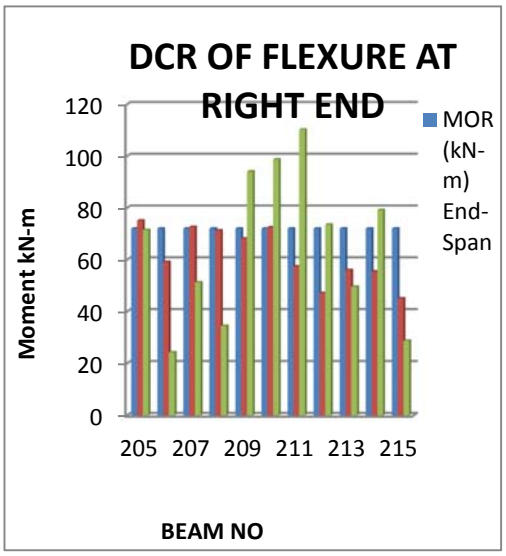


FIGURE.5 COMPARISON OF FLEXURAL DEMAND AND CAPACITY OF BEAM AT RIGHT END

From the above results it is observed that number of beam elements having DCR value greater than 1 are more in case of seismic zone3 and the structure is more vulnerable to seismic intensity zone3 itself.

2. Shear Capacity calculation (V_u): Shear strength concrete (V_{uc}) and Shear is strength of steel (V_{us}) is calculated and summation of this is compared with the Shear demand (Vu). The calculation of the shear demand is given by;

STEP1: For the existing A_{st}, Shear strength in concrete τ_c is found by utilizing IS456:2000 Table19. Where $\tau_c < \tau_{max.}$

STEP2: Shear resistance of concrete $V_{uc} = \tau_c bd$

STEP3: Shear resistance of the steel $V_{us} = \left(\frac{0.87 A_{sv} f_y d}{S_v}\right)$

ISBN: 978-93-85225-02-4,1st February, 2015, Goa

STEP4: Ultimate Shear resistance is given by $V_u=V_{us}+V_{uc}$,

where Vu>Shear demand (V)

STEP5: According to IS13920:1993, Shear force due to formation of plastic hinges at both ends of the beam plus the factored gravity load on the span.

For sway to right: $V_{u,\ a} = V_a^{D+L} - 1.4\left[\frac{M^{As}{}_{u,lim}+M^{Bh}{}_{u,lim}}{L_{AB}}\right]$

And $V_{u,\ b} = V_b^{D+L}+1.4\left[\frac{M^{As}{}_{u,lim}+M^{Bh}{}_{u,lim}}{L_{AB}}\right]$

Where

$M^{As}{}_{u,lim}$ & $M^{Bh}{}_{u,lim}$ are sagging and hogging moments of resistance of the beam section at ends A and B.

V_a^{D+L} and V_b^{D+L} are the shears at ends A and B due to vertical loads with 1.2 partial safety factor on loads.

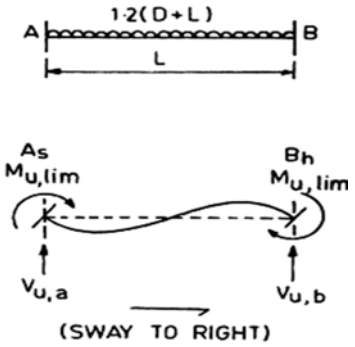


FIGURE.6. CALCULATION OF DESIGN SHEAR FORCE FOR BEAM

In determination of Shear demand of the beam we have taken only the gravity load combination (i.e. DL+LL) hence we get only one shear demand and following results are obtained in terms of Demand Capacity Ratio DCR.

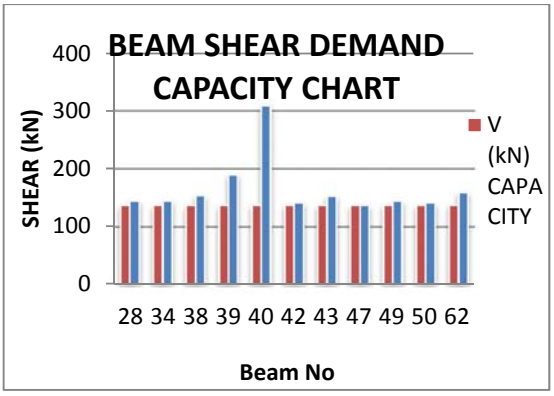


FIGURE.7.COMPARISON OF SHEAR DEMAND AND CAPACITY OF BEAM AT ENDS

1. 183 beam elements in the structure have DCR value 1 to 2.
2. 6 beam elements have DCR value 2 to 3.
3. 5 beam elements have DCR value 7 to 8 and
4. 5 beam elements have DCR value greater than 9.

II. EVALUATION OF COLUMN

In evaluation of the column the Factored axial load and moments (uni-axial or bi-axial) are compared with the ultimate moment carrying capacity of the column with the existing reinforcement and DCR is calculated. Similarly shear demand also calculated but compared with the capacity as given in IS13920:1993.given by

1. MOMENT CAPACITY OF THE COLUMN SECTION:

ISBN: 978-93-85225-02-4,1st February, 2015, Goa

STEP1: For the given column section, existing reinforcement Pt, known d`/D ration, pt/f_{ck} is determined.

STEP2: By referring the interaction curve given in the SP16 for the actual [Pu / $f_{ck}bD$], pt/f_{ck}, determine [M_u / $f_{ck}bD^2$] and calculate M_u, then compare it with the moment from the analysis.

STEP3: Determine the DCR of bending moment, member is safe if DCR<1.

After determining the DCR of flexure following results are obtained.

1. 29 column elements have DCR value 1-2, 3 column elements have DCR value 2 to 3, 3 column elements have DCR value greater than 3 in zone2 seismic intensity. And
2. In zone 3 seismic intensity 46 column elements have DCR value 1 to 2, 8 elements have DCR 2 to 3, 3 elements have DCR 3 to 4 and 3 elements have DCR above 4.

In the case study structure 61 column elements were present out of which 60 columns have very less capacity in Zone 3 seismic intensity.

2. SHEAR CAPACITY OF THE COLUMN:

Calculation of shear capacity in column requires an assumption that one face of the steel reinforcement is completely in tension. Method of calculation of the shear capacity is explained with Figure.8.

STEP1: Area of reinforcement (A_s) of that face is calculated, for which τ_c is calculated from IS456:2000 Table 19.

STEP2: Since the shear reinforcement is known, Design shear strength is determined by;

$$V_{us}= \left(\frac{0.87 f_y A_{sv} d}{S_v}\right)$$

STEP3: Total shear strength (V_u) of the section is calculated by summing up the concrete shear strength (V_c) and shear strength of the stirrups (V_{us}), which is termed as shear capacity of the column.

STEP4: From the IS13920 the design shear force for column shall be the maximum of;

a) Calculated factored shear force from the analysis, and

b) A factored shear force given by Vu= 1.4 $\left[\frac{M_{u,Lim}{}^{bL}+M_{u,Lim}{}^{bR}}{h_{st}}\right]$

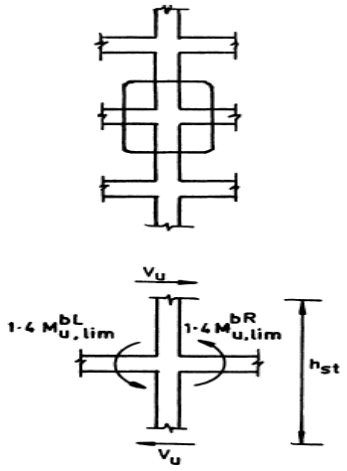


FIGURE.8. CALCULATION OF DESIGN SHEAR FORCE FOR COLUMN

ISBN: 978-93-85225-02-4,1st February, 2015, Goa

Where,

$M_{u,Lim}{}^{bL} + M_{u,Lim}{}^{bR}$ Are moment of resistance, of opposite sign, of beams framing into the column from opposite faces and h_{st} is the storey height.

After a detailed evaluation of column it is found that all columns have higher shear strength capacity.

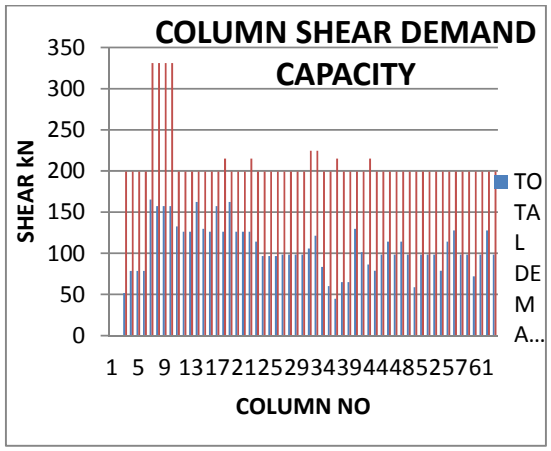


FIGURE.9.COMPARISON OF COLUMN SHEAR DEMAND AND CAPACITY

III. STRONG COLUMN WEAK BEAM

The current approach to the design of earthquake resistant RC rigid (i.e., moment resistant) frame is to have most of the significant inelastic action or plastic hinging occur in the beams rather than in columns. This is referred to as the "STRONG COLUMN-WEAK BEAM" concept and is intended to help ensure the stability of the frame while undergoing large lateral displacement under earthquake excitation. IS15988:2013 gives following equation to determine the strong column-weak beam

$$\sum M_c \geq 1.1 \sum M_B$$

Since interior column consists of beams running in two perpendicular direction, for the simplification it is divided into Major and Minor axis. Number of Columns which do not holds good with Strong Column Weak Beam philosophy are tabulated in Table.1

TABLE.1. NUMBER OF COLUMNS WITH STRONG BEAM AND WEAK COLUMN

AXIS	STOREY 1	STOREY 2	STOREY3	STOREY 4	STOREY 5
MAJOR AXIS	37	48	38	34	39
MINOR AXIS	25	20	11	9	12

Since too many columns in both major and minor axis are weak compared to its adjacent beams, retrofitting has to be adopted in all the storey level and performance is rechecked. Beam-Column joints of the case study 1 building are checked, and it is found that all joints are safe.

IV. RETROFITTING OF COLUMN

Evaluated columns after comparison with demand it is found that all columns are against the philosophy of "Strong Column Weak Beam". Hence depending upon the DCR ration columns are categorized and retrofitted. A simplified analysis for the flexural strength of a retrofitted column can be done by the traditional method of interaction curves (SP 16: 1980, "Design Aids for Reinforced Concrete to IS 456: 1978,

published by the Bureau of Indian Standards). The retrofitted columns and dimension are shown in Table.2.

TABLE.2. Details Of Retrofitted Columns

SL.NO	Existing Column Size (mm)	Revised Sections mm	Increased Ast mm^2	Total Columns
1	200X380	300X480	1561	40
2	200X685	300X785	3000	4
3	200X380	300X480	1273	3

V. STOREY DRIFT

TABLE.3. PERCENTAGE DECREASE IN STOREY DRIFTS OF THE RETROFITTED BUILDING

ZONES	DRIFT X	DRIFT Y
ZONE 2	45%	40%
ZONE 3	45%	42%

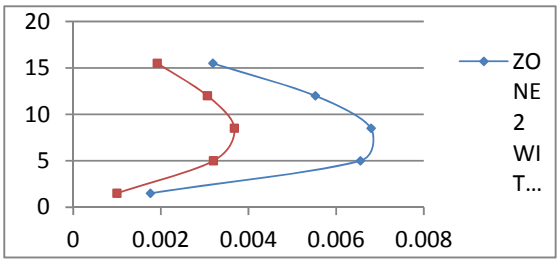


FIGURE.10.STOREY DRIFT X IN ZONE 2

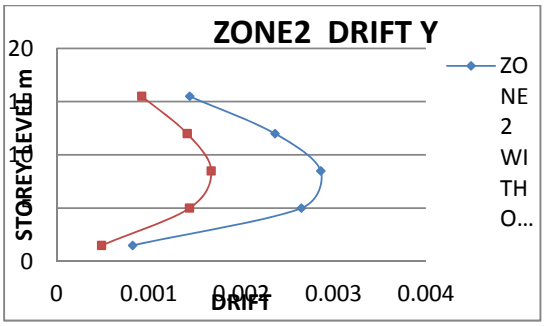


FIGURE.11.STOREY DRIFT Y IN ZONE3

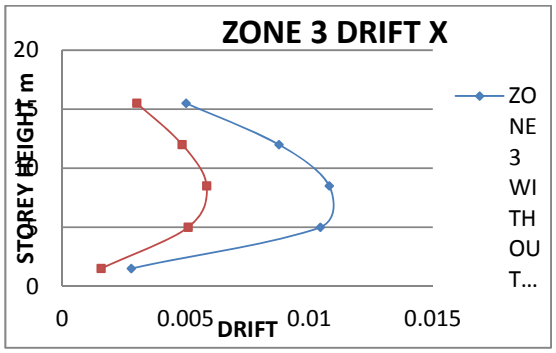


FIGURE.12.STOREY DRIFT X IN ZONE3

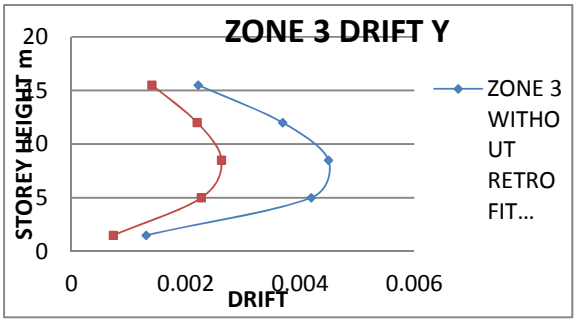


FIGURE.13.STOREY DRIFT Y IN ZONE 3

The actual storey drift of the case study building is displayed in Figure 10, 11, 12 and 13. In these figure's displacement of building in X and Y direction, with existing reinforcement and retrofitted members are compared and the percentage of decreased drift in the retrofitted model are shown in the Table.3. From the results of the storey drift we can conclude that, after retrofitting the building storey drift is reduced by 45% in X direction in both Zone2 and Zone3 seismic region and a 40% reduction in storey drift in Y direction in both Zone2 and Zone3

seismic region. Hence the building is safe after retrofitting under serviceability limit state.

6. RESULTS AND DISCUSSION OF PUSHOVER ANALYSIS

The result obtained from the Pushover analysis that is Base shear versus Displacement, Spectral acceleration versus Spectral Displacement and Hinge formation at performance point are discussed.

I. COMPARISON OF PUSHOVER CURVES

The case study building is designed in ETABS for ZONE 2 and ZONE 3 seismic loading. The same building is analyzed with the existing reinforcement without altering the member dimensions. During the evaluation part of the case study1 structure, it is observed that the columns are deficient in load carrying capacity. Hence retrofit is carried out to all columns. This retrofitted column is provided as such in ETABS and analyzed. Pushover analysis is carried out to all the above cases and 4 different PUHOVER curves are obtained and displayed in Figure.14.

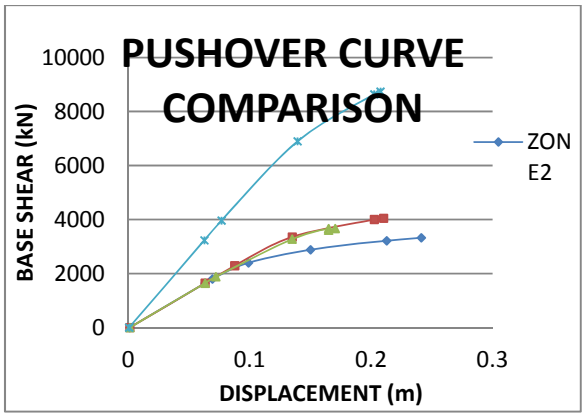


FIGURE.14. PUSHOVER CURVE COMPARISON

From the comparison of the PUSHOVER curves following conclusions are drawn

i. Structure with existing reinforcement has lesser base shear capacity and displacement capacity compared to the same structure designed for Zone2 and Zone3 level of earthquake. Hence, the structure with existing reinforcement is more vulnerable compared to those designed for earthquake loads.

ii. Structure designed for Zone 2 has lesser base shear capacity compared to the structure designed for Zone3. Hence it can be concluded that structures designed for higher zones of earthquake have better seismic capacity.

iii. The pushover curve for retrofitted building shows very high base shear capacity and displacement capacity compared to all other structure. Hence this structure is less vulnerable compared to all other building.

iv. Retrofitting of the existing deficient buildings as detailed in the present study can be an efficient way of improving the seismic performance of vulnerable buildings.

II. COMPARISON OF PERFORMANCE POINT

TABLE.4. COMPARISION OF HINGES AT PERFORMANCE POINT

	Displacement	Base	Force	A-B		B-IO	IO-LS	LS-CP	CP-C	C-D	D-E	>E TOTAL
ZONE2	0.099	2398.3	1358	134		118	0	0	0	0	0	1610
ZONE3	0.1351	3356	1332	137		122	19	0	0	0	0	1610

ISBN: 978-93-85225-02-4,1st February, 2015, Goa

		.4										
EXISTING	0.1355	32744.9	1469	44		54	42	0	1	0	0	1610
RETROFITTED	0.00768	39653.4	1542	56		12	0	0	0	0	0	1610

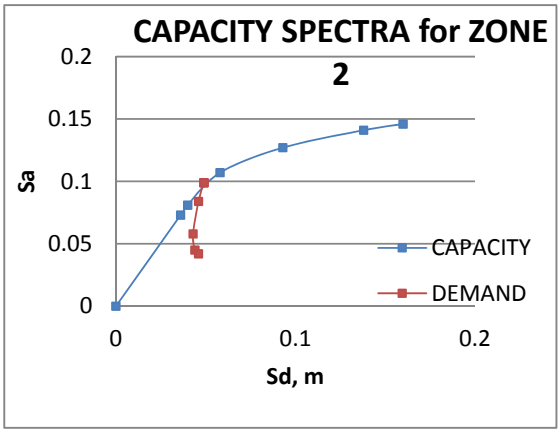


FIGURE.15.CAPACITY SPECTRA FOR STRUCTURE WITH ZONE2 DESIGN

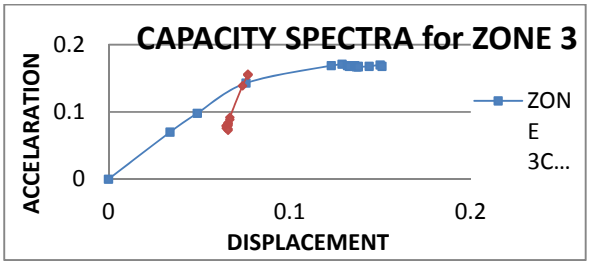


FIGURE.16.CAPACITY SPECTRA FOR STRUCTURE WITH ZONE3 DESIGN

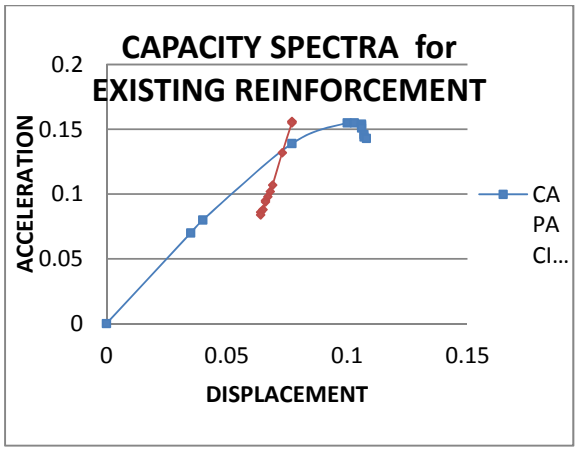


FIGURE.17.CAPACITY SPECTRA FOR STRUCTURE WITH EXIXTING REINFORCEMENT

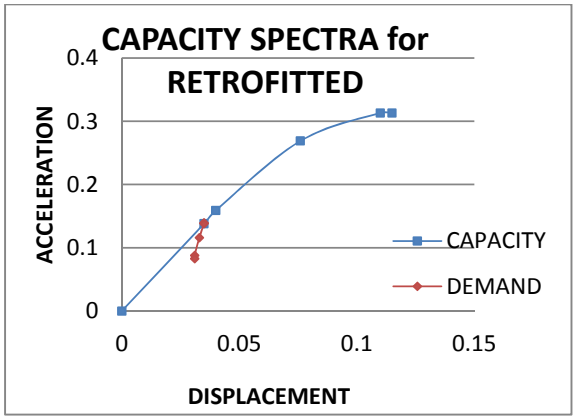


FIGURE.18.CAPACITY SPECTRA FOR STRUCTURE WITH ZONE2 DESIGN

The representation of the two curves in one graph is termed as the Acceleration versus Displacement Response Spectrum (ADRS) format as in Figure 15, 16, 17 and 18. The performance point is the point where the capacity spectrum crosses the demand spectrum. If the performance point exists and the damage state at this point is acceptable, then the building is considered to be adequate for the design earthquake. In the present case study, 4 different capacity spectrums are generated for the same structure (i.e., those designed for Zone2 and Zone3, existing reinforcement, retrofitted structural elements). Hence the capacity spectra of all the 4 models are represented and compared. The status of hinges formed at the performance point is depicted in Table.4. With

ISBN: 978-93-85225-02-4,1st February, 2015, Goa

the performance point in all the 4 cases, we can conclude that in those designed for Zone2 and Zone3 cases, number of hinges in vulnerable damage states formed at performance point are more compared to the other two cases. In structure with existing reinforcement at performance point itself hinges have reached Collapse prevention level, where in other 3 cases no hinges are in collapse prevention level. Very few hinges are formed at immediate occupancy to life safety level in case of structure with Zone3 design and existing reinforcement cases, where no hinges formed in structure with Zone2 design and retrofitted case. In retrofitted structure very less hinges are formed and more hinges are there in elastic region itself. This concludes that retrofitted structure has very few elements that are vulnerable.

