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NCETIE-2011
September 5th- 6th, 2011

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Mr. Gurpreet Singh               Mr. Mandeep Mann
Mr. Rakesh                       Mr. Pawan Rozra
Mr. Arun
# Our Honorable Guests

## 5th September

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<td>Department of Physics</td>
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<td>Dr. I.S. Sandhu</td>
<td>Director</td>
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<td>Dr. Sanyam Aggarwal</td>
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<td>Er. Nitin Sharma</td>
<td>HOD, Electronics</td>
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<td>Dr. Sanyam Aggarwal</td>
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<td>Kurukshetra University</td>
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I congratulate all the members of Geeta Engineering College for organizing “National Conference on Emerging Trends in Engineering” on 5th -6th September, 2011. Such activities provide a platform both for the faculty and the student to exhibit their talent.

The education system is fast changing and new technologies emerging in different disciplines are needed to be adopted by the students and the staff to maintain pace with the global technological innovations. I hope that the participating delegates of this conference will discuss those emerging trends successfully and share the same with the students of our institute who are fostering the dreams.

I extend my best wishes for the success of the conference.

S. P. Bansal
NCETIE- 2011 (5th – 6th September, 2011)

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Chairperson - Mr. Nitin Sharma

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<td>To Detect and Distinguish DDoS Attacks from Flash Crowds in VoIP Networks</td>
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<td>NCETIE-159</td>
<td>Development of Multi-Lane Physical Layer Protocol of PCI</td>
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<td>NCETIE-160</td>
<td>Neural Computation of Array Factor for Sidelobe Reduction of One and Two Dimensional Broadside Arrays</td>
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<td>NCETIE-161</td>
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TECHNICAL SESSION – I
Utilization of Fly Ash to Sequester Carbon Dioxide

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Abstract: The sharp increase in anthropogenic emissions of carbon dioxide since the beginning of the industrial revolution has been globally recognized as the primary factor determining the ongoing global warming of the surface of the Earth. Capturing CO2 from flue-gas streams is an essential parameter for the carbon management for sequestration of CO2 from our environment. In the present research estimation of CO2 capture as a function of stoichiometry was calculated by utilization of fly ash. Fly Ash from ten different power plants in India was collected and elemental composition of each was analyzed by X-Ray Fluorescence Spectroscopy. Based on percentage of reactive metal oxide present in the sample of fly ash, the amount of CO2 captured theoretically was calculated for: Source 1(0.86%), Source 2(1.11%), Source 3(0.64%), Source 4(1.29%), Source 5(0.61%), Source 6(3.63%), Source 7(1.47%), Source 8(6.05%), Source 9(1.09%) and Source 10(1.39%).

Keywords: CO2 capture, Fly Ash, Sequestration, XRay Fluorescence Spectroscopy, Anthropogenic emissions, Global warming.

I. INTRODUCTION

Concerns for the effects of global warming have lead to an interest in the potential for inexpensive methods to sequester carbon dioxide (CO2). Inorder to combat problems of climate change, technical solutions are searched to minimize these harmful consequences. Like the increase of the efficiency of energy conversion, the reduction of energy demand and the use of carbon free energy sources (IPCC, 2007; Schrag, 2007). However, fossil fuels account for 85% of world energy needs in the current energy system, and hence, rapid variations of the demand or the prices in the market may seriously harm the global economy. Understanding the carbon cycle remains the focus of much study, the consensus is that anthropogenically driven increases in atmospheric CO2 will play a major role in climate forcing during the coming centuries. With viable replacement of fossil fuels remaining decades away, alternatives for reducing the impacts of atmospheric CO2 accumulations will surely include carbon sequestration and carbon management. Current cost for carbon fixation scenarios range from approximately $60-500 per ton of carbon dioxide captured plus additional costs for transport and disposal ($4-600/t C). We need cost effective carbon sequestration technologies coupled with very low transport and disposal costs or more preferably, the derivation of useable products. An alternative to reduce the CO2 emission without modifying the energy production system is the retention or sequestration of carbon dioxide in stable geological reservoirs (Bachu, 2000; Bachu and Adams, 2003). A technology that could possibly contribute to reducing carbon dioxide emissions is the in-situ mineral sequestration. Such a strategy, so-called geological carbon sequestration, consists of capturing gaseous CO2 from emissions sources and injecting it as a supercritical fluid in terrestrial reservoirs, such as saline aquifers, depleted oil and gas fields or deep coal seams.

The basic concept behind mineral CO2 sequestration is to mimic natural weathering processes in which calcium or magnesium silicates are transformed into carbonates: (Ca, Mg)SiO3+CO2.(Ca, Mg)CO3+SiO2 (1)

Various studies have proposed the mineral sequestration of CO2 in controlled reactors as a viable approach to reduce CO2 emissions into the atmosphere using liquid or solid alkaline residues such as municipal-waste combustion fly-ash, bottom ash, brine alkaline solutions, waste concrete and cements, steel slag, coal combustion fly-ash, alkaline paper mill waste, asbestos, etc. Capacity to sequester CO2 for these alkaline residues depends directly on the proportion of binary oxides (CaO and MgO) and/or hydroxides (Ca(OH)2 and Mg (OH)2) contained in the waste matrix Coal combustion in power plants provides approximately 40% of world electricity generation. At present, the coal reserves are estimated around 900 billion tons. Considering that coal consumption reached 5 billion tons in 2003, coal-energy production will continue, and even increase, in the next centuries due to the energy demand for industrial and domestic uses. Therefore, the continuous building of power plants is envisaged to sustain this energy production system. This may cause serious disruption to the global climate since
Utilization of Fly Ash to Sequester Carbon Dioxide


2011; Cama et al., 2005), as an effective technique in metal retention processes in contaminated soils (Brake et al., 2003; Dermatas and Meng, 2003) and, for the treatment of acid mine drainage (Pe’rez-Lo’pez, 2007). A recent study (Soong et al., 2006) proposed the use of coal combustion fly-ash and brine solutions (waste from oil and gas production) to sequester CO2 via aqueous mineral carbonation. For this study, CaO-rich fly-ashes were added to increase the pH level of the reactant brine (also containing Ca) in order to maximize the reaction efficiency of the carbonation process. This process was found to generate a high purity CaCO3 product. We think that the use of CaO-rich fly-ashes as reactant to sequester CO2 via aqueous mineral sequestration could be an attractive possibility for CO2 mitigation in puntual sources at industrial scale. The objective of integrated waste management is the search for sustainable development, i.e. to balance the fulfilment of human needs with the protection of the natural environment in the present and indefinite future. With this in mind, the main aim of this work is precisely to quantify the CO2 amount that may be sequestered by different types of fly-ash. This study is in our opinion especially attractive since the residual solid by products from power plants could be used to mitigate the residual gaseous wastes produced by the same plants.

II. MATERIALS AND METHODS

Fresh Flyash samples were collected from ten different from three different electrostatic precipitators located at the outlet of the chimney where combustion gases are liberated to the atmosphere. The chemical composition measured by X-ray fluorescence (XRF) of various fly-ash samples is illustrated in Table 1 below. Table 1 The chemical composition measured by X-ray fluorescence (XRF) of different fly-ash sample from various sources

<table>
<thead>
<tr>
<th>FLYASH SAMPLE</th>
<th>SiO2</th>
<th>Al2O3</th>
<th>Fe2O3</th>
<th>CaO</th>
<th>MgO</th>
<th>K2O</th>
<th>Na2O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source 1</td>
<td>46.7</td>
<td>31.78</td>
<td>1.65</td>
<td>4.62</td>
<td>0.21</td>
<td>0.23</td>
<td>0.62</td>
</tr>
<tr>
<td>Source 2</td>
<td>32.05</td>
<td>37.8</td>
<td>0.9</td>
<td>5.41</td>
<td>0</td>
<td>0.24</td>
<td>1.06</td>
</tr>
<tr>
<td>Source 3</td>
<td>59.06</td>
<td>34.1</td>
<td>0.5</td>
<td>6.1</td>
<td>0.4</td>
<td>0.35</td>
<td>0.2</td>
</tr>
<tr>
<td>Source 4</td>
<td>58.94</td>
<td>30.6</td>
<td>1.5</td>
<td>4.2</td>
<td>0.1</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Source 5</td>
<td>62.20</td>
<td>27.08</td>
<td>1.1</td>
<td>6.12</td>
<td>0.1</td>
<td>0.6</td>
<td>0.27</td>
</tr>
<tr>
<td>Source 6</td>
<td>60.14</td>
<td>26.63</td>
<td>1.13</td>
<td>4.18</td>
<td>0.08</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Source 7</td>
<td>60.94</td>
<td>30.92</td>
<td>1.72</td>
<td>3.33</td>
<td>0.05</td>
<td>0.1</td>
<td>0.61</td>
</tr>
<tr>
<td>Source 8</td>
<td>37.34</td>
<td>43.38</td>
<td>1.82</td>
<td>4.05</td>
<td>0.12</td>
<td>0.02</td>
<td>7.67</td>
</tr>
<tr>
<td>Source 9</td>
<td>39.66</td>
<td>30.12</td>
<td>1.81</td>
<td>5.62</td>
<td>0.04</td>
<td>0.8</td>
<td>0.56</td>
</tr>
<tr>
<td>Source 10</td>
<td>39.61</td>
<td>30.9</td>
<td>1.3</td>
<td>5.02</td>
<td>0.0</td>
<td>0.6</td>
<td>0.9</td>
</tr>
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</table>

The SO32- and Cl' percentage were averaged to 0.16% and 0.005% respectively for all the fly ash samples. CaCO3 value was considered as 0.52% assuming the average percentage present in fly ash.

2.2 CO2 Captured Capacity

CO2 capturing potential of different fly ash samples collected from various thermal power plants in India refers to the amount or fraction of CO2 capture achievable in the fly ash, based on the chemical composition of the waste (reactive oxides). There are large number of reactive oxide present in the alkaline waste material that actively takes part in CO2sequestration to form a stable carbonate product. The calculation was partly derived CO2 sequestration in mortar and concrete (Steinour, 1959).

%CO2Captured=0.785%CaO-0.549%S03--
0.439%CaCO3+ 0.710%Na2O +1.091%MgO +
0.468%K2O- 0.296%KCl In order to estimate CO2 capacity sequestration, consideration must be given to the flyash composition and the extent to which the oxides are available for reaction.

IIII. RESULTS AND DISCUSSION

In the following sub-section the calculation of the sequestrated quantity of CO2 by calcite precipitation, are
commented in the following section. The main purpose for this study was to demonstrate the feasibility to use coal combustion fly-ash to sequester CO2. The LOI (Loss of Ignition) for various fly ash samples collected from ten different sources has been tabulated below in Table 2. The LOI for various fly ash samples collected from ten different sources

<table>
<thead>
<tr>
<th>FLY ASH SAMPLE</th>
<th>LOI</th>
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<tbody>
<tr>
<td>Source 1</td>
<td>2.66</td>
</tr>
<tr>
<td>Source 2</td>
<td>3.01</td>
</tr>
<tr>
<td>Source 3</td>
<td>0.45</td>
</tr>
<tr>
<td>Source 4</td>
<td>0.2</td>
</tr>
<tr>
<td>Source 5</td>
<td>1.5</td>
</tr>
<tr>
<td>Source 6</td>
<td>1.81</td>
</tr>
<tr>
<td>Source 7</td>
<td>0.4</td>
</tr>
<tr>
<td>Source 8</td>
<td>3.4</td>
</tr>
<tr>
<td>Source 9</td>
<td>0.2</td>
</tr>
<tr>
<td>Source 10</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Inherent in this calculation is the assumption that the oxides in certain calcium and potassium phases are unlikely to react with CO2. The fraction of calcite in the unreacted material has a significant impact on calculated theoretical capacities. On the basis of the theoretical calculations Fig. 1 below gives the CO2 capacity of various flyash samples collected from different sources.