7. CONCLUDING REMARKS

- The data obtained in the form of results of analysis for structural elements (Beams and Column) by ETABS is huge. This has to be sorted out systematically so that evaluation of members becomes easier.
- Results of analysis for gravity and earthquake loading obtained in the ETABS are considered as Demand posed on the structure. This demand is compared with the capacity of the elements
- During the linear static analysis of the structure, it is observed that seismic demand of the structural elements increase with the change in the seismic zone and soil type. But the capacity remains unchanged. Hence this demand and capacity of the elements is compared.
- DCR of beam and column in flexure and shear in zone 2 exceeding 1 is less than that in seismic zone 3. This states that elements are more vulnerable to seismic zone3. Hence such column elements are identified and retrofitted using concrete jacketing.
- Before retrofitting almost all columns were failed in ETABS design check. But after retrofitting, all the column elements became safe to the ETABS design check.
- The pushover analysis is a relatively simple way to explore the non linear behavior of the buildings. The results obtained in terms of demand, capacity gave an insight into real behavior of the structure.
- Pushover analysis of casestudy1 building is carried out in 4 different cases. By the comparison of the pushover curve at all incidences we can say that existing structure, which was originally designed for gravity loads only, is more vulnerable to the lateral loads. Hence retrofit is recommended.
- Retrofitted structure is then analyzed using Pushover analysis. It is observed that with the increase in the column section and reinforcement, the base shear capacity and displacement capacity is increased tremendously.
- Pushover analysis also gives status of hinge formation at different level of displacement/base shear. After comparison of the hinge formation at the level of performance point in existing structure, it is found that more hinges have crossed elastic limit than the retrofitted structure. Also some hinges have been observed at collapse level in existing reinforcement structure.
- Comparison of Storey drift of the existing and retrofitted structure shows that structure after retrofit have about 50% less storey drift.
- Hence with all these information it can be concluded that structure after retrofitting the columns only, have shown increased performance for both linear static and non linear static analysis.

- Performance based evaluation of structures gives true picture of element level and global level states of buildings. Pushover analysis can be effectively used in assessing the seismic performance evaluation of buildings.

REFERENCES

1. ACI-ASCE committee 352, American Concrete Institute, Detroit. "Recommendations for Design of Beam-Column joints in Monolithic Reinforced Concrete Structure". As a part of *Journal of Structural Engineering*, May-June 1985.

2. Daniel P Abrams. American Concrete Institute, Detroit. "Scale Relation for Reinforced Concrete Beam-Column joints". As a part of *Journal of Structural Engineering*, November-December 1987.

3. Bahjat Adbel Fattah and James.K.wight. "Study of Moving Beam Plastic Hinging Zones for Earthquake Resistant Design of RC building". American Concrete Institute, Detroit. As a part of *Journal of Structural Engineering*, January-February 1987.

4. A K Jain and R A Mir. The Indian Concrete Journal "Inelastic Response of Reinforced Concrete Frames Under Earthquake". April 1991.

5. V Kumar, B D Nautiyal and S Kumar. The Indian Concrete Journal. "A Study of Exterior Beam-Column Joints". As a part of *Journal of Structural Engineering* , January 1991.

6. A G Tsons, I A Tepos and G Gr Penelis. American Concrete Institute, Detroit. "Seismic Resistance of Type-2 Exterior Beam-Column Joints Reinforced with Inclined Bars". As a part of *Journal of Structural Engineering,* January-February 1992.

7. Moshe. A. Adin, David Z.Yankelevsky and Daniel N. Farhey. American Concrete Institute, Detroit. "Cyclic Behaviour of Epoxy-Repaired Reinforced Concrete Beam-Column Joint". As a part of *Journal of Structural Engineering.* March-April 1993.

8. Andre Filiatrault, Sylvain Pinear and Jules Houde. American Concrete Institute, Detroit. "Seismic Behavior of Steel Fiber Reinforced Concrete (SFRC) Interior Beam-Column Joint". As a part of *Journal of Structural Engineering*, September-October 1995.

9. Gregory.S.Raffelle and James.K.Wight. American Concrete Institute. "Reinforced Concrete Eccentric Beam-Column Connection Subjected to Earthquake Type of Loading". As a part of *Journal of Structural Engineering*. V.92, No1, January-February 1995.

10. Cheng-Cheng Chen and Gwang-Kai Chen. American Concrete Institute, Detroit. "Cyclic Behaviour of RC Eccentric Beam-Column Joints Connecting Spread-Ended Beams". As a part of *Journal of Structural Engineering*. V.96, No3, May-June 1999.

11. Shingeru Hakuto, Robert Park and Hitoshi Tanata. American Concrete Institute, Detroit. "Seismic Load Test on Interior and Exterior Beam-Column Joints with Sub-Standard Reinforcing Details". As a part of *Journal of Structural Engineering*. V.97, No1, January-February 2000.

12. N.Ganeshan and P.V.Indira. *The Indian Concrete Journal*. "Latex Modified SFRC Beam-Column Joints Subjected to Cyclic Loading". July 2000.

13. C.V.R.Murthy, Durgesh.C.Rai, K.K.bajpal, and Sudhir.K.Jain. *The Indian Concrete Journal*. "Anchorage Details and Joint Design in Seismic RC frames". April 2001.

14. Ziad Bayasi, and Michael Gebman. American Concrete Institute, Detroit. "Reduction of Lateral Reinforcement in

Seismic Beam-Column connection via Application of Steel fibers". As a part of *Journal of Structural Engine ering*. V.99, No6, November-December 2002.

15. Bing Li, Yiming Wu, and Tso-Chien Pan. American Concrete Institute, Detroit. "Seismic Behavior of Non-Seismically Detailed Interior Beam-Wide Column Joints". As a part of *Journal of Structural Engineering*. V.99, No6, November-December 2002
16. Umesh Dhargalkar. *The Indian Concrete Journal*. "Seismic Assessment of Buildings Methodology". August 2002
17. Pradip Sarkar, Rajesh Agarwal, and Devdas Menon. *Journal Structural Engineering*. "Design of RC Beam-Column Joints under Seismic Loading". Vol.33, No 6, February-March 2007.
18. Balthasar Novak, K.Ramanjaneyulu, Constanze Rohem and Saptharshi sasmal. *Journal of Structural Engineering*. "Seismic Performance of D-region framed structure Designed according to Different code Requirement". Vol.35, No 1, April-May 2008.
19. G.Appa Rao, M.Mahajan, M.Gangaram, and Rolf Eligehausen. *Journal Structural Engineering*. "Performance of Non-Seismically designed RC Beam-Column joints strengthened by various schemes subjected to Seismic Load". Vol.35, No 1, April-May 2008
20. Akanshu Sharma, G.Genesio, and R.Eligehausen. *Journal of Structural Engineering*. "Non linear Dynamic analysis using Micro-plane model for concrete and Bond slip model for prediction of Behavior of Non-Seismically detailed RCC Beam-Column Joints". Vol.36, No 4, October-November 2009
21. S.R.Uma and Sudhir Kumar Jain, IIT-Kanpur March 2006.
22. Sudhir K.Jain and T.Srikant. *The Indian Concrete Journal*. "Analysis for seismic retrofitting of buildings". August 2002Seismic
23. IS -456-2000 -Code of Practice for Plain and Reinforced Concrete.
24. SP -16- Design Aids for Reinforced Concrete.
25. IS -875-1987 (Part-2) – Code of Practice for Live Loads Over Structures.
26. IS -1893-2002 (Part-1) –Code of Practice for Seismic Design
27. IS -15988 - 2013 - Seismic Evaluation and Strengthening of Existing Reinforced Concrete Buildings
28. IS -13920 -1993 - Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces

BUDGET MONITORING OF RESIDENTIAL BUILDING

[1]Ingle Prachi Vinod
[#1] *Dept.of Civil Engineering, Bhivarabhai sawant college of Engg, Pune,*
Email:[1]prachi03ingle@gmail.com

Abstract

Financial planning is base for survival of any construction industry. It is essential as it identified as the common cause of business failure, and can lead to the failure of profitable and growing firms as well as those declining. As such, there is a need for adequate timing of fund availability in construction and deployment of excess fund to more productive use. Accurate cash flow projections are important to both an owner and a contractor. A corporation's business plan generally includes multi-year cash flow and expenditure forecasts and continuous budget monitoring should be done. Inaccurate cash flow projection of a large project can lead to take wrong decision which may not be in favor of company. Budget helps to aid the planning of actual operations by forcing managers to consider how the conditions might change and what steps should be taken now and by encouraging managers to consider problems before they arise.

Keywords *financial planning, cost control*

Introduction

As many of large scale project gets delay due to funds which is indirectly related to continuous budget monitoring. The project cash flow projection is derived from an execution plan and estimated expenditure. Many projects treat estimated expenditures as cash flow projections. A planned project cash flow is the baseline for comparison with the actual project expenditure. The purpose of budgeting is to

1) To provide forecast detail report on expenditure and revenues.

2) Whether actual budget and planned budget are implemented.

3) Establish cost constraint for project.

We consider the problems associated with resource utilization, accounting, monitoring and control during a project. Interpretation of project accounts is generally not straightforward until a project is completed, and then it is too late to influence project management. There are various problems associated with resource utilization, accounting, monitoring and control during a project. Even after completion of a project, the accounting results may be confusing. Hence, managers need to know how to interpret accounting information for the purpose of project management. A project typically goes through multiple phases till it gets final. Cost estimates, schedule and an execution plan are developed at each phase. Cash flow projection is also prepared to support funding decision at each stage. The time at which major cost savings can be achieved is during planning and design for the project. During the actual construction, changes are likely to delay the project and lead to inordinate cost increases. As a result, the focus of project control is on fulfilling the original design plans or indicating deviations from these plans, rather than on searching for significant improvements and cost savings. The detailed cost estimate provides a baseline for the assessment of financial performance during the project. Project budget is used as a guide for management. As a result, cost overruns or savings on particular items can be identified as due to changes in unit prices, labor productivity or in the amount of material consumer. Good managers should focus

upon future revenues, future costs and technical problem

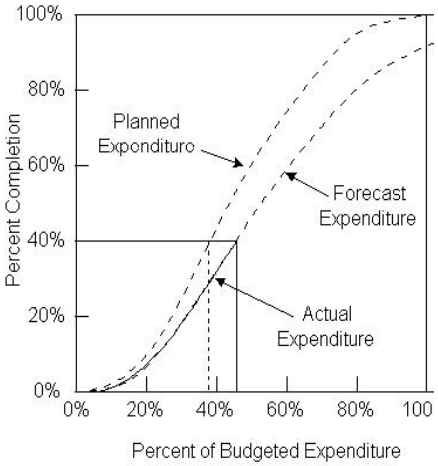


Fig 1.Graph Proportion Completion versus Expenditure for an Activity

Construction projects normally involve numerous activities which are closely related to the use of similar materials, equipment, workers or site characteristics Without this updating, project schedules slip more and more as time progresses. To perform this type of updating, project managers need access to original estimates and estimating assumptions. In the traditional sense, the purpose of preparing budget is to understand and control costs. This concept of budget has therefore transformed into using budget proposal as an instrument for individual, public and private policy. It is useful to all parties involved in a project as a planning and control tool. Budget could be employed by the client to get priorities among projects competing for limited resources. Many start-up companies fail because of insufficient cash flow. Cash flow is where the project cost meets the schedule. Cash flow projections developed from credible project execution plans become the basis of project controls. Combining the cash flow and earned value technique, a project can track the real status of progress and detect any early cost deviation. **C**ash flow means the amount of cash being received and spent during a defined period of time.

Budget Monitoring Methodology:

A budget structure in construction projects is constituted of cost accounts such as bills, sections, items, and resources. Generally, a budget structure in construction projects includes into labor, material, equipment, subcontract, and indirect expenses

1. Budget Monitoring Process

In budget monitoring process we need to monitor each and every phase of project. There are various cost parameters and cost weight age which should be considered.

2. Evaluate the budget Process of residential building

when evaluating budget process all phases of budget are very important. Project initiation and development phase is very important activity for any budget monitoring. Other activity like estimation, construction and maintenance phases are also important in budget monitoring. Project Influence is highest or cost is negligible.

3. Analyze the budget process

Analyzing of budget process is very important. This stage is carried out continuous by while analyzing of budget we focus on procedure which is carried on site. Various techniques must be used for analyzing budget.

4. Develop Budget monitoring process

There are number of soft ware's available in market to work out cash flow and budgeting of any construction project

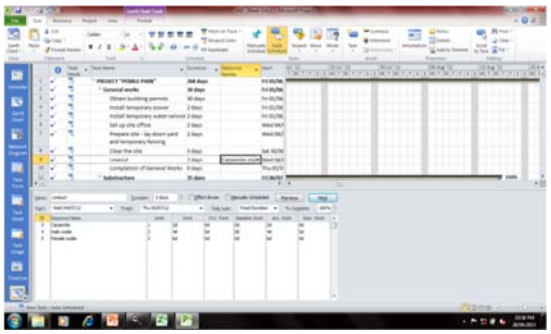
1) Primavera
2) Hit-office
3) Microsoft Project
4) Implementing using softwares.

Steps involved in Budgeting Process

1 linking of activity

2. Assigning Resources.

Such as material, labor, equipment. To monitor detail cost required for material used, equipments are hired or not rent bases. Which type of equipments is used.No. of labor used, wages being paid for them.



3. Make a comparative study of actual with the plan

Using MSP we can Track the Gantt this gives comparison of actual duration and planned duration of project.

4. Develop s curve using MSP tool

S cuve is the s shaped graph produced by the sigmoid formula which calculates the cumulative expenditure of certain parameters (man-hours, cost) against time and it is the representation of project path.

5. Applying the monitor tool to other project

There are various tools which we use in project. we find cash flow which is very important to monitor budget. Cash flow means the amount of cash being received and spent during a defined period of time.

In this Project Budget monitoring and various constraints are focused which are important.

Name of Site: Shriniwas Rainbow Developers

Location: Bavdhan Pune.

Type of Project: Residential Building

Slab area: 429392sqm

Salable built up: 317185sqm

The quantities required for man power study are calculated from the drawings

Estimation of quantity.

Sr No.	Item Of Work	Amount
1	Civil Cost	389305080.35
2	Development Cost	52283464.78
3	Podium Cost	59794169.09
4	Landscaping & Hardscaping & Lighting	8700000.00
5	Overheads	29800000.00
6	Other Expenses	40131788.67
	Total	580014502.89

Rate analysis

It is calculated with help of amount of quantity and rates for them.

Linking in MSP

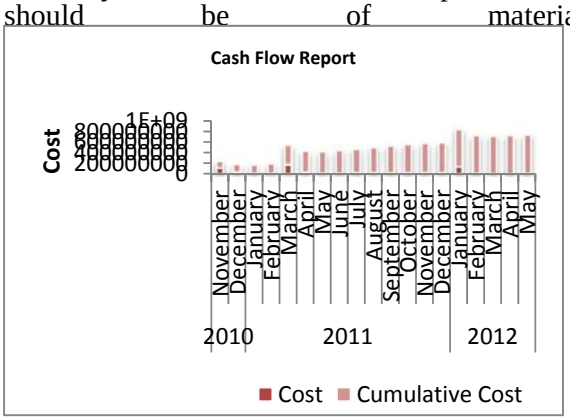
Linking is done for all activity. Critical path is determined so that we understand longest route. After preparing the schedule in MSP software the total project duration is estimated as 480 working days.

Resource sheet

After linking activity we assign resources. Resource can be labor, material, and equipments. In resource sheet all standard rates are considered.

Comparison of actual and planned duration of projects.

Comparison of actual and planned duration of projects is done with help of tracking. Tracking means recording project details such as who did what work, when the work was done, at what cost. These details are often called as actual. Tracking is required to know the status of project, is too essential to track the project and to record the schedule of progress of work being performed. The total project cost isRs 726964820.02 we have got cash flow. The total cost of the project has been divided into two types namely, direct cost and indirect cost. Direct project costs are those expenditures, which are directly chargeable to and can be identified specifically with the activities of the project. These include labor cost, equipment cost, transportation cost etc.cash outflow is not that more in the beigning later is goes on increasing and finally becomes very less.In initial stages of project the cash flow is not that much it constantly gets increased and later gets decreased.We also calculate resource cost summary.As we know 70 to 80 percent cost should be of material.



Scurve

The start up phase includes planning and moblisation phase in which we need to take care about resource allocation.At start it picks up rapidly and towards end it decelerates again as mulitiple loose end.S curve is a vitual representation of progress path.S curve is the s shaped graph produced by the sigmoid formula which calculates the cumulative expenditure of certain parameter

ISBN: 978-93-85225-02-4,1st February, 2015, Goa

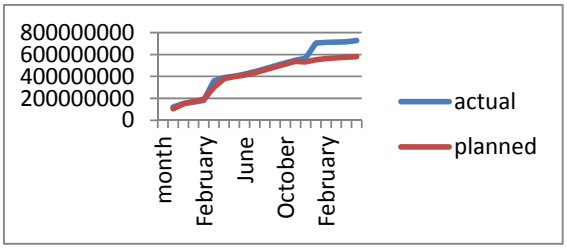


Fig 2. *S Curve Analysis for Planned and Actual*

Limitation Of study

The limited objective of budget monitoring is to control deserves emphasis. Budget control procedures are primarily intended to identify deviations from the project plan rather than to suggest possible areas for cost savings.

Conclusion

The total Budget cost estimates for project consists of actual cost of project increased by 153 million which was planned as 580 million and the actual cost of project is 73 million within period of 2012-2013. The Following parameters are responsible for increasing amount within one year.

Sr. No.	Delay	Duration(month)	Reason
1	Environment clearances	6	Due to no environment clearances all work got stop.
2	Permission	3	The permission was not sanctioned by town planning department up to G+12
3	Building Finishes	8	In proper planning

Sr. No.	Parameter	Percent
1.	Internal plastering of 12th floor	86%
2.	External painting(left side)	52%
3	External painting(front side)	15%
4.	External painting(right side)	47%
5.	Aluminum window grills	65%
6.	Internal painting 10th floor	9%
7.	Building finishes	55%
8.	Garbage chute	1%
9.	Landscape	60%
10.	Sanitary fitting	75%

- **S curve analysis**.

The main highlights are in month of November ,March and January due to which project got delayed.S curve is plotted in which we clearly get idea in month of November Rs119620313 was needed as it was initial stage of project so cost got increase. In month of March usage was Rs 35911873.19 at this time podium construction was there which requires huge investment and there was material shortage so money usage was more. In month of January investment was Rs703765331.9 the activities like external painting and external plastering was being there. Due to in sufficient labor the cost got increase. From s curve it states that there is smooth flow of cash throughout the period with deviation in project.

- Excavation cost has provided with high rate by 15 to 20 Rs per cum rate as there was no space nearby to dump the material. The lead was not in region of 1km so they had to pay more for it.
- Cash inflow is calculated which came Rs. 2297018147.
- The profit margin was reduced by Rs. 153,022,021.

Future Scope:

The MSP software is the first source in conducting this study. This software will be used to develop a budget monitoring for the building construction project.

ACKNOWLEDGMENT

Its my Pleasure to express my deep sense of gratitude to thanks Prof S.v.Pataskar,PG co-coordinator civil department, for there valuable guidance, inspiration.

REFERENCES

1) Hyung K. Park1, "Cash Flow Forecasting Model for General Contractors Using Moving Weights of Cost Categories"

2) Fagbenle Olabosipo '"Developing a realistic budget for construction project" Department of building technology covenant university.

3) Tarek Zayed "Cash flow analysis of construction projects" ,Department of Building, Civil, and Environmental Engineering, Concordia University, Montreal, Canada.

4) Mark T. Chen "ABC of Cash Flow Projections".

5) Henry A. Odeyinka, "An evaluation of construction cash flow management approaches in contracting organizations", Nottingham Trent University, Nottingham School

6) Wenhua Hou, "Payment Problems, Cash Flow and Profitability of Construction Project", World Academy of Science, Engineering and Techno.

7) "Financial Management by,"Prasanna candra.

8) www.sciencedirectory.com

9) www.asce.org

DIVINE NONI – A POTENTIAL NUTRACEUTICAL TO PREVENT OXIDATIVE STRESS INDUCED CATARACT FORMATION IN CHICK LENS EPITHELIAL CELLS

Sudhakar Konada[1], Sarvamangala Dhurjeti[2], Satyanarayana Rentala[3], USN Murthy[4]
[1]Research Scholar, [2]Asst.Professor, Department of Biotechnology,
GITAM Institute of Science, GITAM University, Visakhapatnam- 530045,
Professor & HOD, Ophthalmology Gayatri Vidya Parishad Institute of Healthcare and Medical Technology Visakhapatnam. INDIA

ABSTRACT

Oxidative stress is one of the leading causes of Cataract. Fruits of M.citrifolia are rich in antioxidants and many bioactive compounds. This food supplement with lot of nutraceuticals support good health. To investigate the role of "Divine NONI" in protection against oxidative stress, chick lens epithelial cells were induced with hydrogen peroxide (100µM H_2O_2) over a time course of several hours, with and without pre-treatment of "Divine NONI" and Noni fruit extract (Hexane). The Pi in the chick lens epithelial cells was estimated by performing NaK ATPase assay. The results obtained in the present investigation suggest that Noni extract and juice can preserve the viability and physiological functions of chick lens epithelial cells during oxidative stress.

Key words: Oxidative stress, Lens epithelial cells, Cataract formation, Inorganic Phosphorus (Pi), Apoptosis and "Divine NONI"

INTRODUCTION

Cataracts are the main cause of human blindness worldwide, responsible for 48% of the total cases of blindness [1]. Understanding the pathophysiology of cataract formation is important not only to advance the state of medical knowledge but also for public health purposes [2-4]. Apoptosis of lens epithelial cells by various factors can cause cataract formation. Cataract represents a large financial burden on health-care systems, and there remains a need to develop effective therapeutic agents for the prevention or treatment of cataract [5-13].

Scientists found that people at high risk of developing advanced stages of cataract formation, a leading cause of vision loss, lowered their risk by about 25 percent when treated with a high-dose combination of vitamin C, vitamin E, beta-carotene, and zinc. In the same high risk group -- which includes people with intermediate cataract formation in one eye but not the other eye -- the nutrients reduced the risk of vision loss caused by advanced cataract formation by about 19 percent [14-21]. Noni is rich with vitamin A, beta carotenoids, vitamin E, vitamin C, vitamin E, vitamin B complex, with all trace minerals like Ca, Mg, K, Zn, Molybdenum etc, all flavonoids, and besides that Noni contain more than 150 phytonutrients. Those all ingredients

being present in one fruit; has made the Noni, a most powerful antioxidant [22-27].

MATERIALS AND METHODS

Lens Organ Culture: The lenses used in this investigation were isolated from chicks brought from slaughter houses. The eyes were removed and the lenses were carefully dissected by a posterior approach. Lens Epithelial Cells (LECs) were separated from each of the dissected lenses by incubating in 1× Trypsin-EDTA solution for 1-2 Minutes at 37°C. 0.5×10^6 cells were cultured in a well of a 6-well culture plate containing 1.5 ml minimal essential medium (MEM199, M-3769; Sigma) containing 10% FBS for 6 days.. Transparent lenses were selected for experimentation. All chick lens experiments (n=6) were performed in the MEM 199 containing 26 mM NaHCO3 as buffer. The MEM 199 was prepared with ion-exchange double-distilled water, sterilized by filtration through 0.22-µm filter with a pH adjusted to 7.4. 50µM and 100µM H_2O_2 (Sigma) concentrations were used in this investigation. "Divine NONI" was made to final concentration of 50 mM and diluted to appropriate concentration in culture medium as required. Everyday 1 ml of the medium was replaced.

ATPase Assay.

After that Cells were induced with H_2O_2 along with Noni Extract (Hexane) and Divine Noni. And the ATP Assay was performed by standardized protocol of NaKATPAse.

Assay of inorganic Phosphorous Sodium Potassium dependent adenosine triphosphate (Na+ K+ ATPase) (ATP Phosphohydrolase)

Procedure:

1ml of tris Hcl buffer and 0.2ml of each of magnesium sulphate, sodium chloride, potassium chloride, EDTA, ATP, were added to test tube containing 0.2ml of homogenate. The mixture was incubated at 36^0C for 15 mins. The reaction was arrested by addition of 1ml of 10% TCA, mixed well and centrifuged. The phosphorus content of the supernatant was estimated [28-30].

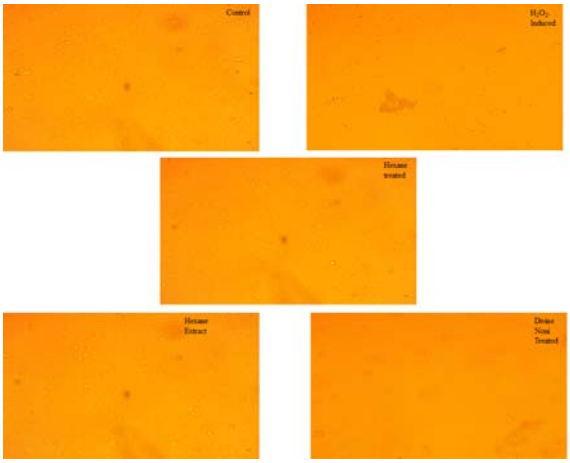
Phosphorus content of the supernatant was estimated by Modified Metol method:

Principle: Ammonium Molybdate under acidic condition react with Phosphorus to form Phosphomolybdate complex which is reduced to blue coloured complex by metol, the absorbance of the colour developed is proportional to the inorganic phosphorus concentration.

Method:

DIRECTIONS FOR USE ON ANALYSERS:

Reaction Type : End point with std.
Reaction Slope : Increasing
Wave Length : 680 nm (red filter)



Incubation Temp : Room Temperature
Incubation Time : 5 min.
Standard : 5 mg%
Linearity : 15 mg%
Unit : mg%

PROCEDURE:

Pipette into clean dry test tubes labele d Blank (B), Standard (S), and Test (T).

	B	S	T
Catalyst Reagent (1)	1.0 ml	1.0 ml	1.0 ml
Molybdate Reagent (2)	1.0 ml	1.0 ml	1.0 ml
Deionised Water	0.1 ml	-	-
Standard (4)	-	0.1 ml	-
Serum/Dilute urine	-	-	0.1 ml
Metol Reagent (3)	1.0 ml	1.0 ml	1.0 ml

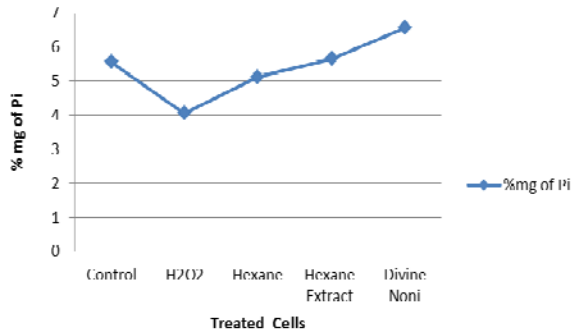
Mixed well and incubated at room temperature for five minutes. After five minutes of incubation the absorbance of Standard(s) and Test (T) measured against Blank (B) either on a

Spectrophotometer at 680 nm, within 30

$$\text{Serum phosphorus in mg\%} = \frac{\text{A of Test}}{\text{A of Standard}} \times 5 \text{ (Std. Conc)}$$

minutes. And the %mg of Pi was calculated using the following formula.

Fig: 1. Chick lens treated with Divine Noni and



Noni extract

Fig: 2

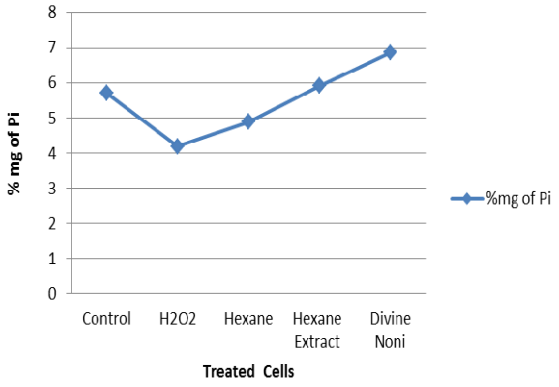


Fig: 3

DISCUSSION

The present study reports that "Divine NONI" and Noni extract was effective in protecting Chick lens epithelial cells from oxidative stress.

ACKNOWLEDGEMENTS

We are whole heartedly thankful to Dr. T. Marimuthu, Dr. Kirthi Singh and Dr. KV Peter of World Noni Research Foundation, Chennai for financial assistance for the entitled project.

REFERENCES

1. Baynes, J. W. Role of oxidative stress in development of complications in diabetes. *Diabetes* 1991, 40, 405-412.
2. Kadenbach, B.; Ramzan, R.; Vogt, S. Degenerative diseases, oxidative stress and cytochrome c oxidase function. *Trends Mol. Med*. 2009, 15, 139-147.
3. Farooqui, T.; Farooqui, A. A. Aging: An important factor for the pathogenesis of neurodegenerative diseases. *Mech. Ageing Dev.* 2009, 130, 203-215.
4. Bigsby RM., Cardenas H., Caperell- Grant A., Grubbs CJ. Protective effect of estrogen in rat model of age related cataracts. *Proc. Natl. Acad. . Science USA*. 1999; 96: 9328 933
5. Cammarata PR., Shaoyou Chu., Andrea M., Zhaohui W., Shao-Hua Y., Simpkins JW. Sub cellular distribution of native estrogen α and β subtypes in cultured human lens epithelial cells. *Experimental Eye Res*.2004; 78:861-871.
6. Goswami S., Sheets NL., Zavadil A., Chauhan BH. Spectrum a range of oxidative stress and response of human lens epithelial cell to H_2O_2 insult. *Invest opthalmol vis. Science*.2003; 44:2084-2092.
7. Gupta P. D. Nandini R., Hormones, cytoskeletal protein and cell shape. *Current science*.1996; 71:737-743.
8. Gupta P D., Kalariya N., Nagpal K., Vasavada A R., Interaction of sex steroid hormones with the eye. *J Cell Mol Bio*.2002; 48:OL379-OL386.
9. Gupta P. D.,Tatsumi K., Kaid Johar SR., Patel DP., Vasavada AR. Fate of peroxidase positive cells in human lens epithelium. EMSI. New Delhi.2004: 52-53.
10. Gupta P.D., Kaid Johar SR., Rajkumar S., Manasi Dave, Patel D., Vasavada AR., Cataract: an old age disease. *Indian journal of Gerontology* 2003; 17(3&4); 306 – 324
11. Hales AM., Chamberlain CG., Murphy CR., MCAvoy JW. Estrogen protects lenses against cataract induced by transforming growth factor beta (TGF β).*J. Experience Med*. 1997; 185: 273 – 280.
12. Kaid Johar SR., Rawal UM., Jain NK., and Vasavada AR. *Photochemistry and Photobiology*, 2003,78(3):306-311.

13. Kaid Johar S R., Rawal U M., Jain N K., Vasavada A R. Sequential effects of ultraviolet radiation on the histomorphology, cell density and antioxidative status of the lens epithelium –In vivo study.*photochem.photobio*.2002; 78:306-311.
14. Spector A.,. Guo-mang W. Ren Rong W; Garner WH., Hans moll. The prevention of cataract caused by oxidative stress in cultured rat lenses. *Curr. Eye research*1993; 12:163-179.
15. Spector A. oxidative stress induced cataract mechanism of action. *FASEB J.* 1995; 9: 1173 – 1182.
16. Ishibashi T, Hatae T, Inomata H. Collagen types in human posterior capsule opacification. *J Cataract Refract Surg.* 1994;20:643–646.
17. Kurosaka D, Kato K, Nagamoto T. Presence of a-smooth muscle actin in lens epithelial cells of aphakic rabbit eyes. *Br J Ophthalmol.* 1996;80:906–910.
18. Uusitalo M, Kivela T. Cell types of secondary cataract: an immunohistochemical analysis with antibodies to cytoskeletal elements and macrophages. *Graefes Arch Clin Exp Ophthalmol.* 1997;235: 506–511.
19. Hatae T, Ishibashi T, Yoshitomi F, Shibata Y. Immunocytochemistry of types I-IV collagen in human anterior subcapsular cataracts. *Graefes Arch Clin Exp Ophthalmol.* 1993;231:586–590.
20. Schmitt-Graff A, Pau H, Spahr R, et al. Appearance of alpha-smooth muscle actin in human eye lens cells of anterior capsular cataract and in cultured bovine lens-forming cells. *Differentiation.* 1990; 43:115–122.
21. Hales AM, Chamberlain CG, McAvoy JW. Cataract induction in lenses cultured with transforming growth factor-b. *Invest Ophthalmol Vis Sci.* 1995;36:1709–1713.
22. Srinivasan Y, Lovicu FJ, Overbeek PA. Lens-specific expression of transforming growth factor b1 in transgenic mice causes anterior subcapsular cataracts. *J Clin Invest.* 1998;101:625–634.
23. Mladenka, P.; Zatloukalova´ , L.; Filipsk_y, T.; Hrdina, R. Cardiovascular effects of flavonoids are not caused only by direct antioxidant activity. Free Radical Biol. Med. 2010, 49, 963-975.
24. Marimuthu, T and Peter, P.I. 2010. Noni (Morinda citrifolia L.) - A Text Book, World Noni Research Foundation, Chennai, India, p.113.
25. Marimuthu, T and Peter, P.I. 2011. World Noni Research Foundation- An overview, World Noni Research Foundation, Chennai, India, p.101.
26. Rethinam, P., Mathivanan, N. and Singh, D. R. 2012. Noni (Morinda citrifolia L.) - An update of Abstracts. World Noni Research Foundation, Chennai, India, p. 326
27. Peter, P.I., Kirti Singh, Marimuthu T and Peter K.V. 2010, Noni fruit health and wellness, Agriculture Year Book 2010, Agriculture Today pp. 160-161.
28. . Morin L.G. and Prox J.(1973) Clin. Chem. Acta, 46, 113.
29. Daly J.A. (1972) Clin. Chem. 18, 263.
30. Gomorri G. (1942) J. Lab. Clin. Med. 27, 9 95.

STRESS ANALYSIS OF 4STROKE DIESEL ENGINE PISTON

Lanka Tata Rao* [1] , Katakam Satyanarayana[1] , M.S.S.Srinivasa Rao[1,] T.V. Hanumanta Rao[1], S.V.UmamaheswaraRao[2]

[1]. Dept. of Mechanical Engg. , ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES,

Sangivalasa, Visakhapatnam-531162 Andhrapradesh ,India.

[2]. Department of Marine Engineering, Andhra University, Visakhapatnam-531006 , INDIA.

Email: tatarao.lanka@gmail.com , snarayanak@gmail.com , msrao.me@anits.edu.in , tvhanumantharao@yahoo.com, svumrao@yahoo.co.in .

Abstract— piston made of Al Alloy, acts as heart of the I.C. engine and is a crucial part of internal combustion engines. When the combustion of fuel takes place inside engine cylinder; high temperature and pressure are developed due to combustion of the fuel. Because of high speed and at high loads, the piston is subjected to high thermal and structural stresses. If these stresses exceed the designed values, failure of piston may take place. The stresses due to combustion are considered to avoid the failure of the piston. Intensity of thermal and structural stresses should be reduced to have safe allowable limits. In the present work the piston model is developed using SOLID WORKS software. The analysis part was carried out using ANSYS Workbench software. The stress analysis of these piston made of Aluminium alloy was performed. Appropriate average thermal boundary conditions such as heat transfer coefficient and heat fluxes were set on different surfaces of the FE model. Two different types of loads namely Thermal load and Static load were imposed on the piston. Ten nodded tetrahedral elements (solid-87) are used to discretize the solid piston model. A surface contact element (surf-152) was also used for applying the heat transfer boundary conditions. The analysis is based on the experimental values obtained a VCR Kirloskar diesel engine at compression ratio of 16.5.

Index Terms— piston, Heat transfer coefficient, heat flux, Structural and thermal analysis.

1 INTRODUCTION

Engine pistons are one of the most complex components among all automotive and other industry field components. The engine can be called the heart of a vehicle and the piston may be considered the most important part of an engine. There are lots of research works proposing, new geometries, materials and manufacturing techniques, and this with the piston has undergone a continuous improvement over the last decades. Notwithstanding all these studies, there are a huge number of damaged pistons. Damage mechanisms have different origins and are mainly wear, temperature, and fatigue related. The fatigue related piston damages play a dominant role mainly due to thermal and

mechanical fatigue, either at room or at high temperature.

The main requirement of piston design is to measure the prediction of temperature distribution on the surface of piston which enables us to optimize the thermal aspects for design of piston at lower cost. Most of the pistons are made of an aluminium alloy which has thermal expansion coefficient, 80% higher than the cylinder bore material made of cast iron. This leads to some differences between running and the design clearances. Therefore, analysis of the piston thermal behaviour is extremely crucial in designing more efficient engines. Good sealing of the piston with the cylinder is the basic criteria in design of the piston. Also to improve the mechanical efficiency and reduce the inertia force in high speed machines the weight of the piston also plays a major role. To allow for thermal expansion, the diameter of the piston must be smaller than that of the cylinder. The necessary clearance is calculated by estimating the temperature difference between piston and cylinder and considering the coefficient of thermal expansion of piston.

1.1. MATERIAL PROPERTIES Aluminum alloys are widely used in engineering structures and components where light weight or corrosion resistance is required.

Table1.1Cast Aluminum Alloy

Physical Properties	**Metric**
Density	**2800 kg/m^3**
Mechanical Properties	**Metric**
Tensile strength, Ultimate	**900 MPa**
Tensile Strength, Yield	**600 MPa**
CTE, linear	**16.5µm/m-°C**
Specific Heat Capacity	**0.461kJ/kg-°C**
Thermal Conductivity	**228 W/m-K**
Melting Point	**1370-1430°C**

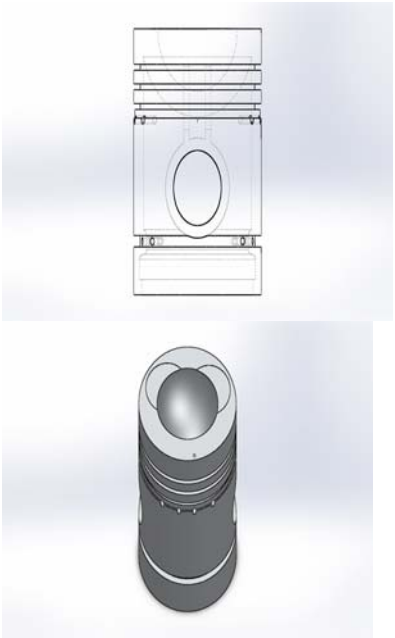
2. LITERATURE REVIEW:

The design and analysis of engine components has become more complex. One of these components is the engine piston. The piston of a diesel engine is usually subjected to periodically changing thermal and mechanical loads. Piston simulation and strength analysis has been an important area of research which has attracted great research interests .

3. GEOMETRY

The image below shows the geometry of the piston. The piston created by solid works is further imported to ansys software for further analysis. The following three types of boundary conditions are applied. Heat transfer co-efficient on the top and bottom surface, heat flux on lateral surfaces and pressure Forces.

3.1 Finite Element Model: The element selected for meshing the piston model's solid187 tetrahedral element. The meshing size Elements are 63,447 and no. Of nodes are 1, 15,057.



(a) 2 D model (b) 3-D Model

Fig 3.1: Kirloskar piston

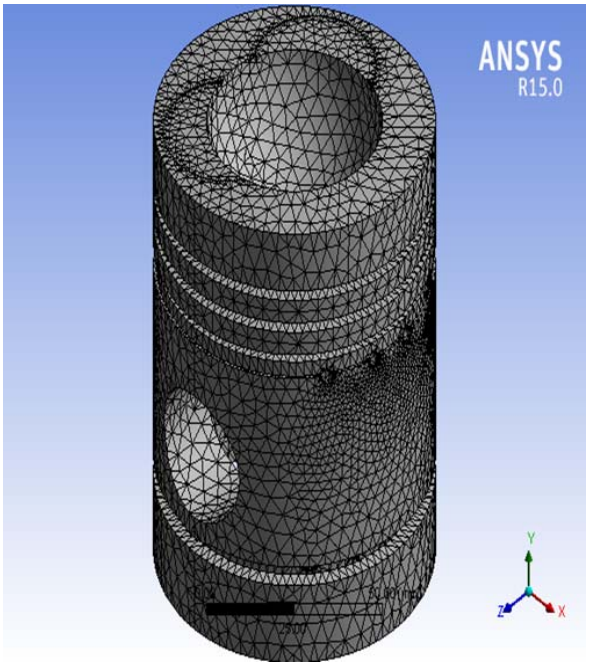


Fig :3. 2 meshing Element

4. Experimental Analysis and Calculations

4.1: Computerized VCR diesel engine specifications and Description:

4.1.1 Description:- The setup consists of single cylinder, four stroke, VCR (Variable Compression Ratio) Diesel engine connected to eddy current type dynamometer for loading. Setup is provided with necessary instruments for combustion pressure and crank-angle measurements. These signals are interfaced to computer through engine indicator for Pθ & PV diagrams. Provision is also made for interfacing airflow, fuel flow, temperatures and load measurement. The setup has stand-alone panel box consisting of air box, two fuel tanks for duel fuel test, manometer, fuel measuring unit, transmitters for air and fuel flow measurements, process indicator and engine indicator. Rota meters are provided for cooling water and calorimeter water flow measurement.

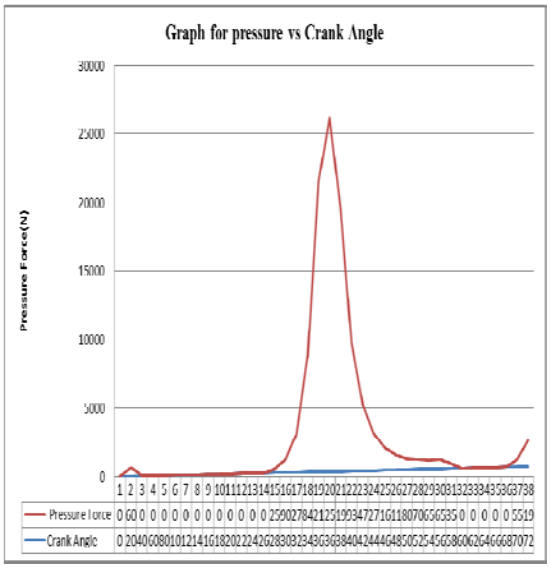
4.1.2 Engine specifications:-

Features	Specifications
Make	Kirloskar oil Engine
Type	Four stroke, Water cooled Diesel
No of cylinders	One
Combustion Principle	Compression ignition
Max speed	1500
Crank Radius	55mm
Connecting Rod length	300mm
Cylinder diameter	80mm
Compression ratio	variable
Stroke length	110mm

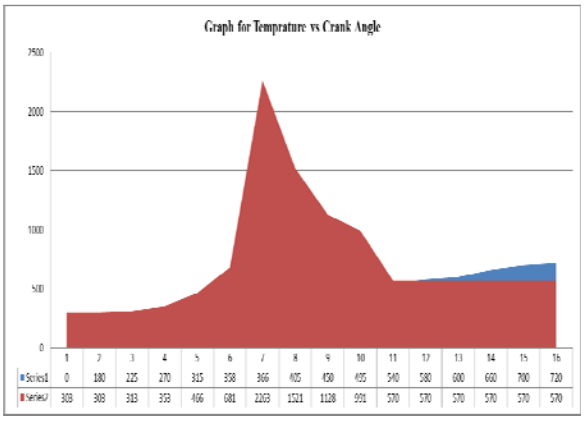
4.1.3: The following reading were taken from experimentation:-

Features	Specifications
Load	21.27 N-M
Speed	1470 rpm
Fuel rate	2.06 kg/hr
Air rate	16.20 m^3/hr
Water Flow	40.80 cc/sec
Cooling Water inlet Temp	26.70 ^{0}C
Cooling Water outlet Temp	30.80^{0}C

4.2: Variation of pressure Force with Crank Angle:-



4.3: Variation of temperature with Crank Angle:-



4.4 Calculations:

Based on these inputs following parameters for thermal analysis is calculated:

Total heat lost through water jacket = 20.59 watts

Average temperature of the piston =412 ^{0}C

Heat transfer coefficient on top surface (h) = 174.125 w/m^{2}k

Heat transfer coefficient on bottom surface (h_b) = 8.6193 w/m^{2}k

Heat flux applied on lateral surface = 780 w/m^2

5. RESULTS

By applying the boundary conditions heat transfer analysis is carried out.