In conclusion, the results presented of this study reveal that the mineral sequestration of CO2 by carbonation of flyash could be an attractive method to reduce the CO2 emission in the atmosphere from power plants. This investigation demonstrated that 1 ton of fly-ash, an industrial waste that contains about 7.67 wt % of lime (CaO), could sequester up to 60.5kg of CO2 per ton of Fly Ash for Source 8. This capacity to sequester CO2 seems small compared with CO2 sequestration capacity in production of steel slag. However, the annual average production of fly-ash in Indian power station is millions of ton. This confirms the possibility to use this residue for CO2 mitigation in punctual sources.

IV. CONCLUSION

V. REFERENCES

Design and Challenges of Management Information Systems in Education - A Case Study

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Abstract—A large number of engineering colleges in Punjab have started to solve problems of strategic planning and control systems improvement by means of modern information-communication technologies only few years ago. Despite of use of computers and local area networks, there are a large amount of troubles and barriers basically of organizational and methodical character which are necessary to solve for successful MIS introduction. The purpose of the paper is to purpose a design of MIS for colleges and scrutinize various challenges to it. The study used the qualitative survey methodology. Data were collected from a sample of 100 subjects from various colleges in Punjab. Data collected were analyzed and challenges were scanned.

Keywords: Management Information System (MIS), engineering colleges, decision making, challenges

I. INTRODUCTION

Today there are a significant number of private universities & colleges in various states of India and the numbers are growing very rapidly day by day. Punjab is also one among organization. The success of decision-making, which is the heart of administrative process, is highly dependent partly on available information, and partly on the functions that are the components of the process. Modern, computerized systems continuously gather relevant data, both from inside and outside the organization. This data is then processed, integrated, and stored in a centralized database (or data warehouse) where it is constantly updated and made them.

Punjab is a progressive State of India with an average growth rate of 10% and has evolved into a land of boundless opportunities for investment, industry, education and employment. Punjab is ranked seventh in terms of education amongst the States. Being an agricultural state, a large part approximately 66% of the population lives in the rural area while the rest 34% is urban resident. As per all India Education Index, Punjab has been adjudged at No 6 place and as per infrastructure index; the State is at No 1 position. Private sector accounts for approx. 90% of the technical institutes in the State. There is a strong higher educational network with 136 Government aided and 188 private colleges out of which there are approximately 80 engineering colleges. With growing pace of industrialization in Punjab, the main stress has been on expansion, modernization and reorientation of professional and technical education system so as to ensure quality. But most of the educational institutes are lacking in effective utilization of resources leading to inefficiency in management system which leads to the requirement of effective implementation of management information system.

Management Information System has become a must and should for every organization.

Why MIS is required in Educational Sector?

1. For effective utilization of resources leading to efficiency in management system
2. To obtain accurate and timely information for planning, budgeting and decision making
3. To properly organize such information
4. To standardize the system of obtaining reports and statistical information from the various sources

It is interesting to know that Management Information System can exist without computers but it is the power of the computer which makes it more feasible. Computer based user-machine features of an MIS affect the knowledge requirements of both System Developer and System User.

II. LITERATURE REVIEW

According to Aminu (1986) [2], information resource is one of the major issues and indices of education planning. Where the relevant information required for planning are not available at the appropriate time, there is bound to be poor planning, inappropriate decision making, poor priority of needs, defective programming or scheduling of activities. Hence, the education system will not be efficient and effective in its operation.

The more complex an organization’s structure is, the greater the need for coordination within and between sections and
departments. However, central to the needed coordination is information. This view is expressed by Murdick and Ross (1971) [5], when they concluded that: Information is absolutely essential to the survival of an organization. As organisations grow, the higher demands of scale and complexities require large information processing. Thus, the information needed for effective decision making in colleges cannot be provided from people’s often-deficient memories.

It is significant to note that the existence of alternatives, based on relevant information, is a necessary condition for making a decision. This analysis was supported by Ogunsaju (1990) [7], when he pointed out that education decision must be based upon sound and well informed evidence that are highly intelligent, rather than those that are weak and baseless. For effective decisions to evolve in any organization, therefore, receiving information from, and supplying information to, people within the system are a necessity. The information so communicated must be accurate and up-to-date to cope with uncertainty. Uncertainty is the condition in which the manager has little information relevant to a decision and there is no way to predict the outcome of the decision.

Fabunmi (2003) [3] stated that MIS is useful in making decisions to solve many of the problems facing educational institutions. Such problems include poor programme scheduling, poor estimate of staff requirements, lack of accurate information on students, personnel and facilities, piling-up of administrative matters, wastage of spaces, lack of feasible budget estimates among others.

According to Knight (2005) [4], there are mechanisms that drive continuous investment in bricks and mortar education, and deny the expenditures that would establish virtual universities by means of telecommunication networks. Even if they wanted to, administrators are restricted in their freedom to move in this direction by traditional funding formulae. Promotion and tenure procedures are seen as barriers in the universities. In many institutions, the primary requirements for promotion and for tenure procedures are publications in traditional journals and teaching in traditional classrooms.

According to Obi (2003) [6], MIS is useful in the area of decision making as it can monitor by itself disturbances in a system, determine a course of action and take action to get the system in control. It is also relevant in nonprogrammed decisions as it provides support by supplying information for the search, the analysis, the evaluation and the choice and implementation process of decision making.

Adesina (1988) [1] upheld the important role of information in decision-making by elucidating that the amount of information available to a decision-making group affects the product of that group. Sisodia (1992) [8] advanced the notion of decision-making as a total process involving discernible and separate activities. The first of such activities is information gathering, which is followed by evaluation of alternatives and finally a choice. The first task of the manager is to design and manage the flow of information in an organization, in ways that would improve productivity and decision-making. Information must be collected, stored, and synthesized in such a way that it will answer important operating and strategic questions.

According to UNESCO survey report [10], over forty World Bank education projects over the last four years have had components related to the development of education management information systems (EMIS), but little is known about best practices and lessons learned from such investments. While EMIS are perhaps the least glamorous types of ICT-related investments in education, they appear to be the most often deployed used of ICTs in large donor-funded education sector. The sheer number and magnitude of such investments, combined with a lack of rigorous studies on their implementation and effectiveness, points to a potential for waste and inefficiencies. Anecdotal evidence suggests that EMIS in World Bank projects, as well as those supported by other donors, are often behind schedule and/or have to be significantly re-worked. Given the seeming ubiquity of their use in donor-funded projects and the absence of useful planning materials, case studies on EMIS planning and deployment, as well as best practices and lessons learned, would be useful planning tools for donor staff and educational policymakers. Just as a liquid changes shape to fit the receptacle into which it’s poured, so too should an EMIS fit the particular environment into which it is introduced. This is especially the case in countries struggling to meet EFA and education-related Millennium Development Goals (MDGs) by 2015, which typically have great needs related to data collection, analysis and dissemination, but limited experience with and capacity for the effective use of EMIS.

The effective use of EMIS can be confounded by a variety of social and cultural factors. Some governments complain that EMIS are imposed by donors more as control mechanisms than as tools for learning and effective planning. Local governmental authorities may have similar complaints about their participation in EMIS managed by a central governmental authority, especially where there is no history of (and trust for) sharing information and receiving anything useful in return. Management information systems in the education sector are often designed by technical people, ignorant of prevailing educational policies and with insufficient input from education specialists, as stand-alone systems, not integrated with information systems in other parts of government. It should be noted that integration with other systems and planning mechanisms may be increasingly
Design and Challenges of Management Information Systems in Education - A Case Study

An investigation needs to be conducted into the types of decisions that college management has to make. For example, staff seeks solutions to their problems from their seniors. In turn, senior staff needs to be in a position to resolve these problems and to document how problems were solved for future reference.

**Step Two: Decide the Levels of Information Groups, Information Frequency, and Content**

The number of information groups within a particular college has to be decided because each group requires a different type of information. Data processing consists of identifying each item of data and systematically placing it within a scheme that categorizes data items on the basis of some common characteristic or feature. Information retrieval refers to the ability to take different types of data in the storage media. A properly designed storage and retrieval system matches the related variables efficiently and accurately. In some cases, it even suggests alternative courses of action for management to take.

Presentation of information should be in a form and format suitable to the needs of management and employees. Generally, information is presented in reports, statistical summaries, analyses, and so forth in the form of text, figures, charts, tables, and graphs. The presentation of information should be precise, clear, and appealing.

**Step Three: Ensure System Flexibility and Compliance**

Flexibility means the ability to retrieve information from a system in whatever form it may be needed by decision makers. Therefore, data need to be collected in some detail so that they can be rearranged or summarized according to the needs of managers. But system design should not be too complex because it must first serve the needs of all levels of management that are likely to be instrumental in collecting important components of the original data. Therefore, considerable care must be taken in assessing what types of information are required by management at the different levels. At the same time, effort must be made to ensure that the information collected meets acceptable standards of accuracy, timeliness, and coverage for each level.

**Step Four: System alternatives and evaluation: Centralization versus decentralization**

A completely centralized information system handles all processing at a single computer site, maintains a single central database, has centralized development of applications, provides central technical services, sets development priorities centrally, and allocates computer resources centrally. The system's remote users are served by transporting input and output data physically or electronically.

A completely decentralized system may have no central control of system development, no communication links among autonomous computing units, and stand-alone processors and databases at various sites. Each unit funds its own information-processing activities and is totally responsible for all development and operation.

An advantage of centralized information systems is that they provide for standardization in the collection of data and the release of information. There also are some *economies of scale*. A centralized system reduces the need for multiple hardware, software, space, personnel, and databases. It may be possible to recruit more qualified personnel in a central facility.

Observations indicate that user motivation and satisfaction are increased under a decentralized environment. This is attained because users feel more involved and more responsible, systems are better customized to their specific needs, and they usually get better response time in routine operations as well as in requests for changes.

It is likely that for an educational organization, neither a completely centralized nor a completely decentralized system is desirable. While it may be useful to decentralize hardware and software resources at different locations, the development of applications and provision of technical services may better be centralized.

**Step Five: End-user computing**

The extensive use of personal computers and computer-based workstations has brought with it the age of end-user computing. End-user computing is a standard term for any information-processing activity performed by direct end users who actually use terminals or microcomputers to access data and programs. The manager as end user may be provided with powerful software (like DBMS) for accessing data, developing models, and performing information processing directly. This has brought computing directly under the control of the end users and eliminates their dependence on the information systems specialist and
the rigidities of pre designed procedures. They may now make ad hoc queries of information and analyze it in various ways. They may write programmers, or may often use ready-made programmers stored in the computer, using the computing power of a local PC or the mainframe to which it is connected.

IV. METHODOLOGY

The study populations used involve 100 teaching and non-teaching staff of various engineering colleges of Punjab. The respondents were asked to cite the biggest challenge, which they think is there to the implementation of Management Information Systems in colleges. Their responses have been concluded in tabular form as shown:

<table>
<thead>
<tr>
<th>CHALLENGES FOR MIS</th>
<th>% Of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not know</td>
<td>24%</td>
</tr>
<tr>
<td>Making IT Accessible to all</td>
<td>22%</td>
</tr>
<tr>
<td>Poor Maintenance and Update Culture</td>
<td>18%</td>
</tr>
<tr>
<td>Getting Used to MIS</td>
<td>14%</td>
</tr>
<tr>
<td>Non allocation of sufficient</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 4: Challenges for MIS

Making IT accessible and poor maintenance and update culture are basic challenges to our educational system. In addition, automation of information resources and services pose new problems. These consist of the acquirement and selection of online information resources, the construction of databases, providing information literacy education for MIS users, and the new skills required by employees. However, if the college guarantees sound and quality automation of services and information resources, creates new advancement to user education, pays attention and helps the employees to master the new techniques obligatory for the management of electronic and the networked information resources and services, the achievements of management information systems are immense.

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Role of Information Technology in Human Resource Management

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Abstract—With the growing possibilities of providing services to employees through Internet and Intranet, Human Resource professionals just need to click once or twice and a need for e-HRM has become imperative to meet the HR challenges of 21st century. E-human Resource Management in administrative HR activities. So in IT based today economy the India is in its preliminary stages. There are lots of hurdles that Employees are no longer held responsible for the operational and are to be met with. The purpose of this paper is to explore the role information technology in determining the competency requirements of HR professionals.

Keywords: E-Human resource management (e-HRM), E-Human resource (e-HR), Employee Self Service (ESS), human resource information systems (HRIS), Human resource management

I. INTRODUCTION

“Technological optimistic voices want us to believe that, from a technical perspective, the IT possibilities for HRM are endless: in principal all HR processes can be supported by IT. E-HRM is the relatively new term for this IT supported HRM, especially through the use of web technology” (Ruel et al.; 2004) [12]. For many functions, HR alteration is currently one of their critical deliverables. As with all change, there are huge possibilities and exciting opportunities that lie at the end of the execution journey. However, the obstacles stand in the way of effective implementation are considerable, and many HR functions lose their way or find that they have failed to deliver the outcomes that were initially predictable. One of the key themes is that the advances around e-HR provide organisations with great opportunities to rethink the way HR management is undertaken in organisations and yet technology driven change is often disconnected from other changes that are needed around capabilities, culture and formation. To transform HR effectively, change needs to be integrated. There needs to be an investment in e-HR, absolutely, but technology is not the end in itself. Technology is only a tool, an enabler, which supports more effective ways of working and of managing the human capital constituent of business organisations. Before any technology can be effectively deployed, the fundamental approaches to people management must be transformed. In most cases, this involves transforming the way HR management is done in organisations and the repositioning of the HR function: its ways of working as well as the ways in which the HR function interacts with the wider organisation and external providers. Like all professions, Human Resource Management (HRM) has been increasingly affected by the ongoing emergence of new technologies. For instance, the first introduction of the “Human Resource Information System” (HRIS) some two decades ago has brought about greater efficiency and automation for people management. With the great leap forward of web technologies during the past few years, we have witnessed the birth of Electronic Human Resource Management (e-HRM) which, as indicated by experts, is a much more powerful enabler in transforming the role of Human Resource (HR) from an administrator to the more value – adding role of a business partner. But of course, the availability of an enabler doesn’t guarantee the successful transformation.

II. MEANING OF E-HRM

People mean different things by the term “e-HRM”. It is a web-based solution that takes advantage of the latest web application technology to deliver an online real-time Human Resource Management Solution. It is comprehensive but easy to use, feature-rich yet flexible enough to be tailored to your specific needs. It also refers to the processing and transmission of digitized information used in HRM, including text, sound, and visual images, from one computer or electronic device to another. It will be able to meet the demands of today's Human Resource Management. Typically, the term e-HR is used to describe technology’s role in enabling the transformation of solely HR activity. Instead of a centralized personnel team handling everyday tasks such as approving pay rises, sorting out training and checking holiday entitlements, these can be handled by the employees themselves or their line manager. Crucially, the adoption of e-HR seeks to minimize or eliminate...
intervention from HR staff, allowing managers and employees to perform HR tasks directly with the self service tools. These can contrast with the shared service center environment, where the service would normally be expected to be delivered by a customer service operative or other category of HR staff.

HR information systems (HRIS) are excluded since there is a fundamental difference between HRIS and e-HR in that basically HRIS are directed towards the HR department itself. Users of these systems are mainly HR staff. These types of systems aim to improve the processes within the HR department itself, in order to improve the service towards the business. With e-HR, the target group is not the HR staff but people outside this department: the employees and management. HRM services are being offered through an internet for use by employees. The difference between HRIS and e-HR can be identified as the switch from the automation of HR services towards technological support of information on HR services. Technically speaking it can be said that e-HR is the technical unlocking of HRIS for all employees of an organisation.

III. E-HRM TYPES

Lepak and Snell (1998) [10] make division of e-HRM as followings; Operational e-HRM:- The first area, operational e-HRM, concerns the basic HR activities in the administrative area. Relational e-HRM:- The second area, relational e-HRM, concerns more advanced HRM activities. The emphasis here is not on administering, but on HR tools that support basic business processes such as recruiting and the selection of new personnel, training, performance management and rewards.

Transformational e-HRM:- Transformational e-HRM, the third area, concerns HRM activities with a strategic character. Here we are talking about activities regarding organizational change processes, strategic re-orientation, strategic competence management, and strategic knowledge management.

IV. BENEFITS OF E-HRM

The main benefits of e-HRM are an increase of quality and pace, because the existing administrative processes were slow and bungling conditional upon mainly paper-based processes.

Standardization: By standardizing the system used within the group and by providing employees with direct access to records, particularly leave records, the company can achieve a significant reduction in employee queries and reduce the need for HR to undertake data entry of employee records.

Ease of recruitment, selection and assessment: e-Recruitment can be one of HR’s nightmares. With e-recruitment the company gets an additional possibility besides the normal application by paper to recruit people over the web in an online-application process. Although this, and like processes, will always need significant human intervention. E-HR systems can streamline the process and reduce errors.

Ease of administering employee records: Whether be it leaves, benefits, personal details, accident and discipline reports, etc., it is generally accepted that once everyone can overcome the initial it phobia, HR and employees will experience fewer headaches and efficiency will rapidly increase.

Reductions to cost, time and labour: Reduced duplication, reduced time spent fixing errors, reduced labour costs through ESS, reduced or no hard-copy entry. Not only manpower can be saved, the processing time can also be shortened. With this e-HRM reaches the prime objective of cost effectiveness.

Access to ESS training enrolment and self development: e-Training can enable employees to search for and enroll in training programs on-line and validating course availability. This can streamline the training administration process enabling employees to access computer based training. Cost and pace can be individualized as well. Cost and ESS: ESS reduced the workload of HR department by more than 50%, for instance in the traditional method the employee has to type in a formal leave application get approved from his/her direct boss who will send it to the HR department for further approval which would consume lot of time to be processed. On the other hand, with eleave, the employee needs only to log in and make his/her leave application and his/her boss will be alerted to approve. Upon approval the leave balance is automatically updated and this is just one aspect.

Location and timeliness: With ESS, the employee could log in online anywhere and anytime without being in the office and without the leave card could be sitting at the boss’ table for a few days, lost or buried.

V. REVIEW OF LITERATURE

As stated by Mark Doughty and Simon Pugh [2000][14] today, within the HR software market there are a myriad of HR systems, payroll, training administration, 360 degree feedback, psychological testing and competency software tools-typically operating in their own software fiefdoms. Evidence suggests that most organisations fail to recognize that nearly all HR software on the market today is at the foundation level of e-HR. “very few organisations have reached the strategic level of e-HR.” This involves the development and deployment of tasks that allow managers,
employees and HR to use the massive amount of data created and housed within the foundation and service levels of emerging internet technology.

Perhaps it could be argued that instead of wasting money on lots of paper, HR is now wasting money on non-strategic databases. More importantly, the buyers of this software (i.e. HR) fail to realize that most HR software solutions available today are based on client server (old) technology. Peoplesoft (v8.1) the world’s number one HR software has only recently moved to a web platform, yet it could be argued that this latest offering is little more than what was available in its client server application. HR as a profession is still struggling to make the impact and earn the respect it deserves, yet HR and organisations are being duped into spending money for something which is fundamentally flawed. However, it does not have to be this way. People can and do make the difference. The human resource management function has changed dramatically over time evolving. Alfred J Walker [2001] [1] states that if HR technology is to be considered successful, it must change the work performed by the Human Resources personnel by dramatically improving their level of service, allowing more time for work of higher value, and reducing their costs. Many systems have been implemented by cutting HR staff, outsourcing and imposing technology on what was left. But Walker argues that survey results demonstrate that overall HR departments have actually upward their staffing levels over the past decade to do the same work. Walker advocates the business process re-engineering the HR function first, then e-engineering the HR work. He suggests the formation of re-engineering teams of providers, customers and users to examine the whole range of HR activities including those which are not being done at present. The end product is a set of processes organized into broad groupings such as re-sourcing, compensation or training and development. These processes should then be examined by the re-engineering team and re-designed. From this redesign comes the picture of a new HR function but Walker argues that the most effective approach is to introduce new technology to deal with the redesigned processes.

According to Biswanath Ghosh [2002] [3], in an organisation the most valuable input is the human element. The success or failure of an organisation depends to a large extent on the persons who manage and run the organisation. In business the greatest asset is the human resource of the enterprise and not the plant, equipment or the big buildings it owns. There was a time when manpower was considered as a cost factor but not it is recognized as an investment. The e-HRM can range from basic personnel records to sophisticated networks of sub-systems with definite purposes. Today most of these will be computer systems. The manpower information system can provide necessary information in a form which can be integrated with any other business data. With most data base systems, there are facilities to pull out any of the data and present them in the required form.

The Institute for Employment Studies at U.K. [2002][9] quotes e-HR as “the application of conventional, web and voice technologies to improve HR administration,

The debate is not around whether the non-transactional activities can be e-enabled or not-clearly it can be done, and as technologies such as neuro-networks improve, it will enable more “human” activities to be done via electronic, internet or mobile technologies. The debate for HR is whether the human interaction role currently played by HR staff adds any value to the employee, the organisation or the work environment, which could not be done by technology. The bottom line is that services such as employee counseling and legal issues, which are definite outsourcing opportunities for organisations, and are likely to remain mainly human-intensive activities, are not currently suitable to be e-enabled. It would be a sad day to see a colleague sending an e-mail request to the ‘performance management computer’ system for a review on a proposed demotion.

VI. E-HRM OUTCOMES

Beer et al. [2] distinguish four possibilities:

a) High commitment,
b) High competence,
c) Cost effectiveness, and
d) Higher congruence.

These outcomes, in turn, may change the state of HRM in an organization, or through individuals and/or groups within an organization actually result in a new HRM state. This closes the circle. With the addition of the E-HRM outcomes, the building blocks which are needed to finalize our E-HRM model have been identified.

Literature suggests that the various goals of E-HRM and the different types of E-HRM are expected to result in outcomes including more efficient HRM processes, a higher level of service delivery and a better strategic contribution. Such expected outcomes can be “encapsulated” in one concept, which could be counted as HRM effectiveness. E-HRM, as the matter of fact, is expected to contribute to the effectiveness of HRM, which consequently could help achieve the organization’s goals.

Critical Success Factors for e-HRM

1) User Involvement

User involvement in the early stages of the implementation and development phases of the e-HRM system allows users to make adjustments to the system to satisfy their needs.
Consequently organizational resistance to the new changes implied by the use of the e-HRM application is minimized and customer satisfaction is increased.

2) Reengineering of Business Process

When a company implements a new e-HRM system, some of the HR processes must be reengineered in order for the e-HRM system to be more effective i.e., the inevitable alignment of processes and activities with the new systems requirements (Remus, 2007) [11]. Such reengineering mechanism is applied when transforming HR manual processes to paperless forms.

3) Planning and Vision

For e-HRM implementation to be successful, a plan must be agreed upon by the project manager or the responsible parties to follow during the project life cycle. The plan will guarantee the alignment of the e-HRM goals and strategy with the HR and corporate strategies to ensure maximum effectiveness, integration and alignment.