5.1. Based on thermal analysis:-

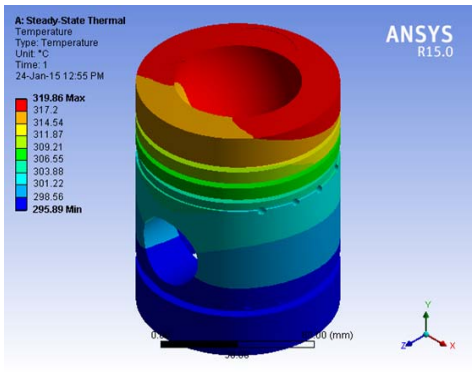


Fig 5.1.1. Temperature distribution plot:

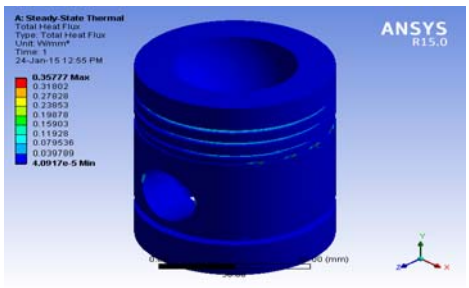


Fig 5.1.2 Total heat flux plot:

we observe from the plots maximum temperature in the piston is 319.86 ^{0}C and minimum temperature in the piston is 295.89 ^{0}C. Maximum heat flux in the piston is 0.35777 w/mm^2

5.2 Based on Static Loads:-

Structural Analysis:.

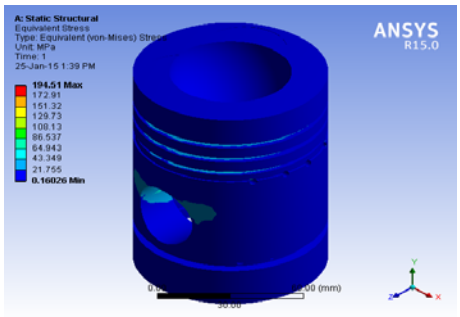


Fig 5.2.1 Von-mises stresses plot:

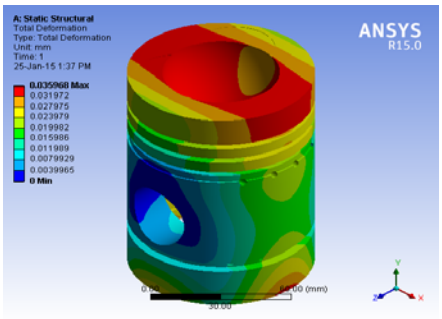


Fig 5.2.2 Total deformation plot:

For structural analysis ,the piston pressure of 53 bar is applied on the piston and FEM analysis carried out. we observe from the plots maximum are 194.51 Mpa and minimum is 0.160 Mpa. von-mises stresses in the piston located. Maximum total deformation in piston is 0.035968 mm.

6. CONCLUSION:

Experimental investigation carried out on computerized VCR diesel test rig to determine the variation of pressure with crank angle in the cylinder at particular compression ratio. The temperature variation of gases was further evaluated using the results obtained from the experimentation.

Using this experimental observations and they actual dimension of piston, stress analysis was carried out with the aid of the modern software like solid works and Ansys.

The stress induced in piston and deformations were found to be with in allowable limits. The factor of safety is found to be around 3. Further investigation is to be carried out at higher compression ratio.

7. ACKNOWLEDGEMENT

We express our sincere thanks to Anil Neerukonda Institute of Technology and sciences for providing experimental test rig Computerized VCR diesel engine,

8. REFERENCES

[1] Hongyuan Zhang, zhaoxun Lin, Dawei Xu, in: An Analysis to Thermal Load and Mechanical Load Coupling of a Gasoline Engine Piston. *Journal of Theoretical and Applied Information Technology, Vol. 48(2)*, 2013, pp. 911-917

[2] Dr. Ahmed A, Dr. Basim., "*Thermal effects on diesel engine piston and piston compression ring*", Engineering and technology Journal, Vol. 27, No. 8, 2009.

[3] Piotr szurgott, Tadeusz Niezgoda "Thermo Mechanical FE Analysis Of The Engine Piston Made Of Composite Material With Low Hysteresis", Journal of KONESpower trains and transport, Vol 18, No 1, 2011.

[4] Dr. S.N.Kurbet and R.Krishnakumar ., "*A Finite Element study of Piston Tilt effects on Piston Ring Dynamics in IC Engines*", Proc Instn Mech Engrs (IMECHE) Part K.2004, pp 107-117.

[5] Mahdi Hamzwhei and Manochehr Rashidi., *"Determination of Piston and Cylinder Head Temperature Distribution in a 4-Cylinder Gasoline Engine at Actual Process"*, Proceedings of the 4th WSEAS Int. Conf. on heat transfer, thermal engineering and environment, Elounda, Greece, August 2006.

[6] M. M. Rahman, A. K. Ariffin, N. Jamaludin, and C. H. C. Haron "Finite Element Based Vibration Fatigue Analysis for A New Free Piston Engine Component" April2009 The Arabian Journal for Science and Engineering, Volume 3.

[7] K.S. Narayana, S. Phani Kumar, M.S.S. Srinivasa Rao **"**Thermo-Structural Finite Element Analysis of I.C. Engine Pistons "International Colloquium on Materials Manufacturing and Metrology, ICMMM 2014, *August 8-9,* IIT Madras, Chennai, India. P 882-84.

STRESS ANALYSIS OF CRANE HOOK USING FEA

B Nagaraju [1], M RajaRoy[1] , P Venkatesh Reddy[1] , K Satyanarayana[1]
[1] Department of Mechanical Engg, Anil Neerukonda Institute of Technology and Sciences, Sangivalasa, Visakhapatnam-531162,Andhra Pradesh.
Email: [1]anitsnagaraju@gmail.com, [2]anitsrajaroy@gmail.com,
[3]venkateshreddy348@gmail.com,

Abstract— Crane hook is very significant component used for lifting the load with the help of chain or wire ropes. Crane hooks are highly liable components and are always subjected to bending stresses which leads to the failure of crane hook. To minimize the failure of crane hook, the stress induced in it must be studied. A crane is subjected to continuous loading and unloading. This may causes structural failure of the crane hook. In the present work, an attempt has been made by considering four different type's of cross sections of crane hooks and are designed theoretically by using curved beam concept. CATIA software is used for modeling the crane hook and ANSYS software used to find out the stresses. As a conclusion, the results obtained from ANSYS and theoretical calculations are compared.

***Index Terms*—crane hook, static analysis , FEA.**

1. INTRODUCTION

Crane Hooks are highly liable components that are typically used for industrial purposes. It is basically a hoisting fixture designed to engage a ring or link of a lifting chain or the pin of a shackle or cable socket and must follow the health and safety guidelines. Thus, such an important component in an industry must be manufactured and designed in a way so as to deliver maximum performance without failure. Thus, the aim of the work is to study the stress distribution pattern of a crane hook using finite element method and to verify the results using caustic method.

The lifting of objects generally occurs on construction sites, in factories and other industrial situations. Correct lifting can move large objects efficiently and reduce manual handling operations. Incorrect lifting however, can lead to disastrous accidents. Every year, incorrect lifting procedures cause injuries, loss of work time and property. People, machinery, loads, methods and the work environment, are all important factors for correct lifting. Provided that enough safety measures are fully implemented, lifting accidents can be reduced. The Fig 1.1 as shows the general diagram of crane hook.

Fig 1.1 Crane Hook

2. LITERATURE REVIEW

Crane hooks are the components which are generally used to elevate the heavy load in industries and constructional
sites. Recently, excavators having a crane-hook are widely used in construction works site. *M. Shaban et al [1]* studied the stress pattern of crane hook in its loaded condition, a solid model of crane hook is prepared with the help of ABAQUS software. Real time pattern of stress concentration in 3D model of crane hook is obtained. The stress distribution pattern is verified for its correctness on an acrylic model of crane hook using shadow optical method (Caustic method) set up. By predicting the stress concentration area, the shape of the crane is modified to increase its working life and reduce the failure rates. *E. Narvydas et al* [2] investigated circumferential stress concentration factors with shallow notches of the lifting hooks of trapezoidal cross-section employing finite element analysis (FEA). The stress concentration factors were widely used in strength and durability evaluation of structures and machine elements. The FEA results were used and fitted with selected generic equation. This yields formulas for the fast engineering evaluation of stress concentration factors without the usage of finite element models. The design rules of the lifting hooks require using ductile materials to avoid brittle failure; in this respect they investigated the strain based criteria for failure, accounting the stress triaxiality . *SpasojeTrifkovic' et al* [3] analyzes the stress state in the hook using approximate and exact methods. They calculated stresses in various parts of the hook material firstly by assuming hook as a straight beam and then assuming it as a curved beam. Analytical methods were used with the help of computers, using FEM. *Bhupender Singh et al* [4] presented the solid modeling and finite element analysis of crane boom has been done using PRO/E WILDFIRE 2.0 and ALTAIR HYPER MESH with OPTISTRUCT 8.0 SOLVER*Y. Torres et al* [5] studied the probable causes which led to a failure of the crane hook in service. The study of accident includes: details of the standards governing the manufacturing and use of lifting hooks, experimental analysis, mechanical behavior of steel of reported hook and simulation of the thermal history of the hook. From the literature survey it is understood by this author that there is a lot of scope for studying the stress analysis with different cross sections. Taking into this consideration, the author has embarked on studying the stress analysis of crane hook with four different cross sections such as rectangle, trapezoidal, triangle and circular cross sections.

3 DESIGN OF CRANE HOOK

Machine frames having curved portions are frequently subjected to bending or axial loads or to a combination of bending and axial loads. With the reduction in the radius of curved portion, the stress due to curvature become greater and the results of the equations of straight beams when used becomes less satisfactory. For relatively small radii of curvature, the actual stresses may be several times greater than the value obtained for straight beams. It has been found from the results of Photo elastic experiments that in case of curved beams, the neutral surface does not coincide with centroidal axis but instead shifted towards the Centre of curvature. It has also been found that the stresses in the fibers of a curved beam are not proportional to the distances of the fibers from the neutral surfaces, as is assumed for a straight beam.
The design of crane hook was done by assuming the data pertaining to load(w), C.S.A and curvatures which are used in industrial applications of crane hook as shown in Figs 3.1 to 3.4

3.1 Theoretical Design of Crane Hook with Rectangular C.S.A

W = 20 KN = 20×10^3N; Ri= 50 mm; R_o= 150 mm; h = 100 mm; b = 60 mm
ri = Distance of inner fibre from centre of curvature, C
ro = Distance of outer fibre from centre of curvature

rc = Distance of centroidal axis (CG axis) from centre of curvature
rn = Distance of neutral axis from centre of curvature
The neutral axis is shifted towards the centre of curvature by a distance called eccentricity
'e'. The value 'e' should be computed very accurately since a small variation in the value of 'e'
causes a large variation in the values of stress.
e = rc – rn
ci = Distance between neutral axis and inner fibre = rn – ri
co = Distance between outer fibre and neutral axis = ro – rn

Resultant stress at the inside fibre,
$\sigma_t + \sigma_{bi}$= 3.33+30.66 = 33.99MPa (tensile)
∴ Resultant stress at the outside fibre,

$\sigma_t - \sigma_{bo}$ = 3.33-14.66 = -11.33MPa (compressive)

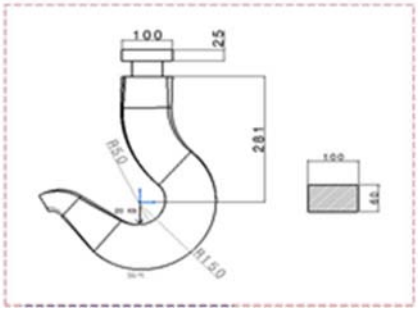


Fig 3.1 Design of Crane Hook with rectangular C.S.A

3.2 Theoretical Design of Crane Hook with Trapezoidal C.S.A

W = 20 KN = 20 × 10^3N; R_i= 50 mm ; R_o= 150 mm ; h = 100 mm ; b_i=90 mm; b_o=30 mm

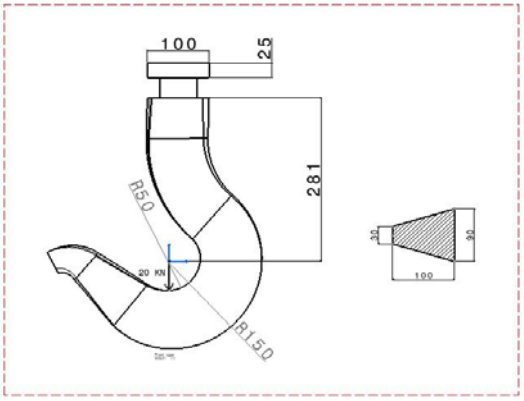


Fig 3.2Design of Crane Hook with Trapezoidal C.S.A

∴ Resultant stress at the inside fibre
σ_{bi}= 3.33+25.169 = 28.499 MPa (tensile)
Resultant stress at the outside fibre
$\sigma_t - \sigma_{bo}$ = 3.33-16.63 = -13.3MPa (compressive)

3.3 Theoretical Design of Crane Hook with Triangular C.S.A

W = 20 kN = 20 × 10^3N; R_i= 50 mm ;R_o= 150 mm ; h = 100 mm ; b_i =90 mm;

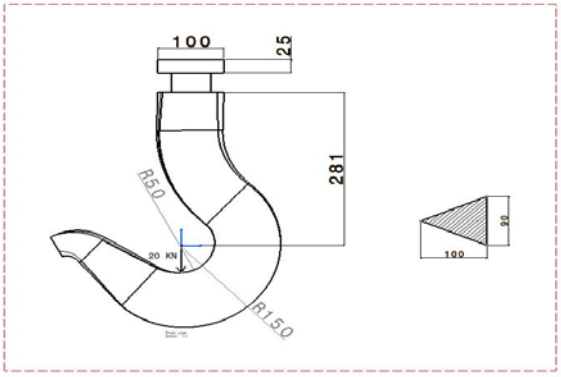


Fig 3.3 Design of Crane Hook with Triangular C.S.A
∴ Resultant stress at the inside fibre

$\sigma_t + \sigma_{bi}$= 6.163+32.654 = 38.817MPa (tensile)

∴ Resultant stress at the outside fibre
$\sigma_t - \sigma_{bo}$ = 6.163-29.177 = -23.014 MPa (compressive)

3.4 Theoretical Design of Crane Hook with circular C.S.A

W = 20 KN = 20 × 10^3N;R_i= 60 mm ; R_o= 150 mm; d=90mm

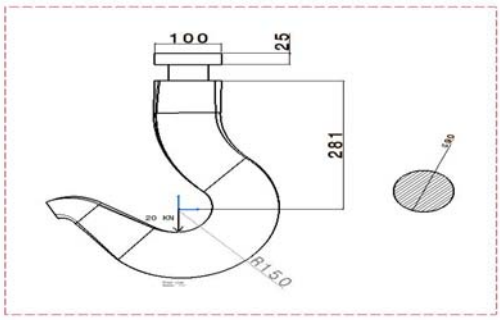


Fig 3.4 Design of Crane Hook with circular C.S.A

∴ Resultant stress at the inside fibre

σ_t+ σ_{bi}= 3.143+43.31 = 46.461MPa (tensile)

∴ Resultant stress at the outside fibre

$\sigma_t - \sigma_{bo}$ = 3.143-21.73 = -18.587 MPa (compressive)

4. MODELLING OF CRANE HOOK USING CATIA

CATIA serves the design tasks by providing different workbenches. A workbench is defined as a specific environment consisting of a set of tools, which allows the user to perform specific design tasks in a particular area. The basic workbenches in CATIA V5 are Part design workbench, Wireframe and Surface Design workbench, Assembly Design workbench, and Drafting workbench.

.

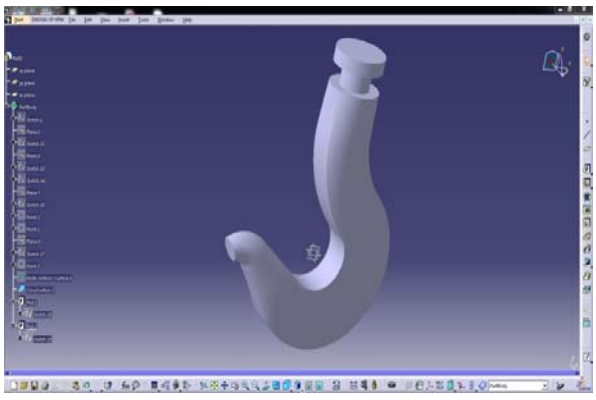


Fig 4.1 CATIA Model of Crane Hook with Rectangular C.S.A

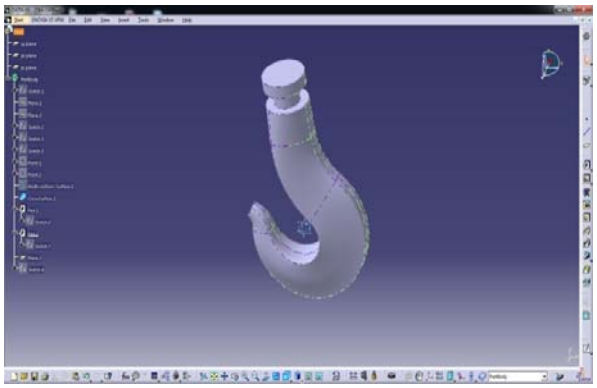


Fig 4.2 CATIA Model of Crane Hook with Trapezoidal C.S.A

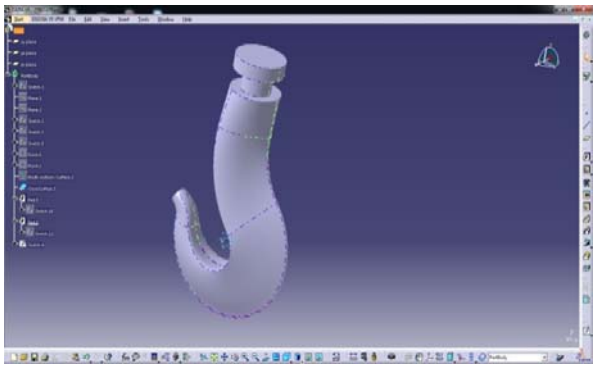


Fig 4.3 CATIA Model of Crane Hook with Triangular C.S.A

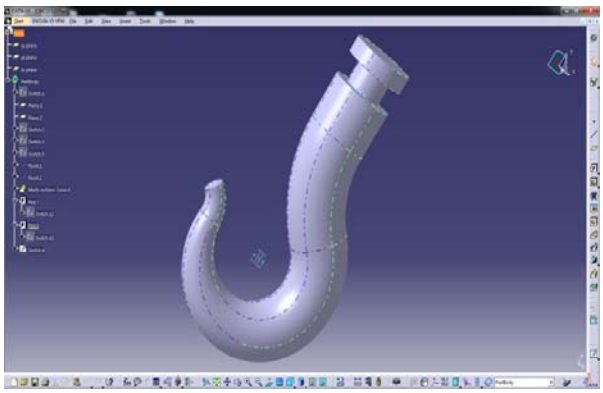


Fig 4.4 CATIA Model of Crane Hook with circular C.S.A

5 FINITE ELEMENT ANALYSIS OF CRANE HOOK USING ANSYS

The finite element method has become a powerful tool for the numerical solution of wide range of engineering problems. Applications range from deformation and stress analysis of automotive aircraft, building, and bridge structures to field analysis of heat flux, seepage and other flow problems, with advances in computer technology and CAD systems, complex problems can be modeled with relative ease.

In this method of analysis, a complex region defining a continuum is discretized into simple geometric shapes called finite elements. The material properties and the governing relationships are considered over these elements and considering the loading and constraints, results in a set of equations. Solution of these equations gives us the approximate behavior of the continuum.

6 RESULTS AND DISCUSSION

In this work, four different types of sections of crane hook are designed successfully by using curved beam concept. The induced Stresses are determined for a load of 20 KN using curved beam concept.

The solid modal was prepared using CATIA V5 R20 version and exported to ANSYS using IGES format. The hook is fixed at the top end in x,y and z directions and are fully constrained. The inner curvature of hook is subjected 20 KN load and is applied on nodes. The results of stresses obtained for a crane hook which is made up of steel material are plotted in the Figs 6.1 to 6.4. The results obtained through analytical and theoretical methods are good in agreement with minor deviation and shown in Table 6.1.