4) Education and Training

Since the e-HRM system offers new methods of processing transformed or new HR activities, proper training must be given to all users of the system. This becomes crucial since the new interface provides functionality that has been never used before and needs to be related to the newly reengineered business processes (Remus, 2007) [11].

5) Change Management

Managing change within the organization could be a full time job by itself as it requires the management of people and their expectations, resistance to change confusion redundancies and errors (Remus, 2007) [11]. For the e-HRM to be successfully implemented, the organization should realize the impact of this new change on employees, managers, and HR staff and understand its dimensions in order to manage the effects with a corporate strategy that is open to change.

6) Top Management Support

In order for e-HRM implementation to be successful, top managers have to approve and continuously support the responsible parties during the implementation stage to make sure no obstacles prevent or delay the progress.

7) Project Management

A company must assign a project manager to lead the project of developing and implementing an e-HRM system professionally according to profound business rules. The project itself must have clearly defined business and technical objectives and goals corresponding to the project deliverables (Remus, 2007) [11].

VII. CONCLUSION

IT has the potential to augment customer service, productivity, speed reaction time, improve decision-making and lower managerial costs all together. The need for cost reduction, higher quality services, and cultural change are three main forces that drive firms to seek IT-driven HR solutions. The rapid development of the Internet during the last decade has boosted the realization and appliance of electronic human resource management (e-HRM).

As technology frees up HR from some of its routine tasks, there is a greater opportunity for HR professionals to become a strategic partner (Ulrich, 1997) [7]. This means moving beyond administrative expertise and becoming an expert in areas such as strategic business partnership, change management, and employee advocacy (Ulrich, 1997) [7].

VIII. REFERENCES

BOOKS REVIEW

JOURNAL REVIEW

E-REVIEW
Abstract- Usenet is the name of a worldwide network of servers for group communication between people from 1979 and onwards, it has seen a fast growth in the amount of data. Break and its effect. Usenet volume has been growing exponentially for down some biases and encourage the reader to consider alternatives which might otherwise have been ignored. Longer be satisfied by a single disk. We wanted to find a solution that could easily scale to meet future growth while requiring many years; this growth places ever increasing demands on the net news server, particularly disk space and file system performance – for the article spool area. Keeping up with transported, which has been a break on bandwidth and storage.

I. INTRODUCTION

Usenet is the name of a world wide network of servers for group communication between people. Since Usenet was created in 1979, it has seen a notable growth from a small academic community to a network used by millions of people from a wide variety of backgrounds all over the world. The total size of the data flowing through Usenet has been more than tripling every year between 1993 and 2001. This growth has not been without problems, and has raised significant challenges in how to handle the ever increasing volume of Usenet data flow. Very few are able to handle all of Usenet, and as the amount of users and data they produce increase, as do the challenges with having enough network bandwidth and storage capacity. Spending large sums of money on hardware components relieves the situation, but it does not solve it. This paper is to find a way to describe the problems that see today. I have introduced the idea of advanced caching methods as a common enhancement for parts of the Usenet distribution network that has been done to relieve network bandwidth and storage capacity.

Advanced caching will be an improvement for those news servers with users that do not read every available news article, which goes for most if not all news servers with users. However, caching does not solve the problem of exponential growth. When the available technology no longer can support enough network bandwidth and storage capacity, this will limit itself.

In this paper, firstly provide an introduction to Usenet, followed by Usenet’s brief history from the viewpoint of growth, as well as suggestions for dealing with the volume of Usenet data traffic.

The development of Usenet technology has been a community effort rather than an academic one, and many of the conventions and standards have been informal at first. There attempted to word the paper for an audience that is not familiar with Usenet, its historical background, how it used to work, or how it works today. It is an advantage to have some familiarity with the Internet, the WWW, e-mail and networks. Definitions that are introduced are marked clearly, while Usenet specific terminology is explained as it is used with the terms emphasized.

II. THE FOUNDATION OF USENET

The birth of Usenet is associated to a single event: An operating system upgrade rendered existing bulletin board software non-functional, which caused two graduate students at Duke University in North Carolina, Tom Truscott and Jim Ellis, to develop the idea of a distributed news system. This was in the fall of 1979 [Hauben and Hauben, 1995].

At first, Usenet was a substitute for a broken bulletin board system, a testing with UUCP, based on a 3-page Unix shell script. The script allowed people to subscribe to different groups, post and read notes in sequence, and also post to different groups at the same time (cross posting) [Hauben and Hauben, 1995].

Steve Bellovin, one of the people who Truscott and Ellis presented their design to, wrote the shell script using Unix V7 to test the design concept. The first Usenet was a two-server setup, but it evolved quickly.

Bellovin notes: “We estimated a maximum size of 100 sites, and 1-2 articles a day, net-wide...you couldn’t read things out of order. The goal there was to have software free of databases. Instead, we chose to let the file system do the work.” [Hauben and Hauben, 1995]
III. BIG CHANGES

At the beginning of 1980 the network consisted of those two sites and phs (another machine at Duke), and was described at the January Usenix conference. Steve Bellovin later rewrote the scripts into C programs. Shortly thereafter, Steve Daniel did another implementation in C for public distribution. Tom Truscott made further modifications, and this became the "A" news release. In 1981 at U. C. Berkeley, grad student Mark Horton and high school student Matt Glickman rewrote the news software to add functionality and to cope with the ever increasing volume of news – "A" News was intended for only a few articles per group per day. This rewrite was the "B" News version. The first public release was version 2.1 in 1982. The last version maintained and released primarily by Mark was 2.10.1. Rick Adams, at the Center for Seismic Studies, took over coordination of the maintenance and enhancement of the B News software with the 2.10.2 release in 1984. By this time, the increasing volume of news was becoming a concern, and the mechanism for moderated groups was added to the software at 2.10.2. Moderated groups were inspired by ARPA mailing lists and experience with other bulletin board systems. In late 1986, version 2.11 of B News was released, including a number of changes to support a new naming structure for newsgroups, enhanced batching and compression, enhanced the control messages, and other features. The final release of B News was 2.11, patch level 19. B News has been declared "dead" by a number of people, including Rick Adams, and is unlikely to be upgraded further; most Usenet sites are using C News or INN. In March 1986 a package was released implementing news transmission, posting, and reading using the Network News Transfer Protocol.

After “The Great Renaming”, Usenet consisted of the top level comp, misc, news, rec, sci, soc and talk hierarchies. These are most commonly referred to as the “Big 8”. Today, “Usenet”, “News” or both refer to a seemingly arbitrary selection of the many available hierarchies in the world, not just the “Big 8”.

IV. TRAFFIC GROWTH IN A HISTORICAL PERSPECTIVE

Usenet traffic — meaning the number and size of the daily accepted flow of articles for a site that attempts to get “all” that is posted to Usenet—has never increased slowly, at least not volume measured in bytes. According to Hardy ([Hardy, 1993], citing Gene Spafford), the rate of growth was fairly constant from 1979 to 1988 in [Spafford, 1990]) and 1997 to 2010 from the site. About 1993, the use of services available by the Internet (such as Usenet) began increasing dramatically with the introduction of the World Wide Web (WWW), and the following success stories of the commercial ISPs.

<table>
<thead>
<tr>
<th>Year</th>
<th>Size/Day (Growth)</th>
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<td>1979</td>
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<td>1997:</td>
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<td>2000:</td>
<td>4 MB</td>
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<tr>
<td>2002:</td>
<td>2 GB/day</td>
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<tr>
<td>2004:</td>
<td>150 GB/day</td>
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<tr>
<td>2005:</td>
<td>300 GB/day</td>
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<tr>
<td>2006:</td>
<td>1000 GB/day</td>
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<td>2007:</td>
<td>1800 GB/day</td>
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<tr>
<td>2008:</td>
<td>2500 GB/day</td>
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<td>2009:</td>
<td>3000 GB/day</td>
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<td>2010:</td>
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<td>5000 GB/day</td>
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<td>6000 GB/day</td>
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Table 1.1: Usenet growth 1979 to 2010

2010: News-Service.com becomes Megabit-supporter of the digital civil rights organization Bits of Freedom.

2009: News-Service.com takes the 1 position as largest Usenet distributor worldwide. News-Service.com expands network with 10GE to Frankfurt, Germany. News-Service.com moves office to new location at Amsterdam-Zuidoost. A full newsfeed has now become over 5 Terabyte per day.

2007: News-Service.com announces binary retention upgrade to 85+ days. News-Service.com #4 in top1000.org. Full newsfeed has now become over 300 Mbit/s and over 3 Terabyte per day.

Birth of Usenet: From at that time to now, we have seen a change from a mostly academic environment to a common public service, available to millions of users across the world. Usage has also changed from being mostly text with a few pictures and sound clips, to many more pictures and even movies. The increasing use of Usenet to send binary data such as pictures and sounds, and in the present, animations and video, will push these requirements significantly higher in the near future. As a result of these changes and the increase in users, full news feed can contain around 100 000 newsgroups.

Hardy writes in The Usenet System [Hardy, 1993] that “Usenet has continued to grow exponentially since its creation in 1979 by two graduate students at Duke University, with traffic volume increasing recently by as much as 10-15% per month. A full newsfeed at a typical site might average more than 30 megabytes per day (about 10 times the size of the King James Bible, of 100 paperback novels, or [10 200 A4 pages].) “.

![Usenet Feed (TB/day)](image)

Figure 1.1 Usenet traffic growth.

VIII. REFERENCES

ABSTRACT: The study of emerging technologies is one of the newest areas of research. Methods and strategies commonly used in research are also used in studying implementations of emerging technologies. In the history of technology, emerging technologies are contemporary advances and innovation in various fields of technology. Various converging technologies have emerged in the technological convergence of different systems evolving towards similar goals. Convergence can refer to previously separate technologies such as voice (and telephony features), data (and productivity applications) and video that now share resources and interact with each other, creating new efficiencies. Emerging technologies are those technical innovations which represent progressive developments within a field for advantage. The current proliferation of effectiveness measures points to a set of methodological problems found often in emerging technologies research: lack of Technological Innovation System, lack of Acquiring New Technologies and Capabilities, lack of funding, Organizations Match New Technologies With Needs and Security and the Computing Infrastructure, technological framework. However, the opinion on the degree of impact, status, and economic viability of several emerging and converging technologies vary.

I. INTRODUCTION

Over centuries, innovative methods and new technologies are developed and opened up. Some of these technologies due to theoretical research, others due to commercial research and development. Technological growth includes incremental developments and disruptive technologies. An example of the former was the gradual roll-out of DVD as a development intended to follow on from the previous optical technology Compact Disc. By contrast, disruptive technologies are those where a new method replaces the previous technology and make it redundant, for example the replacement of horse drawn carriages by automobiles. Emerging technologies in general denote significant technological developments that broach new territory in some significant way in their field. Examples of currently emerging technologies include information technology, nanotechnology, biotechnology, cognitive science, robotics, and artificial intelligence.

Technologies that they consider critical to humanity's future. Technology could be used by elites for good or evil. Some of these technologies could pose dangers, perhaps even contribute to the extinction of humanity itself; i.e., some of them could involve risks. Some analysts argue that as information technology advances, robots and other forms of automation will ultimately result in significant unemployment as machines and software begin to match and exceed the capability of workers to perform most routine jobs. As robotics and artificial intelligence develop further, even many skilled jobs may be threatened. Technologies such as machine learning may ultimately allow computers to do many knowledge-based jobs that require significant education. This may result in substantial unemployment at all skill levels, stagnant or falling wages for most workers, and increased concentration of income and wealth as the owners of capital capture an ever larger fraction of the economy. This in turn could lead to depressed consumer spending and economic growth as the bulk of the population lacks sufficient discretionary income to purchase the products and services produced by the economy.