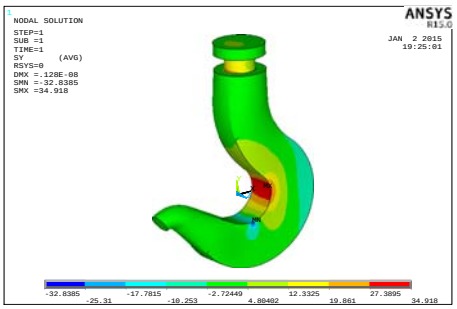


Fig 6.1 variation of Stresses for a crane hook made of steel with Rectangular C.S.A along Y-Direction

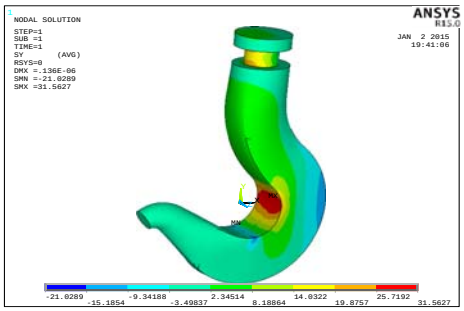


Fig 6.2 variation of Stresses for a crane hook made of steel with Trapezoidal C.S.A along Y-Direction

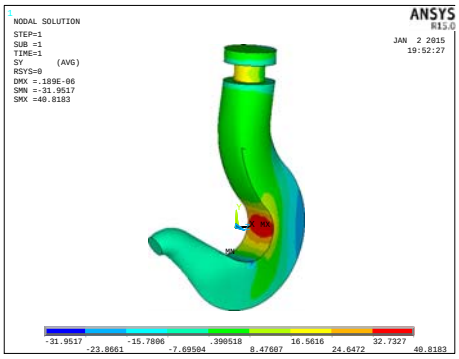


Fig 6.3 variation of Stresses for a crane hook made of steel with Triangular C.S.A along Y-Direction

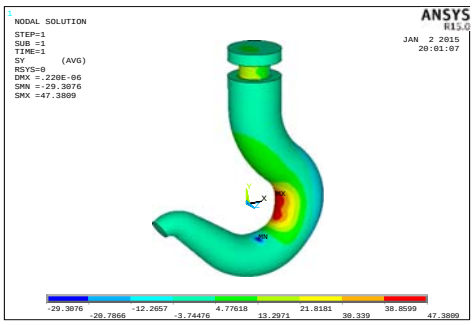


Fig 6.4 variation of Stresses for a crane hook made of steel with Circular C.S.A along Y-Direction

Table 6.1 Comparison of Stresses obtained in Theoretical and analytical methods

SECTION	THEORITICAL		ANSYS	
	COMPRESSIVE	TENSILE	COMPRESSIVE	TENSILE
RECTANGLE	11.3	33.99	10.25	34.91
TRAPEZOIDAL	13.3	28.49	15.18	31.56
TRIANGULAR	23.01	38.81	23.86	40.81
CIRCULAR	18.58	46.46	20.78	47.38

7.CONCLUSION

1. The crane hooks are successfully designed for four different cross sections such as rectangular, trapezoidal, triangular and circular by using curved beam concept.
2. The model was prepared using CATIA software and analysis has been carried out using ANSYS.
3. The trapezoidal cross section gives better results in comparison with other three cross sections as because stresses induced are less in trapezoidal cross section.
4. The stresses obtained in theoretical and analytical methods are in good agreement. The model prepared is used for further studied with different loads and also for different materials.

REFERENCES

[1] M. Shaban, M. I. Mohamed, A. E. Abuelezz and T. Khalifa, "Determination of Stress Distribution in Crane Hook by Caustic", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 5, May 2013.

[2] E. Narvydas, N. Puodžiūnienė, "Circumferential stress concentration factors at the asymmetric shallow notches of the lifting hooks of trapezoidal cross-section", ISSN 1392 - 1207. MECHANIKA. 2012 Volume 18(2): 152-157.

[3] SpasojeTrifković, NebojšaRadić et. al, "Stress analysis of crane hook using FEM", INFOTEH-JAHORINA Vol. 10, Ref. C-2, p. 244- 248, March 2011.

[4]Bhupender Singh, Bhaskar Nagar, B.S. Kadam and Anuj kumar, "Modeling and Finite Element Analysis of Crane Boom", International Journal of Advanced Engineering Research and Studies, Vol. I/ Issue I/October-December, 2011/ 51-52.

[5] Y. Torres , J.M. Gallardo , J. Domínguez , F.J. Jiménez E, "Brittle fracture of a crane hook", Engineering Failure Analysis 17 (2010) 38–47.

[6] Takuma Nishimura, Takao Muromaki et. al, "Damage Factor Estimation of Crane Hook (A Database Approach with Image, Knowledge and Simulation)", 4th International Workshop on Reliable Engineering Computing (REC 2010).

[7] C. Oktay AZELOĞLU, Onur ALPAY, Investigation Stress of A Lifting Hook with Different Methods, "Verification of The Stress Distribution with Photo elasticity Experiments", Electronic Journal of Machine Technologies, Vol: 6, No: 4, 2009 (71-79).

[8] Yu Huali, H.L. and Huang Xieqing, "Structure-strength of Hook with Ultimate Load by Finite Element Method", Proceedings of the International Multi-Conference of Engineersand Computer Scientists, 2009 Vol II IMECS 2009, March 18 - 20, 2009, Hong Kong.

VLSI DESIGN OF FULL SUBTRACTOR USING MULTI-THRESHOLD CMOS TO REDUCE THE LEAKAGE POWER AND GROUND BOUNCE NOISE

[1]Pawar Chander, [2]Pokala Santhosh, [3]Prasad Kurhe
[1,3]Assistant Professor,SRES, College of Engineering,Kopargaon,Maharashtra
[2]Assistant Professor,SRCEW,Nizamabad, Telangana
Email: [1]pawarchander@gmail.com, 2Santu_523@yahoo.co.in, [3]prasad.kurhe576@gmail.com

ABSTRACT

The performance degradation with technology scaling is one of the major issues in today's life. Leakage power dissipation in the IC increases exponentially with technology continuously scaling down. MTCMOS Power Gating is a very well known way to reduce leakage current, but when circuit transition goes from sleep to active mode, due to abrupt transitions introduces Ground Bounce Noise in the circuit, it disturbs the normal working of any circuit and tends to wrong output and also reduces the reliability of circuit.

In this paper a full subtractor using MTCMOS technique design is proposed to reduce leakage power and ground bounce noise. Combinational logic has extensive applications in quantum computing, low power VLSI design and optical computing. Low-power design techniques proposed to minimize the active leakage power in nanoscale CMOS very large scale integration (VLSI) systems and an additional wait mode and extra header transistor is added in the circuit to reduce the ground bounce noise.

Keywords

MTCMOS, Full Subtractor, Leakage Power, Ground Bounce Noise.

1.INTRODUCTION

The rapid increase in the number of transistors on chips has enabled a dramatic increase in the performance of computing systems. However, the performance improvement has been accompanied by an increase in power dissipation; thus, requiring more expensive packaging and cooling technology. Power dissipation in CMOS circuits has been the charging and discharging of load capacitances, often referred to as the dynamic power dissipation. Dynamic power is consume when transistors are switching As the technology continue to scale down a significance portion of the total power consumption in high performance digital circuits is due to leakage current because of reduced threshold voltage .MOSFETs are fabricated with high overall doping concentration, lowered source/drain junction depths, halo doping, high-mobility channel materials, etc. Furthermore, the reduction of the gate oxide thickness (tox) causes a drastic increase in the gate tunnelling leakage current due to carriers tunnelling through the gate oxide, which is strong exponential function of the voltage

magnitude across the gate oxide [1], [6] to minimize the leakage power in active mode. In current CMOS technologies, the sub threshold leakage current is much larger than the other leakage current components. Even in current-generation technology, sub threshold leakage power dissipation is comparable to the dynamic power dissipation, and the fraction of the leakage power will increase significantly in the near future. Today's microprocessor designs devote a large fraction of the chip area [8] to the memory structures. High- performance onchip cache memories are a crucial component in the memory hierarchy of modern computing systems. In this technique each NMOS andPMOS transistors in the logic gates is split into two transistors. Leakage current flowing through the NMOS transistor stack reduces due to the increase in the source to substrate voltage in the topNMOS transistor and also due to an increase in the drain to source voltage in the bottom NMOS transistor. This reduces the power dissipation in logic circuits. This technique is implemented to BASIC gates such as AND,OR,XOR etc,COMBINATIONAL circuits such as FULLADDER,SEQUENTIAL circuits such as D-Flip-flop and also for memory cells such as 6TSRAM CELL.

2.IMPLEMENTATION OF EXISTING DESIGN

2.1 Full Subtractor

A full subtractor is a combinational circuit that performs a subtraction between two bits taking into account that a 1 may have been borrowed by a lower significant stage. This circuit has three inputs and two outputs. The three inputs A, B and C denote the minuend, subtrahend and previous borrow respectively

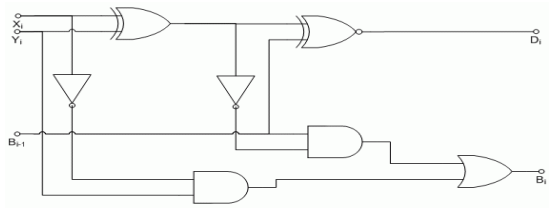


Figure 1. Gate Level Diagram of a Full Subtractor

The two outputs D and B represent the difference and borrow, respectively. The logic circuit for full subtractor is shown in Figure 1. The waveforms for the full subtractor shown in Figure 2 reflect the logic outlined in truth table.

TABLE I. Truth Table of Full Subtractor.

A	B	C	DIFFERENCE	BORROW
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

The simplified boolean functions for the outputs can be obtained directly from the truth table. The simplified logic equations are:

DIFFERENCE=A'B 'C + A'B C' + AB 'C' + AB C

BORROW = C(A'B' + AB) + A'B

Where A, B, C, are the inputs. D is output or difference and B is the borrow. The waveform of full subtractor is shown in figure.

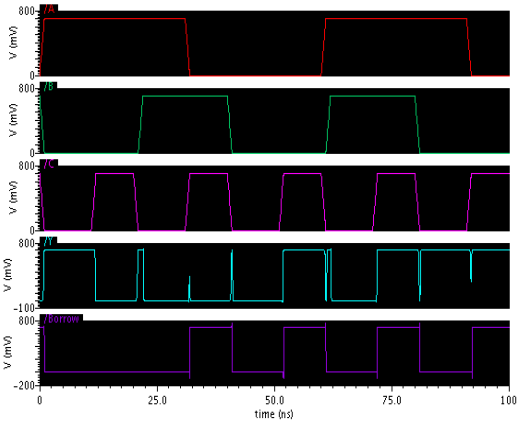


Figure 2.Waveform of Full Subtractor

3. PROPOSED DESIGN IMPLEMENTATION

3.1 Full subtractor using pass transistor logic

A sleep transistor is referred to either a PMOS or NMOS high Vth transistor that connects permanent power supply to circuit power supply which is commonly called "virtual power supply". The sleep transistor is controlled by a

power management unit to switch on and off power supply to the circuit. The PMOS sleep transistor is used to switch VDD supply and hence is named “header switch”. The NMOS sleep transistor controls VSS supply and hence is called “footer switch”. In sub-90nm designs, either header or footer switch is only used due to the constraint of sub-1V power supply voltage.

3.2 Leakage power suppression

Significant amount of subthreshold leakage currents are produced when a nano scale integrated circuit is idle. Furthermore, transistors with no switching activity produce subthreshold leakage currents even in an ACTIVE integrated circuit. Leakage power has been increasing exponentially with the technology scaling. In 90nm node, leakage power can be as much as 35% of chip power. Consequently, leakage power reduction becomes critical in low-power applications such as cell phone and handheld terminals. Power-gating is the most effective standbyleakage reduction method recently developed . In the power gating, sleep transistors are used as switches to shut off power supplies to parts of a design in standby mode. Although the concept of the sleep transistor is simple, design of a correct and optimal sleep transistor is challenge because of many effects introduced by the sleep transistor on design performance, area, routability, overall power dissipation, and signal/power integrity. Currently, many of the effects have not been fully aware by designers. This could result in improper sleeper transistor design that would either fail to meet power reduction target when silicon is back or cause chip malfunction due to serious power integrity problems introduced. We have carried out comprehensive investigations on various effects of sleep transistor design and implementations on chip performance, power, area and reliability. In this paper, we shall describe a number of critical considerations in the sleep transistor design and implementation including header or footer switch selection, sleep transistor distribution choices and sleep transistor gate length, width and body bias optimization for area, leakage and efficiency. A sleep transistor is referred to either a PMOS or NMOS high Vth transistor that connects permanent power supply to circuit power supply which is commonly called “virtual power supply”. The sleep transistor is controlled by a power management unit to switch on andoff power supply to the circuit. The PMOS sleep transistor is used to switch VDD supply and hence is named “header switch”. The NMOS sleep transistor controls VSS supply and hence is called “footer switch”. In sub-90nm designs, either header or footer switch is only used due to the constraint of sub-1V power supply voltage

3.3 Ground bounce noise

During the active mode of the circuit an instant current pass from sleep transistor, which is saturation region and causes a sudden rush of the current. Elsewhere, because of self inductance of the off- chip bonding wires and parasitic Inductance on chip power rails, result voltage function in the circuit depends on input / output buffers and internal circuitry. The noise depends on the voltage.

4. LEAKAGE REDUCTION USING MTCMOS TECHNIQUE

The low-power and high performance design requirements of modern VLSI technology can be achieved by using MTCMOS technology. This technique uses low, normal and high threshold voltage transistors in designing a CMOS circuit. Supply and threshold voltages are reduced with the scaling of CMOS technologies. Lowering of threshold voltages leads to an exponential increase in the sub threshold leakage current [5]. The low-threshold voltage transistors which have high performance are used to reduce the propagation delay time in the critical path. The high-threshold voltage transistors which have less power consumption are used to reduce the power consumption in the shortest path [2], [3]. The multi threshold CMOS technology has two main parts. First, “active” and “sleep” operational modes are associated with MTCMOS technology, for efficient power management. Second, two different threshold voltages are used for N channel and P channel MOSFET in a single chip [4]. These apply on between the low threshold voltage (low-Vt) gates from the power supply and the ground line via cut-off high threshold voltage (high-Vt) sleep

transistors is also known as “power gating”. The schematic of power gating technique using MTCMOS on full subtractor is shown in figure 3.

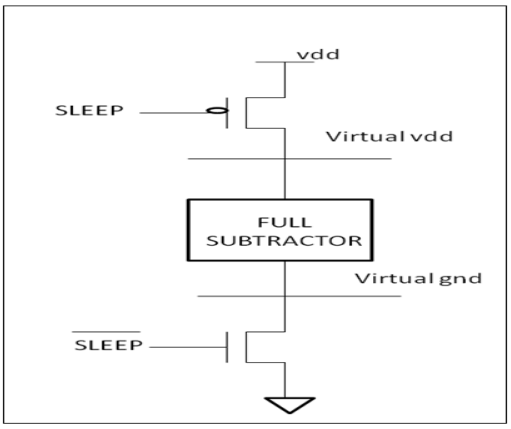


Figure 3. MTCMOS technique on full subtractor

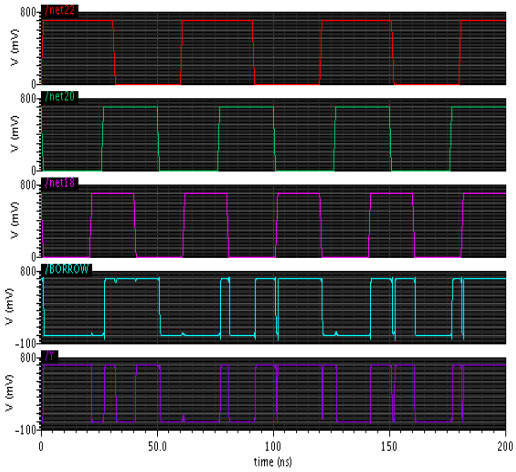
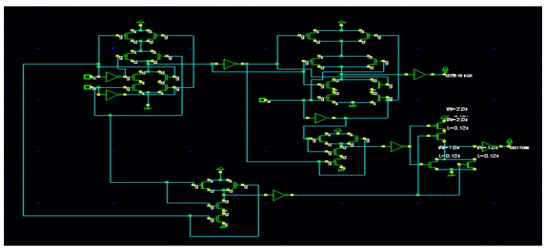


Figure 4. waveform of proposed full subtractor

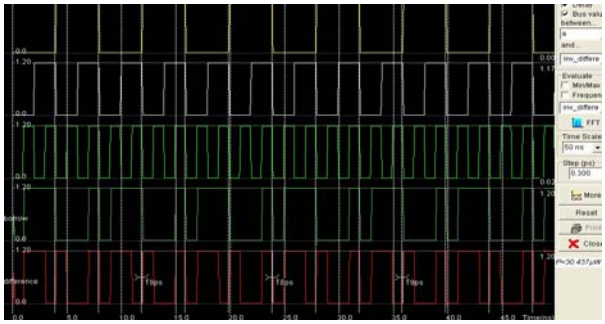
5. SIMULATION RESULT

A full subtractor subtracts 3input bits and gives the output in the form of difference and borrows. The simulation parameters have been analyzed with the help of the Microwind tool and DSCH for the schematic verification. By applying the MTCMOS technique in 60nm technology reduction in current and power is shown.

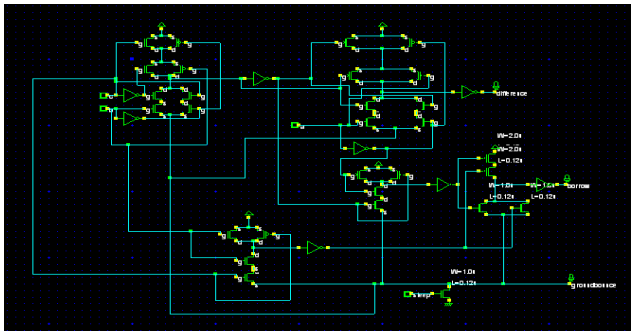
5.1 Full Subtractor Using CMOS Transistor



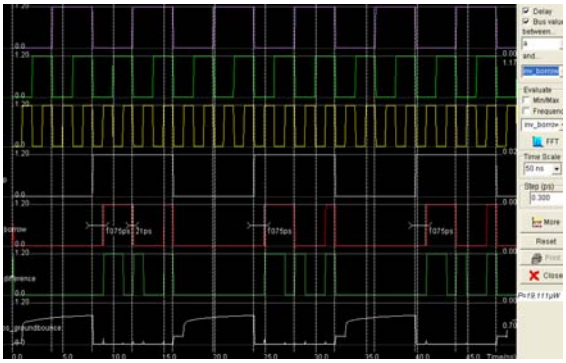
5.2 Power and Ground Bounce Noise Analysis



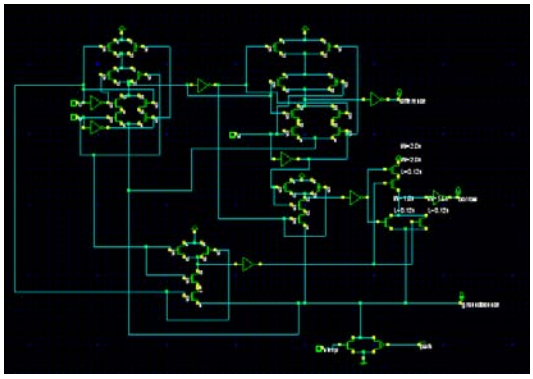
5.3 Full Subtractor Using CMOS in Sleep Mode



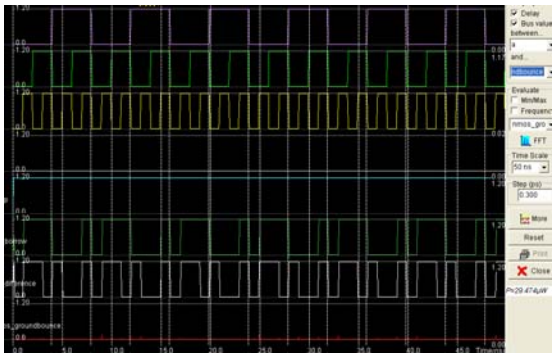
5.4 Power and Ground Bounce Noise Analysis in sleep mode



5.5 Full Subtractor Using CMOS Trimode



5.6 Power and Ground Bounce Noise Analysis in Trimode



6. CONCLUSION AND FUTURE SCOPE

In this paper, low leakage full subtractor cell is proposed for mobile applications with low ground bounce noise. Noise immunity has been carefully considered since significant threshold current of the low threshold voltage transition becomes more susceptible to noise. By using the proposed technique leakage power is reduced by comparison to the conventional cell (Base case). Ground bounce noise is reduced compared to Base case. Further, using the proposed technique the ground bounce noise is reduced in three designs (Base Case) compared to without applying the technique. Active power reduction is reduced in comparison to Base case. Noise immunity of proposed full sbtractor cell is reduced compared to the conventional subtractor cell (Base case). The proposed technique has been introduced with tri-mode technique for further reduction in the peak of ground bounce noise and overall power mode transition noise. The proposed full subtractor is designed with 120nm technology and operated with supply voltage.

In this we are concentrated on the leakage power analysis and ground bounce noise reduction,but the ground bounce noise is not removed completely. To remove ground bounce noise completely we should use triple phase sleep modulator ,so that the impact of ground bounce is completely removed ,but there is always a trade off between area ,speed and power.