II. TECHNOLOGY INNOVATION SYSTEM

The Technological Innovation System is a concept developed within the scientific field of innovation studies which serves to explain the nature and rate of technological change. A Technological Innovation System can be defined as 'a dynamic network of agents interacting in a specific economic/industrial area under a particular institutional infrastructure and involved in the generation, diffusion, and utilization of technology' The approach may be applied to at least three levels of analysis: to a technology in the sense of a knowledge field, to a product or an artifact, or to a set of related products and artifacts aimed at satisfying a particular [societal] function. With respect to the latter, the approach has especially proven itself in explaining why and how
sustainable (energy) technologies have developed and diffused into a society, or have failed to do so. The concept of a Technological Innovation System was introduced as part of a wider theoretical school, called the innovation system approach. The central idea behind this approach is that determinants of technological change are not (only) to be found in individual firms or in research institutes, but (also) in a broad societal structure in which firms, as well as knowledge institutes, are embedded. Since the 1980s, innovation system studies have pointed out the influence of societal structures on technological change, and indirectly on long-term economic growth, within nations, sectors or technological fields.

The purpose of analysing a Technological Innovation System is to analyse and evaluate the development of a particular technological field in terms of the structures and processes that support or hamper it. Besides its particular focus, there are two, more analytical, features that set the Technological Innovation System approach apart from other innovation system approaches.

Firstly, the Technological Innovation System concept emphasises that stimulating knowledge flows is not sufficient to induce technological change and economic performance. There is a need to exploit this knowledge in order to create new business opportunities. This stresses the importance of individuals as sources of innovation, something which is sometimes overseen in the, more macro-oriented, nationally or sectorally oriented innovation system approaches.

Secondly, the Technological Innovation System approach often focuses on system dynamics. The focus on entrepreneurial action has encouraged scholars to consider a Technological Innovation System as something to be built up over time. This was already put forward by Carlsson and Stankiewicz:

Technological Innovation Systems are defined in terms of knowledge/competence flows rather than flows of ordinary goods and services. They consist of dynamic knowledge and competence networks. In the presence of an entrepreneur and sufficient critical mass, such networks can be transformed into development blocks, i.e. synergistic clusters of firms and technologies within an industry or a group of industries. This means that a Technological Innovation System may be analysed in terms of its system components and/or in terms of its dynamics. Both perspectives will be explained below.

The structural factors are merely the elements that make up the system. In an actual system, these factors are all linked to each other. If they form dense configurations they are called networks. An example would be a coalition of firms jointly working on the application of a fuel cell, guided by a set of problem-solving routines and supported by a subsidy programme. Likewise, industry associations, research communities, policy networks, user-supplier relations etc. are all examples of networks.

An analysis of structures typically yields insight into systemic features - complementarities and conflicts - that constitute drivers and barriers for technology diffusion at a certain moment or within a given period in time.

III. ACQUIRING NEW TECHNOLOGIES AND CAPABILITIES

To improve competitiveness and retain sustainability, firms require new technologies and capabilities. In this age of rapid innovation and complexity, it is challenging for the firms to develop internally and remain competitive at the same time. Merger, acquisition and alliance are some of the ways to achieve this, but the primary driver is the desire to obtain valuable resources. Many acquisitions failed to achieve their objectives and resulted in poor performance because of improper implementation.

1. Improper documentation and changing implicit knowledge makes it difficult to share information during acquisition.

2. For acquired firm symbolic and cultural independence which is the base of technology and capabilities are more important than administrative independence.

3. Detailed knowledge exchange and integrations are difficult when the acquired firm is large and high performing.

4. Management of executives from acquired firm is critical in terms of promotions and pay incentives to utilize their talent and value their expertise.

5. Transfer of technologies and capabilities are most difficult task to manage because of complications of acquisition implementation. The risk of losing implicit knowledge is always associated with the fast pace acquisition.

Preservation of tacit knowledge, employees and literature are always delicate during and after acquisition. Strategic management of all these resources is a very important factor for a successful acquisition. Increase in acquisitions in our global business environment has pushed us to evaluate the key stake holders of acquisition very carefully before implementation. It is imperative for the acquirer to understand this relationship and apply it to its advantage.
Retention is only possible when resources are exchanged and managed without affecting their independence.

**IV. TECHNOLOGY AND SOCIETY**

Technology and society or technology and culture refers to cyclical co-dependence, co-influence, co-production of technology and society upon the other (technology upon culture, and vice-versa). This synergistic relationship occurred from the dawn of humankind, with the invention of simple tools and continues into modern technologies such as the printing press and computers. The academic discipline studying the impacts of science, technology, and society and vice versa is called (and can be found at) Science and technology studies.

**V. TECHNOLOGY AND ECONOMICS IN THE FUTURE**

Some analysts argue that as information technology advances, robots and other forms of automation will ultimately result in significant unemployment as machines and software begin to match and exceed the capability of workers to perform most routine jobs.

As robotics and artificial intelligence develop further, even many skilled jobs may be threatened. Technologies such as machine learning may ultimately allow computers to do many knowledge-based jobs that require significant education. This may result in substantial unemployment at all skill levels, stagnant or falling wages for most workers, and increased concentration of income and wealth as the owners of capital capture an ever larger fraction of the economy. This in turn could lead to depressed consumer spending and economic growth as the bulk of the population lacks sufficient discretionary income to purchase the products and services produced by the economy.

**VI. ORGANIZATIONS MATCH NEW TECHNOLOGIES WITH NEEDS**

Depending on what their goals are, enterprises may invest quite differently in new technologies. Our study didn’t look only at the newest, most emergent technologies; it also examined those that, while still relatively new, have reached a point of wide recognition and understanding, if not necessarily widespread deployment. They show what sort of business goals have driven adoption strategies over the past few years. Thus, server virtualization—the most commonly adopted technology (deployed in 61 percent of organizations)—was cited by respondents as one of the best choices for increased cost savings or productivity gains, which have been common business goals since the Great Recession began.

Other business goals that spurred enterprise adoption of new technologies include: the desire for increased business agility driving mobility and information application, and the need to open up new markets driving social networking, RFID and cloud storage. This takes us to the newest technologies—and the reasons that organizations are deploying them (Finding 1.2). If you think, as we do, that coming out of the Great Recession organizations will seek greater agility as a prime goal, then the next wave of adoption should go further in the mobility and cloud areas, with the deployment of tablets and virtualized storage. Each of these, in fact, also benefits one of the other two business goals we tested, giving them much promise in the next year or two. 802.11n WiFi, meanwhile, seems to have downshifted, perhaps because of the rise in importance of carrier networks to go along with all that mobility activity.

**VII. SECURITY AND THE COMPUTING INFRA-STRUCTURE LEAD NEW DEVELOPMENTS**

After three years of somewhat lagging interest, security is busting out all over these days—and that includes the investigation and adoption of the latest technologies and technology strategies. Four of the 10 most active emerging technologies are security-related. The focus is on endpoint and encryption-key management in particular, but there is also surprising and unexpected new interest in trusted operating system schemes. Web 2.0 (or, as some would call it in this context, Enterprise 2.0) is also a highly active area for new ideas. This is understandable, considering that the whole Internet landscape continues to develop quite rapidly. The newest and hottest areas in Web applications look to be crowdsourcing, especially in larger firms, and enterprise app stores (self-service portals).

Some of the most interesting activity is happening in the good old computing infrastructure, which has shown a real resurgence of late as organizations virtualize, consolidate and move to the cloud. In the process, they’re shoring up their rusting systems to take advantage of new technologies. Application virtualization, public clouds and even nerd-at-the-party PaaS are generating new excitement and energy in this area. At the same time, VDI is no longer a budding dynamo, as organizations are beginning to be more cautious about it, following the wild enthusiasm this category exhibited in our 2009 survey.

In other realms outside of virtualization, we take the greatest interest in networking technologies that are clearly on their way in, but just as clearly have far to go. IPv6, for example, may finally start to see serious usage levels, based on the number of large organizations that are in the testing phase. And 4G, while doubling in usage in the past year, still is
very much a minority protocol, especially when you consider that 3G deployment hasn’t even hit the 50 percent mark. In software infrastructure, parallelistic application development may have taken another stutter-step, but XBRL, while still not heavily used, certainly should be on any forward-looking firm’s watchlist in the year to come.

VIII. EMERGING TECHNOLOGICAL FRAMEWORK

Our emerging technology framework can be separated into three different areas with each one creating an environment for an emerging technology. The first component of the framework is the technology itself. Once the technology is actually identified in its pure state the second component ensues as the process through which the technology follows in order to create value. The final aspect of the framework is the internal and external environment of the organization both of which greatly influence the technology and the research and development process.

A. TECHNOLOGY

One of the first questions to be addressed is how to bring substance to a nascent technology. One important way to accomplish this is through open and dynamic communication from diverse perspectives, e.g., developers, technologists, customers, marketing people, etc. This communication with diverse groups is important because there are far more questions than answers. By creating many ideas and with ideas coming from multiple perspectives, the probability of a successful application for a nascent technology increases.

B. PROCESS

With the “fuzzy” boundaries of a new technology the process that is undertaken must be fluid and flexible. This means everything needs to be flexible, particularly the organization and the people involved. Individuals can play many different roles in birthing and managing an emerging technology. Some perform the role of sponsor while others the role of gatekeeper, partner, coach, or champion. Each role is important and can facilitate the entire process. Leadership is important to coordinate the ideas and bring the proper mix of people together to achieve the best applications for a potential technology. With the high degree of ambiguity surrounding the value of a technology a champion is essential. This individual needs to gain the necessary buy-in and resources so the technology can move forward during the research process and ultimately to development. It is important that the technology get beyond the “I have this” phase and move to “this is what we can do with it” phase. Too often the “I have this, now what?” is too difficult an obstacle to overcome because there is a tendency to focus on the less risky options of simply continuing incremental innovations with current technology.

Another important aspect of the process the nascent technology must travel through is the evaluation of the technology. Some low cost ways (see Table 2) to evaluate applications of a nascent technology are the use of focus groups, customer feedback, patent searches, and citation analysis. Low cost is important at this early stage so that loss is reduced in the event that the evaluation is negative. Focus groups can offer insights into what customers want and what they are willing to purchase. Research has found that the strength of a firm’s idea generation process is largely determined by the relationship with the customer. This customer perspective is important as they are the ultimate evaluators and investors of the technology. Patent searches also offer useful information. Not only can legal, implications be surfaced but patent searches can uncover related ideas. Similar to this is citation analysis which can be used to discover potential applications for an emerging technology from similar areas of technology.

necessary risk involved with nascent technologies the market must be able to sustain the new product, service, or idea. Commercialization success is dependent on a favorable external market environment.

IX. CONCLUSION

The relatively new area of emerging technologies research has inherited both the strengths and weaknesses of research in general. Emerging technologies are contemporary advances and innovation in various fields of technology. Various converging technologies have emerged in the technological convergence of different systems evolving towards similar goals. Various strategies are to be adopted for advancements in emerging trends in engineering.

XIX. REFERENCES

Comparative Study of JPEG & TIFF File Formats for Geographic Information System Based on Revenue Maps Related to Jaipur Metro Corridor

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Abstract: Image file formats are standardized means of organizing & storing digital images. Basically Image files consists of two graphic formats either vector or raster. In this paper authors are comparing two raster file formats TIFF (Tagged Image File format) and JPEG (Joint Picture Expert Group), and advantages of TIFF over JPEG for GIS based applications. The objective of this research is to evaluate the results and characteristics of image file formats in GIS applications. The evaluation and analysis of image files are based on visual assessment and analysis of various attributes. The result of this experiment is mainly to evaluate the revenue maps pixels, size of maps, outlining the advantages and disadvantages between two file formats. The investigation indicates that JPEG and TIFF format files appears to have discrepancy in the original image file and also have differences in their respective sizes. Result shows that TIFF is better than JPEG from GIS perspective as size is maintained during scanning and after editing, so files are not compressed and data is not lost, due to these advantages accurate spatial data analysis can be performed on GIS applications.