ACKNOWLEDGEMENTS

The Author would like to thank SRES, College of Engineering, Kopargaon for providing the Microwind and DSCH(Digital Schematic) tools for the work to be completed.

REFERENCES

[1] D. A. Antoniadis, I. Aberg, C. N. Chléirigh, O.
M. Nayfeh,A. Khakifirooz, and J. L. Hoyt,
"Continuous MOSFET performance increase with
device scaling: The role of strain and channel
materialinnovations," IBM J. Res. Develop., vol. 50, no.
4, pp. 363–376, Jul. 2006.

[2] Dong Whee Kim, Jeong Beom Kee, "Low-Power Carry
Look-Ahead Adder With Multi-Threshold Voltage
CMOS Technology", in Proceeding of ICSICT
International Conference on Solid-State and Integrated-
Circuit Technology, pp. 2160-2163, 2008 .

[3] H. Thapliyal and N. Ranganathan, "Conservative
QCAGate (CQCA) for Designing Concurrently Testable
Molecular QCA Circuits", Proc. of the 22nd Intl. Conf.on
VLSI Design, New Delhi, India, pp. 511-516, 2009.

[4] H. Thapliyal, M.B Srinivas and H.R

Arabnia,"Reversible Logic Synthesis of Half, Full and
ParallelSubtractors", Proc.of the 2005 Intl. Conf. on
Embedded Systems and Applications, Las Vegas,pp.165-
181, 2005.
[5] Hemantha S,Dhawan A and Kar H ,"Multi-threshold
CMOS design for low power digital circuits",TENCON
2008-2008 IEEE Region 10 Conference,pp.1-5,2008.
[6] K. Roy, S. Mukhopadhyay, and H. Mahmoodi-
Meimand, "Leakage current mechanisms and leakage
reduction techniques in deepsubmicrometerCMOS
circuits," Proc. IEEE, vol. 91, no. 2, pp. 305–327,Feb.
1994.
2003.
[7] Phanikumar M and N. Shanmukha Rao, "A Low Power
and High Speed Design for VLSI Logic Circuits Using
Multi-Threshold Voltage CMOS Technology",
International Journal of Computer Science and
Information Technologies (IJCSIT), Vol. 3(3), pp- 4131-
4133, 2012.
[8] S. Dutta, S. Nag, K. Roy, "ASAP: A Transistor Sizing
toolfor speed, area, and power optimization of static
CMOS circuits", IEEE International Symposium on
Circuits andSystems, pp. 61-64, June,

STUDY OF FUZZY LOGIC CONTROLLER AND ITS APPLICATION TO PH NEUTRALIZATION PLANT

Mrs.Gayatri K Palnitkar,
Department of Electrical Engineering, Modern College of Engineering,University,Pune
Email: gayatrisane@gmail.com

***Abstract*- The need to regulate the pH value within a specific level and limit arises from environmental legislative and quality standards. The pH control poses some interesting challenges in the area of process control. The inherent nonlinearity of the pH process often renders conventional control difficult. This paper demonstrated that fuzzy controller, whose ability to handle nonlinearity is well known, suggests better approach to control the pH. In this paper pH neutralization model is developed in MATLAB/Simulink. First, a conventional PI controller is designed and its performance is tested for various set points on neutralisation curve. Its limitation in controlling nonlinear process like pH is highlighted. Further, a fuzzy logic controller is designed and its ability to control nonlinear process is presented using simulation results. The results clearly indicate superiority of fuzzy controller over conventional PI controller in dealing with nonlinear systems.**

Keywords- Nonlinear control; pH neutralization; Fuzzy Logic Control.

I.INTRODUCTION

Studies on pH neutralization control in process engineering have increased in last few decades. pH control systems were developed and used successfully on various applications of pH neutralization process plants in many industries such as chemical processes, biotechnological industries, waste water treatment plants, sugar industries, food and beverages and pharmaceuticals. The main problem in pH process control is highly non-linear dynamic characteristics of the process. In order to achieve better performance of pH neutralization process control, non-linear response of the system must be taken into consideration.

The excessive nonlinearity of the pH process makes control by conventional linear PI controller difficult. The fuzzy controller uses three different membership functions for three linear regions of a standard pH-base titration curve. These three functions provide three different control gains and thus the fuzzy controller works as a varying gain controller compensating against the nonlinear behavior of the pH titration process. For simulation purpose, we have used MATLAB-Simulink based empirical model of the pH titration curve. This simulation assumes that the acid flow is constant and base flow is manipulated in order to control the pH. While showing the benefits of fuzzy approach for pH control, this thesis also highlights limitations of the conventional PID control.

II.OVERVIEW OF PH PROCESS

pH pilot plant consists of a reactor tank. The acid stream (HCL) and the base stream (NaOH) are introduced into the reactor tank. The pH transmitter sends pH value to the pH controller. The pH controller then based on the set point, manipulates the base flow using a linear control valve. The acid flow is maintained constant and not manipulated. The out flow is kept constant during the process.

The set up for the process is as shown below in the figure

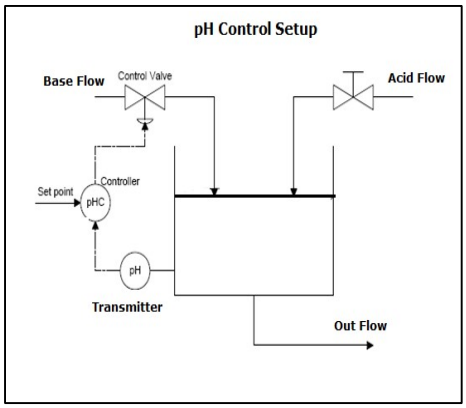


Fig. 1. Overview of pH Neutralization Plant

The steady state values of the acid and base flow are assumed to be 15 volumetric units. The outlet flow is maintained at a constant value of 5 units of flow in order to keep storage volume of this tank at 100 volumetric units.

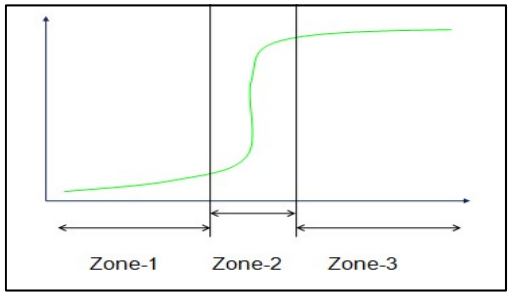


Fig. 2. Titration Curve for pH

III. MATHAMATICAL MODEL FOR PH NEUTRALIZATION PROCESS

Mathematical Equation for pH is

$$pH = -\log$$

10 [H+]

For neutralization of strong acid (HCL) with strong base (NaOH)

$$HX\Lambda + N\alpha OH \quad H_2O + N\alpha X\Lambda$$

$$H^+ + OH^- \quad H_2O$$

For,

Q_a= Flow of acid in CSTR

Q_b = Flow of base in CSTR V = Volume of fluid inside CSTR

$$v\frac{d}{dt}[Cl^-] = [Cl^-_{in}] * [Q_a] - [Cl^-] * [Q_{out}]$$

$$v\frac{d}{dt}[Na^+] = [Na^+_{in}] * [Q_b] - [Na^+] * [Q_{out}]$$

$$[Na^+] + [H^+] = [\ C_a^{++}\ ] + [OH^-] \qquad (5)$$

$$[H^+][OH^-] = \kappa_\omega = 10^{-14}$$

Relationship expressed in difference of ionic concentration X:

$$X = [OH-] - [H+]$$

$$X = [Na+] - [Cl-]$$

$$[H+] = \left(\frac{X}{2}\right) * \left(\sqrt{1 + \frac{4*kw}{x\hat{}2}}\right) - 1) \quad \text{if } X > 0$$

$$\sqrt{kw} \quad \text{if } X = 0$$

$$[H+] = -\left(\left(\frac{X}{2}\right) * \left(\sqrt{1 + \frac{4*kw}{x\hat{}2}}\right) - 1\right) \quad \text{if } X < 0$$

$$[H+] = \quad \text{if } X = 0$$

IV.CONTROL STATEGIES FOR NEUTRALIZATION PLANT NTLA

The pH neutralization process was simulated and controlled using two approaches as discussed below using MATLAB Simulink.

A. pH Neutralization using PI controller MATLAB

Simulation representation of the PI controller for the pH neutralization pilot plant is as shown below. pH is affected by the variation in base flow, where acid flow is kept constant. According to disturbance of flow of base, pH should give the output as set point.

A PI controller was designed and implemented for the pH neutralization model. The acid solution is neutralized by the base flow entering the reactor tank manipulated by a linear flow control valve. This control valve is manipulated by a PI controller, which receives the pH set point and pH measured value. This controller has reverse action and it is implemented through individual blocks of the Simulink. To avoid saturation of the integral action, saturation block is added at the output side. The Simulink model of the closed loop system is as shown in figure below.

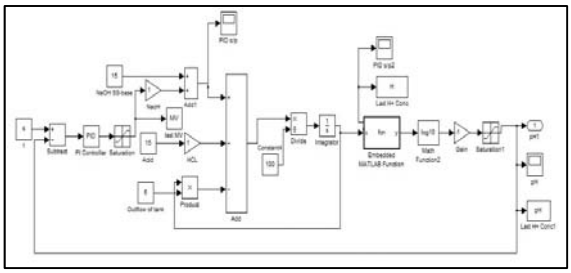


Fig. 3. MATLAB-Simulation representation for the overall pH control using PI controller, with pH=4

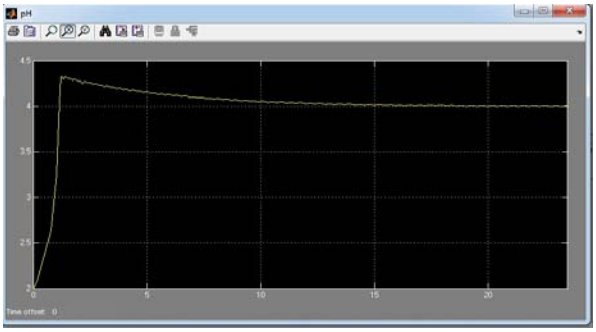


Fig. 4. Simulation graph for pH=4, when PI setting are kp=0.8 and ki=0.01

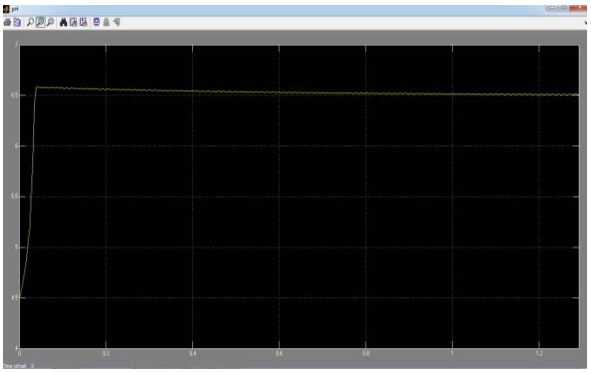


Fig. 5. Simulation graph for pH=4, when PI setting are kp=0.06 and ki=0.1

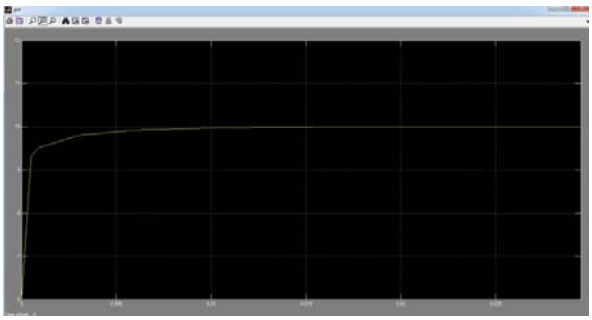


Fig. 6. Simulation graph for pH=10, when PI setting are kp=5 and ki=0.1.

pH	10	6.5	4
With kp1=5, Ki1=0.1	8.74	128977	13
With kp2-0.06, Ki2-0.1	31.1	13	205
With kp3=0.8, Ki3=0.01	15.98	17687.2	14.6

Fig. 7. IEA Result for various values of pH using PI controller

V. DISADVANTAGES OF PI CONTROLLER IN PH CONTROL

1) For a nonlinear process like pH, controller gain needs to follow the changes in process gain
2) Linear structure of PI controller is intended to workwith linear processes only.
3) PI settings need to be changed as per the change inprocess gain.
4) pH neutralization process gain varies with strength ofAcid/Base and needs to be captured in a model which is not considered in conventional PI controller.
5) Thus controlling pH requires a model based nonlinear controller.
6) Above disadvantages are needs to be taken into the consideration while designing new controller.

B. pH Neutralization using Fuzzy Controller

A Fuzzy inference system is a process that forms the mapping for the input and output variables using a fuzzy logic approach. This process involves several steps. It usually starts with identifying and defining the boundary of the input and output variables involved(i.e. establishing the relevant Fuzzy Set).This first procedure is quite crucial as the result of this will show the pattern of the input and output sets and provides general ideas about how these variables are linked. This information makes it is easier to move on to the next process, which involves identifying the membership functions for the input and output sets. The simplest and most commonly used membership function is a triangular membership function, which is used in this thesis. The final process is to develop a set of it-then rule statements. Such statements are used toformulate the conditional statements that comprise the fuzzy logic approach.

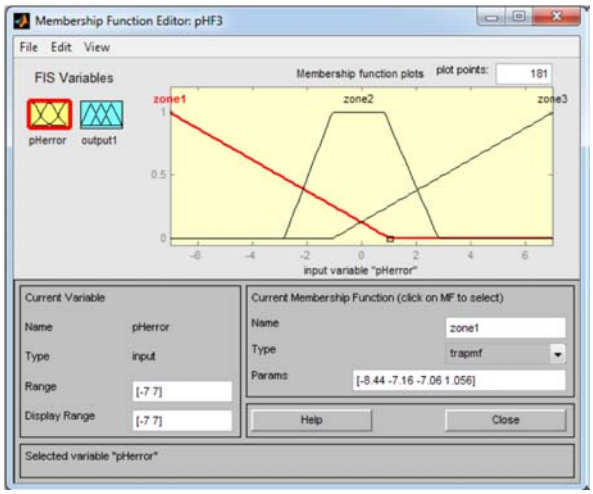


Fig. 8. Membership function for input set

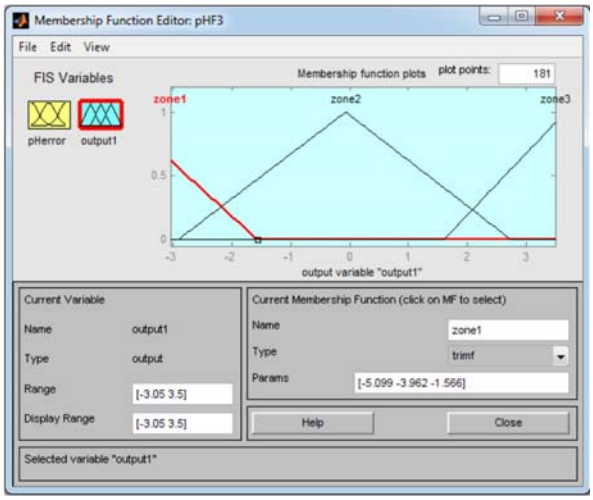


Fig. 9. Membership function for Output set.

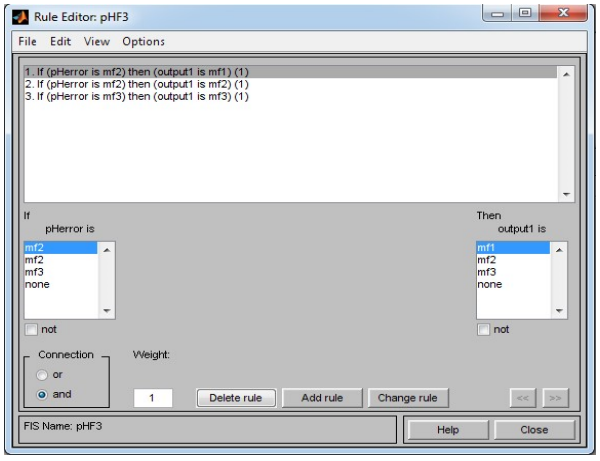


Fig. 10. Fuzzy Rule Set

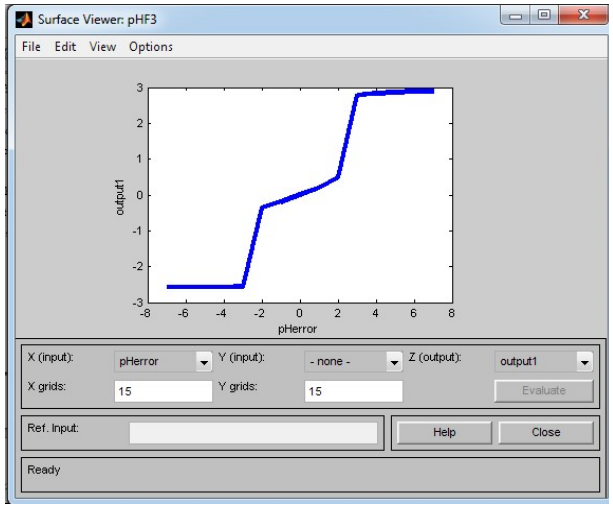


Fig. 11. The response of the fuzzy logic controller in terms of the manipulated variable as a function of the error.

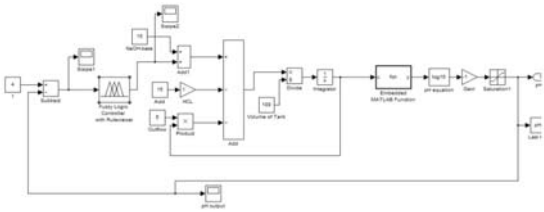


Fig. 12. MATLAB/Simulink representation of the overall system using Fuzzy Logic Controller.

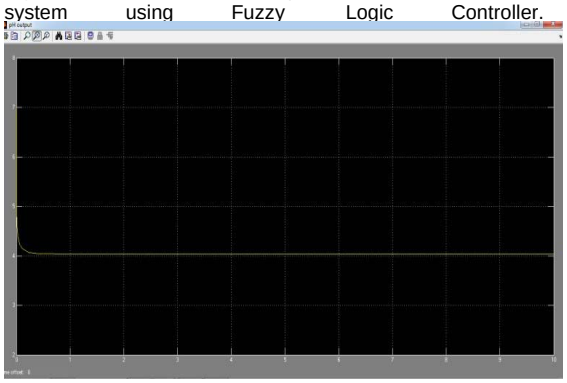


Fig. 13. Response obtained from the system with Fuzzy controller tuned for an operating point at pH=4

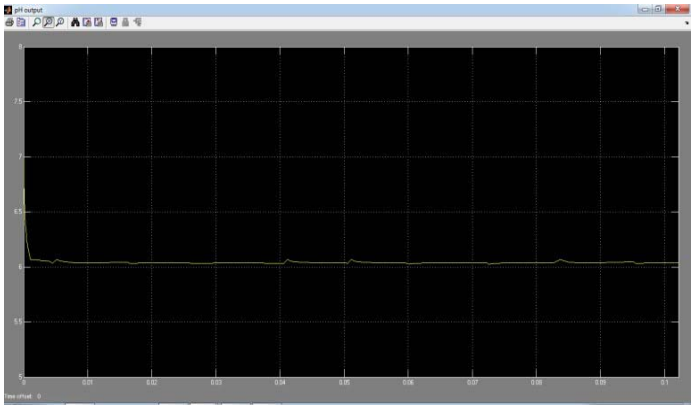


Fig. 14. Response obtained from the system with Fuzzy controller tuned for an operating point at pH=6

Fig. 15. Response obtained from the system with Fuzzy controller tuned for an operating point at pH=10

VI. CONCLUSION

1) Application of PID control is limited to linear process with constant gain.

2) For non-liner process with varying gain, gain of the PID controller also needs to be changed (kp, ki)

3) Fuzzy Logic is known to capture non-linear dynamic of the process with simple representation.

4) Using Fuzzy Logic, non-linear dynamics of pH neutralization process can be conveniently captured.

5) Thus Fuzzy controller can suitably used as non-linear model based control for controlling complicated process such as pH neutralization.

VII. FUTURE SCOPE

1) The fuzzy model based controller can be tuned further to improve the steady state error.

2) The pH neutralization model could be made more realistic considering the measurement delays, control valve characteristics, cascaded flow control for acid and base.

3) This Simulink model could be interfaced to an actual pH neutralization process and performance could be verified. 4) The PID control could be extended to gain scheduling PI controller and could verify with real plant interface.

VIII. REFERENCES

[1] Abdullah, M.N.Karsiti and Rosdizali,"Review of pH Neutralization Process Control", in 2012 4th International conference on intelligent and Advanced Systems(ICIAS2012), IEEE.

[2] Nio Tiong Ghee, Sivakumar Kumaresan and Liau chung Fan, "Fuzzy PID Controller to Control the pH Neutralization Process" , in 2002 Student Conference on Research and Development Proceedings, Shah Alam, Malaysia, IEEE.

[3] Claudio Garcia and Radrigo Juliani Correa De Godoy, "Application of MATLAB in Science and Engineering".

[4] "Basics of pH control", Application Data Sheet, ADS 43-001/rev.C, March2011, Rosemount Analytical.

[5] Gaylon Lynn Williams, B.S., "A thesis on Process Model Based control of wastewater pH ",August 1989,Texas Tech University.

[6] S. Joe Qin and Guy Borders, " A Multiregion Fuzzy Logic Controller for Nonlinear Process Control", in 1994, for IEEE Transactions on Fuzzy Systems, Vol 2,No 1. [7] [7]"A Guide to pH Measurement", The theory and practice of laboratory pH applications.