Keywords: Geographic Information System (GIS), Tagged Image File Format (TIFF), Joint Photographic Expert Group (JPEG), Limpel-Ziv-Welch (LZW).

I. INTRODUCTION

Image File Format
Image File Formats are the means of storing digital images. Images are made of pixels (raster), geometric data (vector), or a combination of two. It is possible that every format is rasterized to pixels. Pixels are combination of grid cell and each pixel constitutes a magnitude of color. On the basis of computer graphics two file formats are used vector file format and raster file format which further divide in extensions. Here we perform comparison between two extensions of raster graphic format JPEG and TIFF file and proposed a TIFF extension is better than a JPEG extension, for GIS applications on the basis of revenue maps of Jaipur metro corridor.

Raster
Raster graphics are the most common type of image files. It is a data structure generally rectangular grid of pixels, which is viewable by a monitor, paper or other display medium. It is graphical technique using array of pixel values where each pixel represent a color.

Raster graphics is resolution dependent. Raster images are produced by digital image capture devices: digital scanners or digital cameras or by pixel editing programs. Raster images are composed of matrix or bitmap of digital picture elements (pixels). As shown in Fig.1.

Pixels are square or rectangles described as black, white, gray or color. Raster images are typically share among various platforms and typical to modify so security will maintain in raster image format.

Limpel-Ziv-Welch
LZW is named after Abraham Limpel Jakob Ziv and Terry Welch, the scientists who developed this compression algorithm. It is a lossless ‘dictionary based’ compression algorithm. Dictionary based algorithms scan a file for sequences. These sequences are then stored in a dictionary and within the compressed file, references are put where-
ever repetitive data occurred. LZW compression replaces strings of characters with single codes. It does not do any analysis of the incoming text. Instead, it just adds every new string of characters it sees to a table of strings. Compression occurs when a single code is output instead of a string of characters. The code that the LZW algorithm outputs can be of any arbitrary length, but it must have more bits in it than a single character. The first 256 codes (when using eight bit characters) are by default assigned to the standard character set. The remaining codes are assigned to strings as the algorithm proceeds. The sample program runs as shown with 12 bit codes.

**Joint Photographic Expert**

*Group* JPEG compression is used in a number of image file formats. JPEG is the most common image format used by digital cameras and other photographic image capture devices; along with JPEG/JFIF, it is the most common format for storing and transmitting photographic images on the World Wide Web. These format variations are often not distinguished, and are simply called JPEG.

### II. GEOGRAPHIC INFORMATION SYSTEM

GIS is a set of computer tool that allows people to work with data that are tied to a particular location of the earth. GIS are used to input store, manage, analyze and display data. GIS allows us to view, understand, question, interpret & visualize data in many ways that reveal relationship, pattern, and trends in form of maps, globe, report and chart.

From GIS perspective TIFF format is better because there is no data loss in this format so, visualization of different objects and geographical data managed easily, map projection and spatial referencing is done in a better way and data analysis of different locations can be done accurately.

### SCANNING IN GIS

GISA scanning technology continues to improve; the uses for scanned maps continue to grow, especially for data conversion. Scanning facility and property maps for vectorization will be a major use and will continue to advance as automated conversion techniques continue to advance. The scanning of irreplaceable documents allows the safe handling of raster images. Scanned maps have several uses for GIS data conversion.

### III. COMPARISON BETWEEN JPEG AND TIFF

Table 1 shows the comparison between JPEG and TIFF on the basis of various factors and below it various tables are shown of revenue maps (a graphic representation, usually on a plane surface and at an established scale, of natural or artificial features on the surface of a part or the whole of the Earth or other planetary body.) which are scanned in both formats and comparison is perform on them by considering various factors.

**COMPARISION OF REVENUE MAPS OF JAIPUR CITY OF VARIOUS LOCATIONS**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Attributes</th>
<th>TIFF</th>
<th>JPEG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Compression</td>
<td>Lossless, so accurate data analysis performed.</td>
<td>Lossy, so data analysis is cumbersome.</td>
</tr>
<tr>
<td>2.</td>
<td>Errors</td>
<td>Reduced, so accurate geodatabase is created.</td>
<td>Not reduced, so not suitable for geodatabase.</td>
</tr>
<tr>
<td>3.</td>
<td>Color Management</td>
<td>Easier, so better for digitization.</td>
<td>Digitization is typical, because accurate location cannot be shown.</td>
</tr>
<tr>
<td>4.</td>
<td>Archiving</td>
<td>Easier, so better for portability and data maintenance.</td>
<td>Typical, because data is lost.</td>
</tr>
<tr>
<td>5.</td>
<td>File Size</td>
<td>Maintained, as after scanning and editing of maps file size remain same.</td>
<td>Reduced, Because data is lost.</td>
</tr>
<tr>
<td>7.</td>
<td>Supported By</td>
<td>Most photo sharing websites.</td>
<td>Not supported.</td>
</tr>
<tr>
<td>8.</td>
<td>Editing</td>
<td>Better choice, because data does not lose.</td>
<td>Not a better choice, as maps are edited and resaved, it losses some quality.</td>
</tr>
<tr>
<td>9.</td>
<td>RGB Grayscale</td>
<td>24 or 48 bits 8 or 16 bits</td>
<td>24 bits 8 bits</td>
</tr>
<tr>
<td>10.</td>
<td>Data Analysis</td>
<td>Accurate, because of lossless compression spatial referencing and map projection is better.</td>
<td>Not accurate, because data is lost.</td>
</tr>
</tbody>
</table>

*Fig.2.1 Revenue Map of Hathroi scanned in JPEG format*
Fig. 2.1 and Fig. 2.2 shows the revenue maps (a graphic representation usually on plane surface at an established scale, of natural or artificial features on the surface of a part or the whole of the Earth or other planetary body.) of various locations which are scanned in both formats and comparison is perform on it by considering various properties.

As shown from fig 2.2 revenue map Hathroi location of scanned in TIFF, which have more in size because of lossless compression, data should be maintain so that accurate spatial analysis perform.

For comparative study of other locations (Kishanpole, Bhojpura, Khokhawas, Sanagner) tables should maintain which shown comparison on the basis of various properties.

Fig.2.2 Revenue Map of Hathroi scanned in TIFF format

<table>
<thead>
<tr>
<th>Attributes</th>
<th>TIFF (277MB,17,365 bytes)</th>
<th>JPEG (12549*9252)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>277MB(29,17,365 bytes)</td>
<td>12549*9252</td>
</tr>
<tr>
<td>Size On Disk</td>
<td>277MB(277,137,19,808 bytes)</td>
<td>12549*9252</td>
</tr>
<tr>
<td>Dimensions</td>
<td>8219*10770</td>
<td>8244*10755</td>
</tr>
<tr>
<td>Width</td>
<td>480 pixels</td>
<td>8244 pixels</td>
</tr>
<tr>
<td>Height</td>
<td>629 pixels</td>
<td>10755 pixels</td>
</tr>
<tr>
<td>Horizontal Resolution</td>
<td>300 dpi</td>
<td>300 dpi</td>
</tr>
<tr>
<td>Vertical Resolution</td>
<td>300 dpi</td>
<td>300 dpi</td>
</tr>
<tr>
<td>Compression</td>
<td>LZW</td>
<td>JPEG</td>
</tr>
<tr>
<td>Resolution Unit</td>
<td>2</td>
<td>N/A</td>
</tr>
<tr>
<td>Bit depth</td>
<td>N/A</td>
<td>24</td>
</tr>
</tbody>
</table>

Fig3 this sample file (on the left) was saved in two file formats - the relative sizes are shown in the graph on the right. As you can see, the flattened TIFF has a significant size advantage over JPEG format.

As shown in Fig. 3 TIFF file size is more than JPEG because there is no data loss in TIFF format. Other comparative study performs on the basis of map editing. As editing is perform on JPEG files their properties should be vary but in TIFF they remain same.

As you seen there is change in file size after editing. As results shown there should be sustainable change in file size after editing in JPEG. So TIFF is better choice for GIS because there because if editing is perform on file its property remains same means data maintain in its original form so data analysis performs accurately.

Effect of Zooming On JPEG and TIFF Image

Fig.5 Above images showed the effect after 800% zooming on JPEG and TIFF

V. RESULT

In this paper, we have reviewed JPEG and TIFF file format for scanning maps in GIS both the formats are used for storing images and work better in their specific domain. We have shown comparison on the basis of graphs by considering original size of maps after scanning.
First comparison result shows in Fig.3 by scanning the maps, size in TIFF is more than JPEG due to lossless compression in TIFF therefore information of data remains in maps which is required for data analysis, spatial referencing and map projection in GIS.

Another comparison shows in Fig.4 and Fig. 5 are on the basis of editing, if a JPEG image is edited (like rotate and zoom) and re-saved, it loses some quality each time, therefore size of maps is reduced because of lossy compression.

VI. CONCLUSION
So, after analyzing the results we conclude that JPEG format does not have much suitability for GIS based applications because in spatial referencing particular locations on maps are used to locate the features on earth so, in JPEG due to data loss particular location is not found for spatial referencing, data analysis and map projection purpose.

TIFF files do not get compressed so 100% of the data is captured during scanning and retains the quality for data analysis, spatial referencing and map projection even after editing. Hence, accurate analysis of data takes place, which helps decision makers for GIS, based applications.

VII. REFERENCES
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Thermal Effect on Natural Frequencies of A Square Plate with Varying Thickness

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ABSTRACT: In the modern technology, the plates of variable thickness are widely used in engineering applications i.e. nuclear reactor, aeronautical field, naval structure, submarine etc. In this paper, effect of thermal gradient on vibration of square plate of varying thickness is studied. Thermal effect is taken as parabolic in two directions and thickness varies parabolic in x-direction. Rayleigh Ritz technique is used to calculate the fundamental frequencies. The frequencies corresponding to the first two modes of vibrations are obtained for a square plate for different values of taper constant and thermal gradient. Results are presented in graphical form.

Keywords: Vibration, Frequencies, Square Plate; Thermal Gradient; Thickness; Taper Constant; Parabolically.

I. INTRODUCTION

In the engineering we cannot move without considering the effect of vibration because almost all machines and engineering structures experiences vibrations. As technology develops new discoveries have intensified the need for solution of various problems of vibrations of plates with elastic or visco-elastic medium. Since new materials and alloys are in great use in the construction of technically designed structures therefore the application of visco-elasticity is the need of the hour. Sufficient work [1 – 4] is available on the vibration of a rectangular plate of variable thickness, but none of them done on parallelogram plate. Singh and Saxena [5] have considered transverse vibration of skew plates with variable thickness. Recently, Gupta and Khanna [6] have considered vibration of visco-elastic rectangular plate with linearly thickness variations in both directions.

A. Khanna, A. Kumar and M. Bhatia [7] recently presented an analysis on two dimensional thermal effect with two dimensional with linearly varying thickness of visco-elastic square plate. The aim of present investigation is to study two dimensional thermal effect on the vibration of visco-elastic square plate whose thickness varies parabolically in x-direction. It is assumed that the plate is clamped on all the four edges and its temperature varies parabolically in both the directions. Due to temperature variation, we assume that non homogeneity occurs in Modulus of Elasticity. For various numerical values of thermal gradient and taper constants; frequency for the first two modes of vibration are calculated with the help of latest software and all the results are shown in Graphs.

II. EQUATION OF MOTION

Differential equation of motion for visco-elastic square plate of variable thickness in Cartesian coordinate is given by [1]:

\[
D_1 \left( \frac{W_{xx} + 2W_{yy} + W_{yy}}{h_{x}^2} \right) + 2D_2 \left( \frac{W_{x} + W_{y}}{h_{y}^2} \right) + D_3 \left( W_{x} + W_{y} \right) + D_4 \left( W_{xy} \right) + 2 \left( 1 - \nu \right) \frac{D_1}{h_{x}^2} \frac{D_2}{h_{y}^2} W = 0
\]

which is a differential equation of transverse motion for non-homogeneous plate of variable thickness.

Here, \( D_1 \) is the flexural rigidity of plate i.e.

\[
D_1 = Eh^3 / 12(1 - \nu^2)
\]

and corresponding two-term deflection function is taken as [5]

\[
W = \left( \frac{x}{\alpha} / \left(1-x/\alpha\right) \right) \left( \frac{y}{\alpha} / \left(1-y/\alpha\right) \right) \left( \frac{1-x/\alpha}{\left(1-y/\alpha\right)} \right)
\]

Assuming that the square plate of engineering material has a steady two dimensional parabolically temperature distribution i.e.

\[
\tau = \tau_0 \left( 1 - x^2 / a^2 \right) \left( 1 - y^2 / a^2 \right)
\]
where, $\tau$ denotes the temperature excess above the reference temperature at any point on the plate and $\tau_0$ denotes the temperature at any point on the boundary of plate and $\gamma$ is the length of a side of square plate. The temperature dependence of the modulus of elasticity for most of engineering materials can be expressed in this

$$E = E_0 \left(1 - \gamma \tau \right)$$

where $E_0$ is the value of the Young's modulus at reference temperature i.e. $\tau = 0$ and $\gamma$ is the slope of the variation of $E$ with $\tau$. The modulus variation (5) become

$$E = E_0[1 - \alpha(1 - x^2/a^2)(1 - y^2/a^2)]$$

where, $\alpha = \gamma \tau_0$ $(0 \leq \alpha < 1)$ thermal gradient. It is assumed that thickness also varies parabolic in $x$-directions as shown below:

$$h = h_0(1 + \beta_1 x^2/a^2)$$

where, $\beta_1$ is taper parameters in $x$-directions respectively and $h=h_0$ at $x=y=0$.

Put the value of $E$ & $h$ from equation (6) & (7) in the equation (2), one obtain

$$V = Q \int_{0}^{1} \int_{0}^{1} \left[1 - \alpha(1 - x^2)(1 - y^2)(1 + \beta_1 X^2)^3 \left((1 + \beta_1 X^2) \eta^2 + (1 - \eta)^2\right) + 2 \eta (1 + \beta_1 X^2)^3 \left((1 + \beta_1 X^2) \eta^2 + (1 - \eta)^2\right) \right] \eta \dd X \dd Y$$

where, $Q = E_0 h_0^3 a^3 / 24(1 - \nu^2)$

Using equations (12) & (13) in equation (9), one get

$$(V^* - \lambda^2 T^*) = 0$$

where,

$$V^* = \int_{0}^{1} \int_{0}^{1} \left[1 - \alpha(1 - x^2)(1 - y^2)(1 + \beta_1 X^2)^3 \left((1 + \beta_1 X^2) \eta^2 + (1 - \eta)^2\right) + 2 \eta (1 + \beta_1 X^2)^3 \left((1 + \beta_1 X^2) \eta^2 + (1 - \eta)^2\right) \right] \eta \dd X \dd Y$$

and

$$T^* = \int_{0}^{1} \int_{0}^{1} ((1 + \beta_1 X^2) \eta^2 + (1 - \eta)^2) \dd X \dd Y$$

Here, $\lambda^2 = 12 \rho (1 - \nu^2) a^2 / E_0 h_0^2$ is a frequency parameter.

Equation (16) consists two unknown constants i.e. $A_1$ & $A_2$ arising due to the substitution of $W$. These two constants are to be determined as follows

$$\frac{\partial (V^* - \lambda^2 T^*)}{\partial A_n}, n=1,2$$

On simplifying (2.17), one gets

$$b_{n1} A_1 + b_{n2} A_2 = 0$$

where, $b_{n1}$, $b_{n2}$ (n=1,2) involve parametric constant and the frequency parameter.

For a non-trivial solution, the determinant of the coefficient of equation (18) must be zero. So one gets, the frequency equation as

$$\begin{vmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{vmatrix} = 0$$

With the help of equation (19), one can obtains a quadratic equation in $\lambda^2$ from which the two values of $\lambda^2$ can found. These two values represent the two modes of vibration of frequency i.e. $\lambda_1$(Mode1) & $\lambda_2$(Mode2) for different values of taper constant and thermal gradient for a clamped plate.

**III. RESULT AND DISCUSSION**

All calculations are carried out with the help of latest Matrix Laboratory computer software. Computation has been done for frequency of visco-elastic square plate for different values of taper constants $\beta_1$ and $\beta_2$, thermal gradient $\alpha$, at different points for first two modes of vibrations have been calculated numerically.
In Fig I:- It is clearly seen that value of frequency decreases as value of thermal gradient increases from 0.0 to 1.0 for $\beta_1=0.4$ and $\beta_2=0.6$ for both modes of vibrations.
In Fig II:- Also it is obvious to understand the increment in frequency as value of taper constant $\beta_1$ from 0.0 to 1.0 for $\alpha=0.4$ and $\alpha=0.6$ for both modes of vibration.

**Table 1: Frequency Vs Thermal gradient**

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>$\beta_1=0.4$</th>
<th>$\beta_2=0.6$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mode 1</td>
<td>Mode 2</td>
</tr>
<tr>
<td>0</td>
<td>162.18</td>
<td>41.57</td>
</tr>
<tr>
<td>0.2</td>
<td>153.63</td>
<td>39.85</td>
</tr>
<tr>
<td>0.4</td>
<td>144.58</td>
<td>38.04</td>
</tr>
<tr>
<td>0.6</td>
<td>134.94</td>
<td>36.11</td>
</tr>
<tr>
<td>0.8</td>
<td>124.57</td>
<td>34.03</td>
</tr>
<tr>
<td>1</td>
<td>113.26</td>
<td>31.74</td>
</tr>
</tbody>
</table>

**Table 1: Frequency Vs Taper constant**

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>$\beta_1=0.4$</th>
<th>$\beta_2=0.6$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mode 1</td>
<td>Mode 2</td>
</tr>
<tr>
<td>0</td>
<td>125.71</td>
<td>32.53</td>
</tr>
<tr>
<td>0.2</td>
<td>135.23</td>
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</tr>
<tr>
<td>0.4</td>
<td>144.61</td>
<td>38.12</td>
</tr>
<tr>
<td>0.6</td>
<td>154.16</td>
<td>41.19</td>
</tr>
<tr>
<td>0.8</td>
<td>163.86</td>
<td>44.28</td>
</tr>
<tr>
<td>1</td>
<td>174.15</td>
<td>47.57</td>
</tr>
</tbody>
</table>

**IV. CONCLUSION**

The main aim for our research is to develop a theoretical mathematical model for scientists and design engineers so that they can make a use of it with a practical approach, for the welfare of the human beings as well as for the advancement of technology.

**V. REFERENCES**

Abstract: Thin film of micron order thickness is being superimposed on a substrate having thickness greater than of film. Stresses in film can be calculated from both material and mechanical point of view. Generally thermal, intrinsic and epitaxial stresses are produced in the combination. During deposition of film on substrate some misfit strain is produced which causes deformation in film. This deformation must be elastic. Finite Element method predicts the behavior of this deformation and changes in curvature in substrate. This investigation pertains to Finite Element Analysis of the stress state in thin films as a function of the thickness of film and substrate. During all the analysis thin film is considered as a thin plate. Behavior of multilayer thin film on substrate is also taken into consideration during all the modeling process. Buckling of thin film under external loading, neutral section of the film substrate combination and interfacial shear effect is also calculated independently.

Keywords: Finite element method, Thin Film, Solid mechanics

I. INTRODUCTION

Thin films and substrates combination are generally used in Microelectronic IC’s, Magnetic Storage, Optical Filters, Wear Resistant Coatings, and Corrosion Resistant Coatings etc. Thin films have strong significance in all of these. Because of the very small size of all these components it’s mechanical property plays a very important role in its overall performance. For increasing the surface performance we need to deal with the film and substrate’s material and mechanical property.

For example during IC’s fabrication different materials are combined, resulting in a complex system. The fabrication steps are performed at various temperature (ranging from room temperature up to 1200 C from diffusion and oxidation) and consequently thermo mechanical stress will be induced once the packaged chip is cool down to the temperature of its application (in most cases it is around room temperature). The difference between the thermal expansion of Si and that of the other materials is the main cause of the induced thermo mechanical stress. Such a phenomenon can change the curvature of the substrate so it become very necessary to control the curvature of the film substrate and making it flat while the whole operation. In spite of thermo mechanical stress some epitaxial and intrinsic stresses will also produced due the difference in the material property and lattice structure.

Mechanical properties of these materials are also a very important parameter for designing these components. Because as the no of layers are increased on the substrate the curvature and stress values in the combination will be changed. Due to the misfit between these two some misfit strain will produced which is calculated by mechanical means.

II FILM STRESS AND CURVATURE RELATION

The film stress-curvature relation shows that:
1. Film stress can be found by measuring the curvature of the substrate (or change of curvature, Δκ if not initially flat).
2. Results depend only on the dimensions of film and substrate and the elastic properties of substrate, not the properties of the film.

With this feature, the film may be plastically deforming or undergoing phase transformations and still the measurement of the substrate curvature gives the current stress in the film.

\[
s_{f} = \frac{E_s}{(1 - \nu_s)Gtf} \kappa = \frac{E_s}{(1 - \nu_s)Gtf} \frac{ts^2}{6tf}
\]


**III. FINITE ELEMENT ANALYSIS**

*Modelling of thin film:* Solid 46 element type which has the capability of modeling the layered solid was used to model elastic layers. Using this element type helped modeling of three solid layers in one element layer.

Substrate was modeled using solid 45 element type. The small thickness-width ratio is the most challenging issue in the FE modeling of the thin films. Huge amount of elements are required to achieve suitable aspect ratio. In the present work, two layers of elements in modeling the membrane and substrate requires huge amount of CPU time. Some author used simplified model to decrease the CPU time.

In this study a simplified model was used which assume that the substrate is a rigid body. The nodes in the interface between substrate and film were fixed. Modeling the thin film layers offers more relaxed boundary condition and need to more CPU time.

**BOUNDARY CONDITION:** The boundary condition in film substrate condition depends upon the kind of analysis. In this work only the structural analysis of film substrate is being done with the help of various external conditions. Moduli of elasticity, density, coefficient of thermal expansion are the input which predicts the results. Since the degree of freedom of the film substrate in the x and z direction is restricted in the whole analysis so $u_x = u_z = 0$ as initial condition for substrate.

For calculation of substrate curvature since the curvature will be found only in the y direction so for the accuracy of the result we need to restrict the motion in the z direction. This will give the maximum curvature due to film stress in the substrate. For the more practical result we can apply the dof in the x direction also this will give somewhat lower value of curvature than the previous one.

**IV. RESULT AND DISCUSSION**

*Simulation*
Variation of Film stress with other properties:

After doing analysis we found that film stress is varying linearly with the thickness of the substrate up to critical point. After that this variation becomes very large. This is mainly because of critical thickness so this result will predict the behaviour of film substrate combination that thickness of the substrate should not be greater than the critical thickness otherwise it will cause huge amount of stress in the film and that causes the failure of the combination.