[8] B.T. Jadhav, R.R. Mudholkar & S.R.Sawant ,"Fuzzy Logic pH control technique", Industrial Automation- April 2003, pp42-46.

[9] Kevin M. Pasino and Stephen Yurkovich, "Fuzzy Control", Addition Wesley, pp21-65.

SLIDING MODE CONTROLLER DESIGN FOR CONTROLLING THE SPEED OF A DC MOTOR

[1]Vyoma Singh, [2]Dr. Veena Sharma
[1]M.tech student (Signal Processing and Control)
Electrical Engineering Department, NIT Hamirpur, India
[2]Associate Professor Electrical Department NIT Hamirpur, India

ABSTRACT: **The objective of this paper is to control the speed of a DC motor efficiently by using SMC. Model of a separately excited DC motor has been choose. First PID controller is used for the speed con- trol of the motor (both linear and non-linear model) and then SMC is used for the same non-linear model. The modeling and simulation has been done in MATLAB. The observations shows that SMC gives better results as compared to PID. While PID is not capable to give the desired result satisfactorily in case of non-linear systems, SMC has robust nature in presence of such disturbances.**

KEY WORDS: **Sliding mode controller, chattering, non-linearity in dc motor, modeling of dc motor.**

I. INTRODUCTION

DC motors have been widely used in industrial, agricultural and domestic sectors with various applica- tions. Different fields require different speed ranges of the motors with different ranges of load changes. Usual- ly where a higher speed of dc motor is required, the non – linear factors of the motor are neglected since these factors do not affect much. Also, in such cases, conven- tional controllers such as PI (Proportional-Integral) con-troller and PID (Proportional-Integral-Derivative) con- troller are effective.

When we come across non-linear systems the above controllers are likely to fail, they do not provide the desired output in desired time. For this reason, some better approach has to be taken. In this paper, SMC (Sliding Mode Controller) is that approach, a controller which has ability to work satisfactorily under linear as well as non-linear factors of the system.

This paper has taken two types of non-linearities that are present in a DC motor. One of them is friction that occurs in the motor itself and the other non-linear factor is backlash. Backlash is generated at the gear box which is driven by the motor.

When the motor is required at low speed level such as in chemical processing application in industries, the non-linear factors do affect the output of the system that can not be eliminated by the conventional control- lers in real time. SMC is designed for avoiding such un-certainties. It has many advantages over PID controller. Some of them are robustness, disturbance rejection and independent of he system parameters. The results shown in the paper proves that SMC is much better than PID for the speed control of a DC motor especially when the non-linear model of the motor is considered

II. SLIDING MODE CONTROL (SMC)

Sliding mode controller works by switching the trajectory of the system from one structure to other and in between sliding on a specific line, plane or surface in state space. The motion of

the system trajectory along a chosen path in state space is called the sliding mode and the controller designed with the aim to achieve the slid- ing motion is called sliding mode controller. The path such chosen is called the sliding surface or switching surface.

While choosing the sliding surface, there are some requirements that has to be taken care of. The system stability has to be confined to the sliding (switching) surface. Also, the system trajectory should converge to the sliding surface within finite time

REQUIREMENT I.

System stability: Consider the following system dynamics

$\dot{x}1 = A11\ x1 + A12\ x2$ -1

$\dot{x}2 = A21\ x1 + A22\ x2 + Bu$ -2

Let the sliding function chosen be :

$s = Cx_1 + x_2 = 0$ -3

Equation 1 can be rewritten as:

$\dot{x}1 = A11\ x1 - A12\ Cx1 = (A11 - A12C)x1$ -4

Taking C > 0 such that the solution of equation 4 lies to the left hand side of the phase plane, the dynam- ics of x_1 can be made stable at the sliding surface. From equation 3 the dynamics of x2 already becomes stable at the sliding surface. Thus this sliding surface validates the first requirement.

REQUIREMENT II.

Convergence to s = 0 : For this requirement to be ful- filled, the **reachability condition** has to satisfied which states that in order to make sure that sliding mode starts at some time t > 0, irrespective of the initial state x(0), we should be sure that the state trajectory is always moving towards s = 0, for s ≠ 0.

$d(s^2)/dt < 0$ -5

As the state trajectory comes closer to the sliding surface, the rate of convergence becomes slow. So along with reachability condition, there is one more condition called **η condition** that ensures the conver- gence of the trajectory towards s = 0 within finite time as the trajectory approaches towards the same. For the example taken above, its η condition can be written as:

$d(s^2)/dt < -\eta|s|$ -6

When the state trajectory changes its structure from one path to other ie; as it is on the verge to slide on the sliding surface, due to the stronger condition been applied to it, the transition from one structure of the path to the other is not smooth. In fact it forms a zig -zag path along the sliding surface. This happens due to the practical limitations of the devices used for the measurements. Such an undesirable phenomenon is known as chattering.

Chattering occurs due to the presence of the sig- num function used in the controller. Hence, to avoid or reduce chattering, signum function has to be replaced by some smoother functions may be tangent function or saturation function. Many types of functions have been used in different papers for reducing the chattering ear- lier and many are still working on it.

III. DC MOTOR (LINEAR MODEL)

DC motors have a wide area of application in all sorts of sectors, be it industrial, agricultural or domes- tic. Moreover, they have been used in scientific re- search and technology works too. The electric circuit of the DC motor is shown in Fig. 1. Objective here will be controlling the speed of the motor through arma- ture voltage.

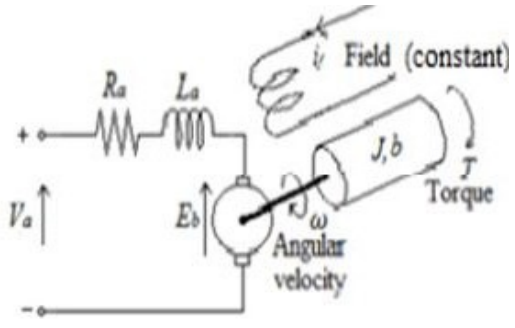


Figure 1. Electric circuit of DC motor

The parameters shown in figure 1. are given below: V_a : armature voltage (input to the motor)

R_a : armature resistance
L_a : armature inductance
E_b : back emf
ω : angular velocity (output of the motor)
i_f : field current
J : moment of inertia
b : constant of moment of inertia
T : torque produced

The motor rotates with a constant speed which is gained by balancing the load torque and the torque pro- duced by the motor. The motor is excited by the field current with input as armature voltage applied at the terminals. This induces a voltage in the motor known as back emf. The output speed of the motor rotates the shaft attached to it which is actually the load.

The equations that govern the working of the motor are written as:

Torque in terms of shaft parameters:

$$T = J(d\omega/dt) + B\omega \quad -7$$

Torque produced by armature current:

$$T = K_t\, i_a \quad -8$$

Now applying KVL in the circuit shown in fig- ure 1., we get:

$$V_a - E_b = R_a i_a + L_a(di_a/dt) \quad -9$$

$$(di_a/dt) = V_a/L_a - E_b/L_a - (R_a/L_a)\, i_a \quad -10$$

Where , $E_b = K_b\, \omega$ -11

And ,$(d\omega/dt) = - (b/J)\omega + (K_t/J)\, i_a$ -12

With ω and i_a as state variables, V_a as the input, the state model of the motor can be represented by equations 10 and 12. Finally by putting the values in equations 11 and 12, the system model becomes:

$$(d\omega/dt) = - \omega + 47.9041916\, i_a \quad -13$$

$$(di_a/dt) = - 66.66667\omega - 50 i_a + 83.3333 V_a \quad -14$$

Equations 13 and 14 are obtained by using the following values:

$R_a = 0.6\Omega$ $L_a = 0.012H$
$K_t = 0.8Nm/A$ $K_b = 0.8Vs/rad$
$J = 0.0167Kgm^2/s^2$ $b = 0.0167$

Simulink model of DC motor (linear) is shown in fig- ure 2. below.

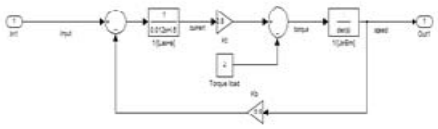


Figure 2. Simulink model of DC motor (linear)

IV . DCMOTOR(NON-LINEARMODEL)

Two non-linearities considered in this paper are friction and backlash. Friction has three com- ponents namely static friction, coulomb friction and viscous friction. Whenever two surfaces are in contact they are having some static friction which one surface has to overcome so as to move. Static friction is also called stiction. As the surface of one object starts to move it glides over the other object with some velocity and in a direction. Op- posite to this velocity and direction, coulomb force is always present which is independent of the mag- nitude of the velocity. It depends on the nature (properties) of the two surfaces in contact. The static friction is greater than the coulomb friction. The friction proportional to the velocity is viscous friction. It has the same direction as that of the moving object ie; the velocity. Below is a figure describing the relationship between the three com- ponents of the friction and the velocity.

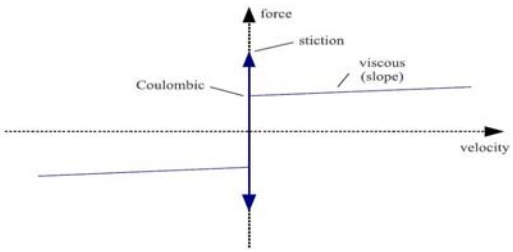


Figure 3. Friction - velocity plot

Backlash occurs in every mechanical system that has some movement. It is like hysteresis (that occurs in electric systems), but in mechanical sys- tems. When the motor drives the shaft, it rotates with certain speed and the gear box attached pro- duces backlash. The plot of input angle (driving motor angle output) vs output angle (driven

shaft angular position) is shown below in figure 4.

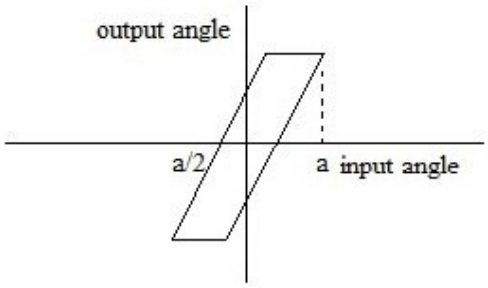


Figure 4. Backlash in gear box

Here 'a' is the perpendicular distance be- tween the teeth of the motor driving the shaft and the shaft been driven (as an example).

The Simulink model of DC motor is taking into consideration the friction and backlash non-linearities, is shown in figure 5. Below

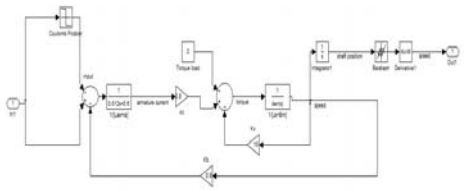


Figure 5. Simulink model of DC motor (non-linear)

V. CONTROLDESIGN

Take $x_1 = \omega(t)$; $x_2 = x_1$; $u = V_a$

The system then becomes:

$$\dot{x}_1 = x_2 \qquad -15$$

$$\dot{x}_2 = -51.39\, x_1 - 51\, x_2 + 3992.015\, u \qquad -16$$

$$y = x_1 \qquad -17$$

Selecting the sliding surface as:

$$s = Ce + x_2 = 0 \qquad -18$$

where C is negative and
e = reference speed - actual speed $e = r - x_1$

The controller 'u' is defined as:

$$u = K, \quad s < 0 \qquad -19$$
$$= -K, \quad s > 0$$

where K should be a positive value. In the simu lation given below, $K = |C|$.

VI. SIMULATION RESULTS

First comparison between the output of PID controller for DC motor linear and non - linear model has been done. Then the results of PID and SMC for non - linear DC motor model are compared

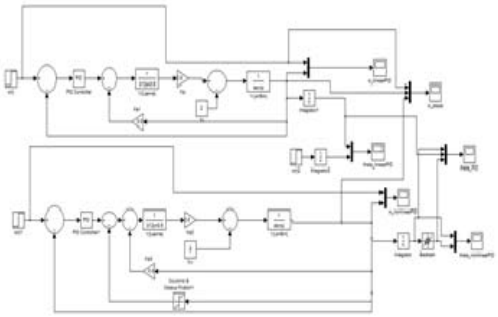


Figure 6. Modeling of PID controller for DC motor speed

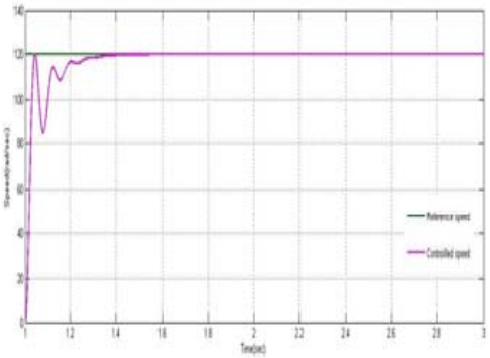


Figure 7. Speed control of linear DC motor model using PID controller

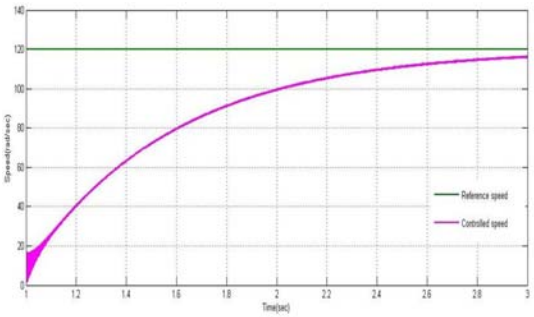


Figure 8. Speed control of non-linear DC motor model using PID controller

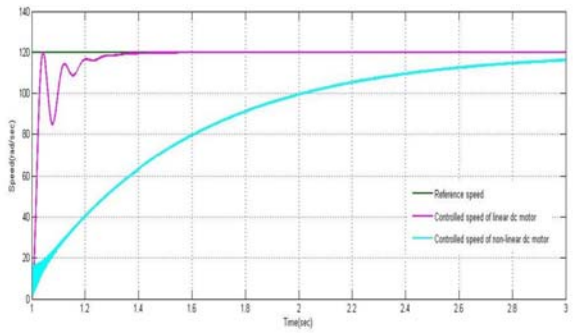


Figure 9. Speed control of DC motor using PID controller

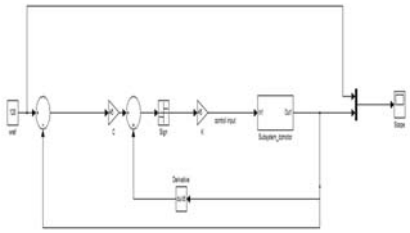


Figure 10. Modeling of SMC for DC motor speed

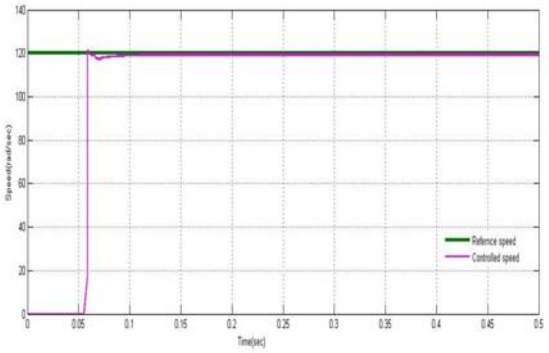


Figure 11. Speed control of DC model (non-linear) using SMC

VII. CONCLUSIONS

In this paper conventional controller PID and a different approach SMC have been applied for speed control of DC motor. As far as linear model of the motor is concerned, PID is capable to control the speed within desirable time and er- rors under limitations. But when it comes to con- trol the speed under the presence of non- linearities, SMC is far better than PID. However, results of PID controller can be improved by changing the gains of P, I, D terms but SMC proves to be efficient than PID controller, be it in terms of peak overshoot or the settling time

REFERENCES

. Vadim I. Utkin, “Sliding Mode Control Design Prin- ciples and Applications to Electric Drives”, IEEE Transactions on Industrial Electronics, February 1993.

2. K. David Young, Vadim I. Utkin and U mit O zgun- er, “A Control Engineer,s Guide to Sliding Mode Control”, IEEE Transactions on Control Systems Technology, Vol.7, No.3, May 1999.

3. Mohammed Godam Sarwer, Md. Abdur Rafiq and B.C.Gosh, “Sliding Mode Speed Controller of a D.C. Motor Drive”, Journal of Electrical Engineer- ing, The Institution of Engineers, Bangladesh, Dec 2004.

4. Uma Maheshwararao, Y.S.Kishore Babu, K.Amaresh, “Sliding Mode Speed Control of a DC Motor”, 2011 International Conference on Com- munication Systems and Network Technologies.

5. Ned Mohan, "Electric Drives: An Integtalive Ap- proach”, MNPERE Minneapolis, 2001.

6. J. K. Liu and F. C. Sun, "Research and development on theory and algorithms of sliding mode control", Journal of Control Theory and Applications, vol. 24, no. 3, 2007.

COLOR IMAGE COMPRESSION USING HIERARCHICAL PREDICTION OF PIXELS

[1]P.LOHITHA, [2]T.RAMASHRI

[1]M.Tech , Dept. of ECE, SVUCE, SV University, Tirupati, India

[2] Professor , Dept. of ECE, SVUCE, SV University, Tirupati, India

Email ID:[1]lohitha.p@gmail.com,

[2]rama.jaypee@gmail.com

***Abstract*— A vital problem in evaluating the picture quality of an image compression system is the difficulty in describing the amount of degradation in reconstructed image, Wavelet transforms are set of mathematical functions that have established their viability in image compression applications owing to the computational simplicity that comes in the form of filter bank implementation. This paper presents a new lossless color image compression algorithm, based on the hierarchical prediction and Wavelet Coding. We develop a hierarchical scheme that enables the use of upper, left, and lower pixels for the pixel prediction, whereas the conventional raster scan prediction methods use upper and left pixels. An appropriate context model for the prediction error is also defined and Haar wavelet transform is applied to the error signal corresponding to each context. Proposed work is carried out by the application of hand designed wavelet family like Haar on a variety of bench mark images. It is shown that the proposed method further increases the compression ratios with more peak signal to noise ratios.**

***Index Terms*— Hierarchical prediction, Lossless color image compression, Reversible color transform, Wavelet Coding.**

I. INTRODUCTION

Memory and channel bandwidth are the prime constraints in image transmission and storage applications. In view of the growing energy requirements of wireless data services, the volume of multimedia data being transmitted over wireless channels may be reduced using various compression techniques, image compression entails transforming and organizing the data in an easy way of representation in which images of various types and sizes are compressed using different methodologies.

Image compression is one of the most visible applications of wavelet transforms additional to diversified fields as biomedical applications, wireless communications, computer graphics etc. [1] Wavelet based image coders like JPEG2000 standard easily outperform the traditional discrete cosine transform based JPEG image compression.

Wavelets provide good compression ratios for high resolution images and perform better than competing technologies like JPEG, in terms of signal to noise ratio and visual quality[4]. Unlike JPEG, wavelets show no blocking affects but allows for a degradation of the image quality while preserving the significant details of the image. In JPEG2000 standard wavelet based image compression system the entire image is transformed and compressed as a single data object rather than

block by block as in a DCT based compression system there by allowing uniform distribution of the compression error across the entire image to provide better image quality and high compression ratio[3].

This paper is organized as follows. Section 2 discusses the proposed transform based image compression system. Section 3 details the objective fidelity measures to assess the quality of reconstructed images and their measures..

II. TRANSFORM BASED COMPRESSION SYSTEM

Image compression techniques are broadly classified as lossy compression techniques and lossless compression techniques, depending on whether or not an exact replica of the original image could be constructed using the compressed image.

Lossless image compression techniques are limited in terms of compression ratios, they encode data exactly such that decoded image is identical to the original image. Lossless compression uses predictive encoding which uses the gray level of each pixel to predict the gray value of its right neighbor, the overall result is the reduction of redundancy in the data. Lossless image compression techniques are mainly preferred for applications with stringent requirements such as medical imaging and diagnosis etc.

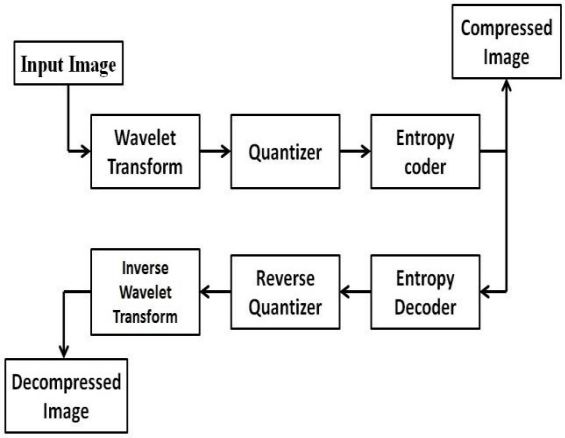


Fig 1: Transform based image compression system

III. PROPOSED WORK

For the compression of color images, the color components are first de-correlated by a color transform, and each of the transformed components is independently compressed. For example, the RGB to *Y CbCr* transform may be the most frequently used one for the lossy compression of color image and video. However, in the case of lossless compression, most color transforms cannot be used due to their un-invertibility with integer Hence an invertible version of color transform, the reversible color transform (RCT) was defined and used in JPEG2000 .

After the transformation of RGB to *Y Cu Cv* by an RCT the Y channel is encoded by a conventional gray scale image compression algorithm. In the case of chrominance channels (*Cu* and *Cv*), the signal variation is generally much smaller than that of RGB, but still large near the edges. For more accurate prediction of these signals, and also for accurate modeling of prediction errors, we use the hierarchical scheme: the chrominance image is decomposed into two sub images; i.e. a set of even numbered rows and a set of odd numbered rows respectively. Once the even row sub image *Xe* is encoded, we can use all the pixels in *Xe* for the prediction of a pixel in the odd row sub image *Xo*. In addition, since the statistical properties of two sub images are not much different, the pdf of prediction errors of a subimage can be accurately modeled from the other one, which contributes to better context modeling for Wavelet coding[5].

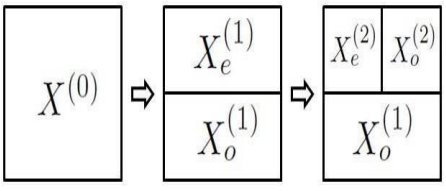


Fig 2: Illustration of hierarchical decomposition.

The efficiency of lossless compression based on the estimation of the pdf of the prediction error. For the compression of Xo pixels using Xe, directional prediction is employed to avoid large

prediction errors near the edges. for each pixel xo(I,j) in Xo, the horizontal prediction x^h(I,j) and vertical predictor x^v(i,j) are defined as

$$\hat{x}_h(i,j) = x_O(i, j-1)$$

$$\hat{}(i,j) = round(\frac{(\quad)\qquad(\quad)}{\quad})$$

One of them is selected as a predictor for Xo (i,j).With these possible predictors, the most common approach to encoding is " mode selection" where the predictor of each pixel is selected and the mode is also transmitted as side information. We define a variable for the direction of edge at each pixel dir(i,j) ,which is given either H or V .Mode selection is tried when more than one of dir(i-1,j) or dir(i,j-1) are H and the vertical prediction is performed for the rest.

For the efficient compression, the statistics of symbols (prediction errors) should well be described by an appropriate model and/or parameters. We model the prediction error as a random variable with pdf *P(e|Cn)*, where *Cn* is the coding context that reflects the magnitude of edges and textures. Specifically, *Cn* is the level of quantization steps of pixel activity *σ(i, j)* defined as

$$\sigma(i\ j) = |x_e(i,j)-x_e(i+1)|$$

Note that the local activity and its quantization steps are calculated with the pixels in X_e, because all the pixels of X_e are available and its statistical property would be almost the same as that of *Xo*. The local activity is quantized into *K* steps such that C_n represents the step

$q_{n-1}<=(i, j)<q_n$

for $n = 1, \ldots, K$ with $q_0 = 0$ and $q_K = \infty$. The length of quantization steps is determined such that each step includes the same number of elements (local activities). For each context, a generic adaptive arithmetic coder [12] is used to encode the prediction error. For illustration, Fig 3 shows an input image, the local activity of a sub image (context), and *P(e|Cn)* for several *Cn*. It describes the statistical property of prediction error very well, in that the error magnitude is large when the local activity is strong. Hence the proposed model is strong with wavelet coding. The Context is taken as the input of haar wavelet transform, which are again divided in to LL, LH, HL, HH sub images [2]. LL sub image is having more information than the remaining sub images hence, LL sub image is taken into consideration and Haar wavelet transform is applied. The output obtained is having design metrics such as mean square error(MSE),peak signal to noise ratio(PSNR) and compression ratio(CR)[6].

IV. ANALYSIS OF RESULTS

In the proposed work, different color images and gray scale images with varying content of details are considered with decomposition using hand design wavelet family like haar wavelet transform. Metrics PSNR, CR and MSE so obtained are tabulated in Table I for analysis after simulation in Matlab environment.

Table I: Quality Metrics

Image (128x128)	PSNR	CR	MSE
Lena	11.9084	18.2156	4.1902
Mandrill	10.1693	10.6176	6.2617
Barbara	11.9053	16.1377	4.1933
Endoscope	16.0378	26.4924	1.6192

V. CONCLUSIONS

The Proposed work of lossless color image compression method based on a hierarchical prediction of pixels .For the compression of an RGB image, it is first transformed into $Y\ C_u\ C_v$ color space using an RCT. After the color transformation, the luminance channel *Y* is compressed by a conventional lossless image coder. Pixels in chrominance channels are predicted by the hierarchical decomposition and directional prediction. Finally Haar wavelet transform is applied to the context image. This proposed method is tested on different images. The results obtained clearly indicate that Haar offer good compression performance; it can be concluded

that compression performance depends on the size and content of the image therefore it is appropriate to tailor the choice of wavelet based on image size and content for desired quality of reconstructed image

VI. REFERENCES

[1] Seyun kim,nam ik cho "Hierarchical Prediction and Context Adaptive Coding for Lossless Color Image Compression", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 23, NO. 1, JANUARY 2014

[2] Sridhar, Rajesh kumar , Ramanaiah "Wavelet Transform Techniques for Image Compression An Evaluation", I.J. Image, Graphics and Signal Processing, 2014, 2, 54-6
7.

[3] Telagarapu, Prabhakar, et al. "Image Compression Using DCT and Wavelet Transformations." International Journal of Signal Processing, Image Processing and Pattern Recognition 4.3 (2011).

[4] Rafel C. Gonzalez, Richard E Woods, Steven L Eddins, "Digital Image Processing using Matlab," 2008, Fourth Impression, Pearson Education.

[5] Grgic, Sonja, Mislav Grgic, and Branka Zovko-Cihlar. "Performance analysis of image compression using wavelets." Industrial Electronics, IEEE Transactions (2001).

[6] Gupta, Maneesha, and Amit Kumar Garg. "Analysis Of Image Compression Algorithm Using DCT." (2012).

SLOTTED PIER AS A SCOUR CONTROL MEASURE

Dr. Pankaj Goswami[1], Miss Manisha Barua[2]
Assistant Professor,Assam Engineering college[1], Guwahati,
Assistant Professor at SITM[2]
Email: pgoswami31@rediffmail.com[1], manishacivil1989@gmail.com[2]

Abstract— Scour is result of the erosive action of flowing water, excavating and carrying away material from bed and banks of streams and other waterways. Scour is one of the major causes of failure of bridges across the world. The estimation of correct depth of scour below the stream bed is very important since that determines the depth of foundation. In this study an attempt has been made to study the effectiveness of slotted pier as a scour control measures. The provision of slot in the pier helps in reducing the strength of the horseshoe vortex due to the reduction of effective diameter of the pier. Furthermore, the passage of water through the slot reduces the intensity of adverse pressure gradient upstream of the pier. The slot helps to pass most of the flow through it and only the balance is left to cause much reduced scour damage. For this, a rectangular slot is provided on the pier, above bed level and behavior of scour around the pier was observed by conducting model test under clear water
Index Terms—Bridge piers, Scour reduction, scour depth with time, pier diameter.

I. INTRODUCTION

Scour is the result of the erosive action of flowing water, excavating and carrying away material from the bed and banks of streams and from around the piers and abutments of bridges. Construction of bridge requires careful planning and in depth study and no undue risk should be taken in design and construction. The most common cause of bridge failures is from floods, scouring bed material from around bridge foundations. Scour is the engineering term for the erosion caused by water of the soil surrounding a bridge foundation (piers and abutments). During the spring floods of 1987, 17 bridges in New York and New England were damaged or destroyed by scour. In 1985, 73 bridges were destroyed by floods in Pennsylvania, Virginia, and West Virginia.

The 1973 national study for the Federal Highway Administration (FHWA) of 383 bridge failures caused by catastrophic floods showed that 25 percent involved pier damage and 75 percent involved abutment damage. A second more extensive study in 1978 indicated that abutment scour problems also have the same responsibility as that of local scour for failure of bridge foundation.

II. OBJECTIVE OF THE STUDY

Many bridges failed around the world because of extreme scour around pier and abutment. The failure of bridges due to scour will result in economical loss and may also result in losses of human life. In an extensive study of bridge failures in United States, it reported that damage to bridges and highways from regional floods in

1964 and 1972 amounted about $100,000,000 per event. A large depth of foundation is require for bridge piers to overcome the effect of scour which is a costly proportion. Therefore, for safe and economical design, scour around the bridge piers is required to be controlled. So in this study an effort have been made to reduce the depth of scour by using a rectangular slot through pier, which helps to pass most of the flow through it because of a favorable pressure gradient and balance would be left to cause much reduced scour damage. The basic principle of a slot is either to divert the down flow away from the bed, or to reduce the down flow impinging on the bed. When the slot is placed near the bed, the oncoming flow at the bottom boundary layer accelerates through the slot as a horizontal jet.

III. METHODOLOGY

A laboratory model study has been carried out in a flume channel of 19.25m long, width 1000mm and the depth is 1300mm and observations are made for local scour around slotted and solid bridge piers of different diameters. The experiments were conducted till the scouring process stopped or the change in scour depth was small enough to be neglected. The sand bed is used as bed material and local scour depth was observed for different approach velocity. For each and every set of experiments the pumps were started and water collected at the inlet tank and discharged through the flume channel and finally returned back to the main reservoir through recirculation channel. The pumps are run for up to six hour period and scour depth are measured after every hour interval. The process was continued till scouring reaches a stable condition. The test were conducted for different diameter viz. 3.81cm (1.5″), 5.08cm (2″), 7.62cm (3″) solid and slotted pier and also for different opening ratio of slot at different velocity.

IV. LITERATURE REVIEW

The provision of slot to reduce the power of the horseshoe vortex includes create a conduit for passing the flow through the pier of the bridge. Tanaka and Yano (1967) and Chiew (1992) have studied the effect of providing slots through the body of circular piers on scour depth. Chiew (1992) conducted experiments with two distinct locations of the slots. Kumar et al. (1999) carried out research to determine the scour reduction efficiency of slots of different lengths and aligned at different angles to the flow. The application of slot to control scour in a group of circular bridge piers in a direct canal was studied by Heidarpoor, et al. (2003) findings revealed that the group of bridge piers has a great impact on the depth of scouring on the front part of the pier compared with an individual pier. A.T. Monakada and et. al. (2009) by examining effect of a rectangular slot (width 1.8cm and varied height) observed that a slot in the pier considerably reduces the scour depth. When the slot length increases from the water surface to the bed Level, the efficiency was between 48% and 85%. Therefore, the slot location is a parameter that has a direct effect on the scour depth, with the best location near the bed.

IV SCOUR MECHANISM

The basic mechanism causing local scour at a pier is the formation of vortices at their base. The formation of these vortices results from the pileup of water on the upstream surface and subsequent acceleration of the flow around the nose of the pier. The action of the vortex removes bed material from around the base of the pier. When the transport rate of the sediment away from the pier caused by the vortex is greater than the transport rate of sediment into the region around the pier, a scour hole develops. As the depth of the scour hole increases and widens, the strength of the vortices is reduced, thereby reducing the transport rate of sediment out of the scour hole. At the same time, the widened scour hole is able to capture a greater amount of the bed load moving past the pier. Eventually, an equilibrium condition is established and scouring process can be ignored.

V. SCOUR PROTECTION MEASURE CONSIDERED IN THIS STUDY

There are many approaches available for scour protection measure, but all are economically expensive and construction cost is also more. In our experiment we have used an approach for scour protection measure using rectangular slot on the pier, which helps to pass most of the flow through it because of a favorable pressure gradient and balance would be left to cause much reduced scour damage. The basic principle of a slot is either to divert the down

flow away from the bed, or to reduce the down flow impinging on the bed. Considering that, experimental study were conducted with provision of vertical slot on the piers at different velocities and at different opening ratio as scour control measures. Experiments were run under a clear water scour regime on sand bed for a period of 6 hour and the observations were taken at one hour interval.

VI. OBSERVATION

A model bridge arrangement has been made in such a way that the pier axis is perpendicular to the direction of flow of water. The experiment have been conducted using the circular pier of different diameter 3.81cm (1.5″), 5.08cm (2″), 7.62cm (3″) and slotted pier with percentage of opening are 26.24 %, 39.37%, 35.43 %, 49.21%, 32.80 % and 52.49 % of width. The observations were done at four locations, location- U_1 and U_2 just along the upstream face and location D_1 and D_2 along the downstream face of the pier. The observations are made at every 1 hour of interval and the experiments were conducted till the scouring process stopped or change in scour depth was small enough to be neglected. Scour observations were made at all the 4 points under clear water at different diameter and velocity for solid and slotted pier with different opening ratios and observations were explained in the graph

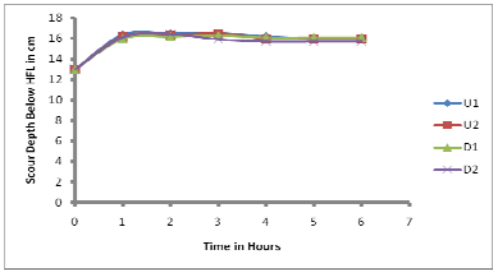


Fig.1: Scour depth behavior for solid pier

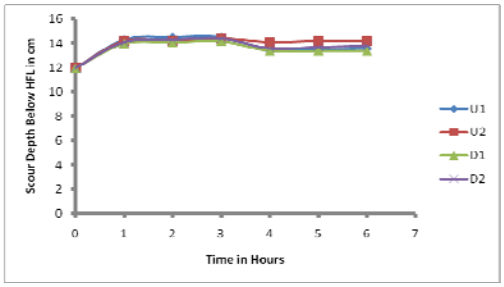


Fig.2: Scour depth behaviour for slotted pier

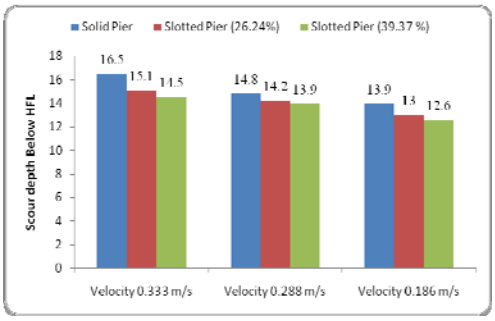


Fig.3: Variation of scour depth at different velocity for pier Diameter 3.81 cm

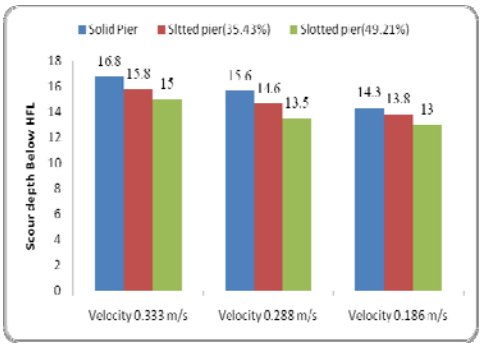


Fig.4: Variation of scour depth at different velocity for pier Diameter 5.08 cm

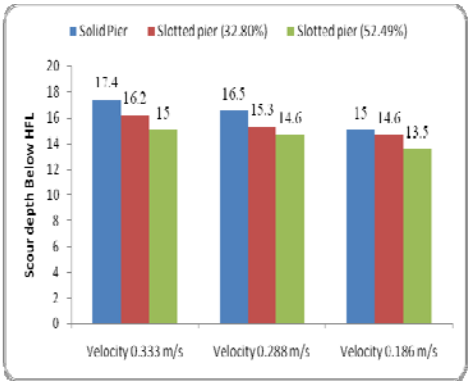


Fig.5: Variation of scour depth at different velocity for pier Diameter 7.62 cm

From above Fig. it was observed that the provision of slot on the pier reduces the scour depth, also observed that scour depth is inversely proportional to the size of slot on pier. Using laboratory data as input, analysis were made for calculation of anticipated scour depth by using current evaluation practices. For the analysis the approach like IRC-78-2000, HEC-18, U.C. Kothiyari methods are adopted

and calculated results are compared with experimental results.

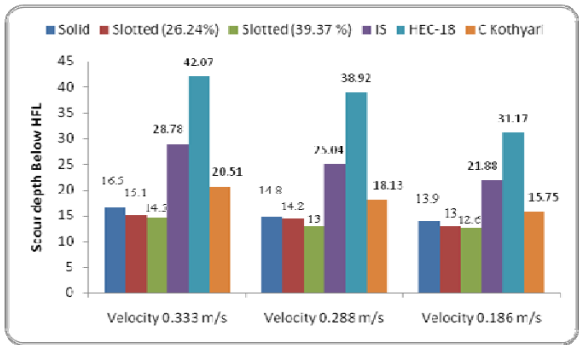


Fig.6: Scour depth evaluated using different approach for pier diameter 3.81 cm

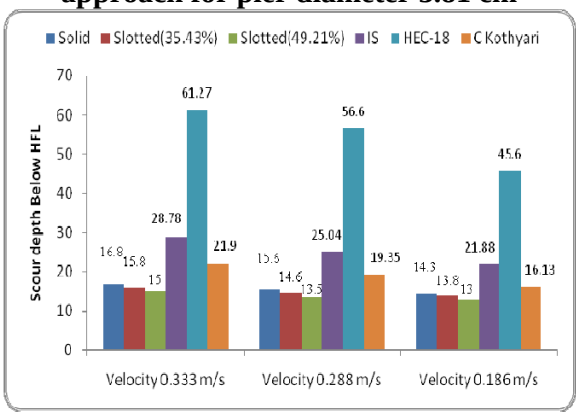


Fig.7: Scour depth evaluated using different approach for pier diameter 5.08 cm

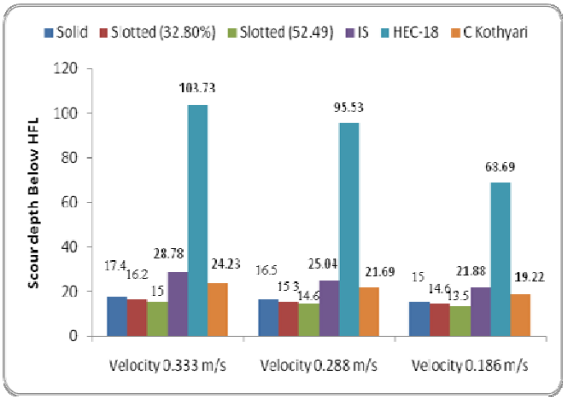


Fig.8: Scour depth evaluated using different approach for pier diameter 7.62 cm

VII. SCOUR DEPTH PREDICATION EQUATION

Development of Regression based model for prediction of equilibrium scour depth in slotted pier:

Using the observed data from laboratory physical models and considering flow velocity (v), pier diameter (d), opening ratio (O_R) and shape of pier as parameters for circular pier, non-linear regression analysis is done by using "XLSTAT" software and the following equations are formulated for estimation of clear-water scour depth around bridge piers.

$$D_{sc}=15.14-0.31v+0.56d-1.84\times10^{-2}xO_R+8.73\times10^{-3}xv^2-2.41\times10^{-2}xd^2x6.23\times10^{-4}xO_R^2$$

Where,

D_{sc}= Scour depth below HFL in meter
v= Approach velocity in m/s
d=Pier diameter in meter

Inaccuracy of the equation may arises in different situation, as they are based on limited data obtained from laboratory physical models.

Validation of proposed equation using field data

For validation of proposed equation, the field data used in this study was obtained from American Journal of Environmental Sciences 1(2):119-125,2005 ISSN 1553-345X © Science Publications, 2005. The field data mainly include the discharge, water depth, mean approach velocity, silt factor and maximum observed local scour depth.

The comparison between the measured scoured depths and computed scour depths using proposed equation shows that they are in agreement. The study shows that the proposed formula appear to give a reasonable estimate of local scour depth for solid as well as slotted pier.

VIII. CONCLUSION

From the model study as well as from the analysis of laboratory data and different approaches for scour depth determination, the following conclusion are drawn.

1. For the same approach velocity, bed material and pier diameter, the scour depth reduces due to the provision of slot on pier.
2. Increase in width of slot in the pier reduces the intensity of adverse pressure gradient upstream of the pier, which results in further reduction on scour depth
3. The proposed regression based model for slotted as well as solid pier appears to give

a reasonable estimate of the local scour depth.

4. The intensity of scour is greater in the upstream face of the pier than in the downstream face.
5. The rate of scour is maximum at initial period and reduces with time, but the process continues for long time and time to reach equilibrium scour depth varies widely. A practical equilibrium is reached within a relatively short time and after which the increase in the depth and extent of scour becomes virtually imperceptible.

REFERENCE

1 Ali Khodabakhshi, Mojtaba Saneie, Abdolnabi Abdoh Kolahchi. "Experimental study on effect of slot level on local scour around bridge pier" International Journal of Research in Engineering and Technology.

2 Ansari S.A and Qadar A., (1994). "Ultimate depth of scour around Bridge piers". Proc. A.S.C.E. National Hydraulics conference, Buffalo, New York, U.S.A.,51-55.

3 Baldev Setia and Upain Kumar Bhatia "Scour protection by a slot through a model bridge pier" Journal of Indian Water Resources Society, vol 33, no 1, January, 13.

4 Chiew Y.M (1984) "Local scour at Bridge piers". Report No. 355, School of Engineering, University.

5 Chiew Y.M and Melville B.W (1987) "Local scour around bridge pier" Journal of hydraulic Engineering, ASCE 1987.

6 Chitale S.V., (1993) "Indian practice of scour estimation –limitation. J Irrigation and Power 50.

7 Chitale S.V., (1988) "Estimation of scour at Bridge piers". J. Irrigation and Power (CBIP) 45.

8 Datta, P., (2010). "Scouring around bridge pier and remedial measures". M.E. Thesis, Gauhati University.

9 Ettema R., (1980). "Scour at bridge piers" Rep. No. 216, University of Auckland, New Zealand.

10Gao D.G.L. and Nordin C.F., (1993). "Pier scour equations used in the people's Republic of China-Review and summary". Proc., A.S.C.E. National Hydraulics conference, San Francisco, CA, U.S,A., 1031-1036.

11Garde R.J., Kothyari U.C., (1998). "Scour around bridge piers". PINSA 64, July 1998, 569-580.

12Hydraulic Engineering Circular No-18 (1991)"Evaluation of scour at Bridge", FHWA, 1991.

13Hydraulic Engineering Circular No-20 (1995) "Stream stability at Highway structures" FHWA, November, 1995.

14Johnson P.A.,(1995). "Comparison of pier scour equation using field data". J. Hydraulic Eng., ASCE, 121:626-629.

15Jagadeesh T.R. Jayaram M.A. "Design of Bridge structures"