Curvature of substrate is found due to imposition of single layer of thin film. This will continuously vary if we increase the additional layer of thin film. Again the number of layer on thin film can be decided on the basis of curvature change. Since in practical problem substrate should be flat in every condition with having some layer of film itself and these layers should not impose any additional curvature on substrate. In other words every layer will cause some of curvature in substrate but there is some limiting value regarding this to avoid large deformation curvature should be in elastic limit.

When the critical thickness is exceeded misfit dislocations are nucleated at the interface and the energy of an edge dislocation as derived from the theory of elasticity using a Volterra cut is:
\[ E_{\text{dis}} = \frac{Gb^2}{4\pi(1-v)} \left( z + \ln \left( \frac{\gamma_0}{b} \right) \right) \]

Where, \( \gamma_0 \) is usually taken as the grain size \( \sim 70b \).

The total energy of the system in the presence of dislocations is:

\[ E_{\text{Tot}} = E_h + E_{\text{dis}} \]

2. Increasing the no of layer on the substrate will cause the increments in the curvature of the substrate.
3. Critical thickness is the most important term for designing the film substrate combination.
4. Since after the critical thickness there are huge increments in the total and dislocation energy of the system so no of layers greatly depends upon the critical thickness.
5. Stress in film away from the substrate is more relaxed than the nearer one. So layer of the film nearer to the substrate is more effective than the away from the substrate.

**REFERENCES**


**V. CONCLUSION**

1. In a film substrate combination variation of film stress depends upon the dimension of film and substrate both and only on the elastic property of the substrate not on the film.
Abstract: The use of web based learning management systems is getting pace in the academia in the last few years. The education world is making use of immense features developed and deployed in hundreds of available virtual learning environments. The higher education institutes and universities throughout the globe are giving more emphasis on launching the academic activities using learning management systems. As per the report of Bersin et al. 2009, the LMS industry represents an $860 million market which is made up of more than 60 different providers. The paper expresses the study and experiments that can be conducted on an eminent learning management system MOODLE.

Keywords: Web Based Learning Technologies; Learning Management Systems; Asynchronous Learning; E-Learning; Open Source Technology; Virtual Learning Environment; Performance Evaluation; E-Learning Products

I. INTRODUCTION

A learning management system (commonly abbreviated as LMS) is a software application for the administration, documentation, tracking, and reporting of training programs, classroom and online events, e-learning programs, and training content. Moodle (abbreviation for Modular Object-Oriented Dynamic Learning Environment) is a free source e-learning software platform, also known as a Course Management System, Learning Management System, or Virtual Learning Environment (VLE). As of October 2010 it had a user base of 49,952 registered and verified sites, serving 37 million users in 3.7 million courses.

Moodle was originally developed by Martin Dougiamas to help educators create online courses with a focus on interaction and collaborative construction of content, and is in continual evolution. Moodle is an Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It has become very popular among educators around the world as a tool for creating online dynamic web sites for their students. To work, it needs to be installed on a web server somewhere, either on one of your own computers or one at a web hosting company. The focus of the Moodle project is always on giving educators the best tools to manage and promote learning.

Features:
Moodle has several features considered typical of an e-learning platform, plus some original innovations (like its filtering system). Moodle is very similar to a learning management system. Moodle can be used in many types of environments such as in education, training and development, and business settings.

Some of these features are:

General:
Moodle is a PHP based software product. This means that it runs in a browser. If you install it on a web server it will be accessible for anyone who has an Internet connection. Basically Moodle can substitute a complete learning environment with a digital version. Teachers can set up discussions, publish course materials and other resources, hand out and mark assignments and create quizzes with automatic grading. Students will always be able to see exactly what the assignment is, can discuss the course with their fellow students and have all the aspects of the course in one easy space with a clear layout.

Course Structure
There are presently three types of course structure.
Weekly
This type of course has a starting date and a set amount of weeks. Every week can contain one or more of all the learning elements.

Topic
Here there are different topics. You can name each topic and every topic can have all the learning elements listed below. This is a good structure for rotating practices where all students do the same amount of topics (or maybe even get to choose), but do not do these in the same order. Every topic can easily be made visible and invisible.

Free Form:
This course type is mainly useful as the quickest way to set up a course. It consists of just one topic in which to put all the learning elements. It is an excellent way for just setting up some forums.

II. PERSONAL PAGE
Every user of the Moodle site has a personal page with information about them. This is a common feature in digital learning environments and is often called a resume or a CV. In Moodle you create it by filling out a form with a couple of standard fields like name, place of residence, e-mail address, URL of website, etc. Added to this is the possibility of uploading a user picture (in GIF or JPEG format). This picture is then added to every post in every forum the user does, and even gets send out by e-mail to subscribers of the forum. By clicking on the picture other members of the forum can see the personal page.

Many freely-available third-party Moodle plugins make use of this infrastructure.
Moodle users can use PHP to author and contribute new modules. Moodle's development has been assisted by the work of open source programmers. This has contributed towards its rapid development and rapid bug fixes.
By default Moodle includes the TCPDF library that allows the generation of PDF documents from pages.

III. DEPLOYMENT
Users can install Moodle from source, but this requires more technical proficiency than other automated approaches such as installing from a Debian package, deploying a ready-to-use TurnKey Moodle appliance or using the Bitnami installer.
Some free Moodle hosting providers allow educators to create Moodle-based online classes without installation or server knowledge. Some paid Moodle hosting providers provide value-added services like customization and content-development.

IV. INTEROPERABILITY
Moodle runs without modification on Unix, Linux, FreeBSD, Windows, Mac OS X, NetWare and any other systems that support PHP and a database, including almost all webhost providers.
Data goes in a single database. Moodle version 1.6 could use MySQL or PostgreSQL. Version 1.7, released November 2006, makes full use of database abstraction so that installers can choose one from many types of database servers such as Oracle and Microsoft SQL Server.
E-learning systems can have many dimensions of interoperability. Moodle's interoperability features include: Moodle also has import features for use with other specific systems, such as importing quizzes or entire courses from Blackboard or WebCT. These import tools are not, however perfect. At the time of writing (Feb 2011), Moodle will not import Blackboard courses due apparently to some change in php code-releases.

V. BACKGROUND

origin
Martin Dougiamas, who has graduate degrees in computer science and education, wrote the first version of Moodle. Dougiamas started a Ph.D. to examine "The use of Open Source software to support a social constructionist epistemology of teaching and learning within Internet-based communities of reflective inquiry". Although how exactly social constructionism makes Moodle different from other eLearning platforms is difficult to show, it has been cited as an important factor by Moodle adopters. Other Moodle adopters, such as the Open University in the UK, have pointed out that Learning Management Systems can equally be seen as "relatively pedagogy-neutral".

Origin of the name
The acronym Moodle stands for Modular Object-Oriented Dynamic Learning Environment (in the early years the "M" stood for "Martin's", named after Martin Dougiamas, the original developer). As well as being an acronym, the name was chosen because of the dictionary definition of Moodle and to correspond to an available domain name.
"Moodle" is a trademark in many countries around the world registered to Martin Dougiamas. Only Moodle Partners may legally use the trademark to advertise any Moodle related services such as hosting, customization, training and so on.

VI. PEDAGOGICAL APPROACH
The stated philosophy of Moodle includes a constructivist and social constructionist approach to education, emphasizing that learners (and not just teachers) can
contribute to the educational experience. Moodle supports an outcomes-oriented learning environment.

VII. DEVELOPMENT

Moodle has continued to evolve since 1999 (since 2001 with the current architecture). The current version is 2.0, which was released in November, 2010. It has been translated into 82 different languages. Major improvements in accessibility and display flexibility were developed in 1.5.

Not having to pay license fees or to limit growth, an institution can add as many Moodle servers as needed. The Open University of the UK is currently building a Moodle installation for their 200,000 users. It is often known for individual departments of institutions to use the unlimited feature, such as the maths department of the University of York.

The development of Moodle continues as a free software project supported by a team of programmers and an international user community, drawing upon contributions posted to the online Moodle Community website that encourages debate and invites criticism.

Users can freely distribute and modify the software under the terms of the GNU General Public License version 2 or any later version.

VIII. CERTIFICATION

Since 2006 there has been an official certification available for teachers using Moodle. Initially called the Moodle Teacher Certificate (MTC) this was renamed in 2008 to the Moodle Course Creator Certificate (MCCC).

MCCC is available only through Moodle Partners, and through Central Certification Services. MCCC for Moodle version 2.0 will be available from early in 2011. Discussion is ongoing regarding an official Moodle Administrators Certificate.

IX. MOODLE - AN EXCELLENT VIRTUAL LEARNING ENVIRONMENT

X.

The educational institutes are searching for a secure platform as well a product with all the features which includes all the components that are required in the academia. These components include Online Exams., Quiz, Forums, Chat, Wiki, Blog, Newsletter, Bulletin Board, Content/Course Management System. Hundreds of e-learning products are available in the global learning industry, but the academic establishments are concentrating on open source technologies because of flexibility and efficiency of these products.

Moodle was developed by Martin Dougiamas as part of his research thesis and to help educators create online courses with a focus on interaction and collaborative construction of content.

XI. TECHNICAL ASPECTS

Most LMSs are web-based, built using a variety of development platforms, like Java/J2EE, Microsoft .NET or PHP. They usually employ the use of a database like MySQL, Microsoft SQL Server or Oracle as back-end. Although most of the systems are commercially developed and have commercial software licenses there are several systems that have an open-source license.

Till now MOODLE has 36,421,666 users and hosted in 212 countries throughout the global education industry. The following statistics typifies the increasing use of MOODLE in the academia –

<table>
<thead>
<tr>
<th>Institution</th>
<th>2009 Online Enrollment Totals</th>
<th>Online Enrollment Growth from 2008 to 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Phoenix Online</td>
<td>310,400</td>
<td>22%</td>
</tr>
<tr>
<td>Kaplan University</td>
<td>68,200</td>
<td>47%</td>
</tr>
<tr>
<td>DeVry</td>
<td>56,300</td>
<td>26%</td>
</tr>
<tr>
<td>Strayer University</td>
<td>54,300</td>
<td>25%</td>
</tr>
</tbody>
</table>

Top 5 sites by users

<table>
<thead>
<tr>
<th>Site</th>
<th>Users</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moodle.org</td>
<td>10,84,781</td>
<td>66</td>
</tr>
<tr>
<td>OU online</td>
<td>7,14,310</td>
<td>6,093</td>
</tr>
<tr>
<td>Hocmai.vn</td>
<td>5,73,752</td>
<td>132</td>
</tr>
<tr>
<td>AulaXXI</td>
<td>2,25,546</td>
<td>1,04,248</td>
</tr>
<tr>
<td>Christian Courses</td>
<td>2,15,676</td>
<td>195</td>
</tr>
<tr>
<td>Institution</td>
<td>Registered Users</td>
<td>Registered Users accessed in last 24 hours</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>American Public Education</td>
<td>53,600</td>
<td>49%</td>
</tr>
<tr>
<td>Bridgepoint Education</td>
<td>45,500</td>
<td>101%</td>
</tr>
<tr>
<td>Walden University</td>
<td>40,500</td>
<td>17%</td>
</tr>
<tr>
<td>UMassOnline</td>
<td>40,000</td>
<td>18%</td>
</tr>
<tr>
<td>Liberty University</td>
<td>36,200</td>
<td>15%</td>
</tr>
<tr>
<td>Education Management</td>
<td>34,800</td>
<td>54%</td>
</tr>
<tr>
<td>Capella Education</td>
<td>33,900</td>
<td>26%</td>
</tr>
<tr>
<td>Grand Canyon Education</td>
<td>32,600</td>
<td>53%</td>
</tr>
<tr>
<td>University of Maryland</td>
<td>30,400</td>
<td>17%</td>
</tr>
</tbody>
</table>


**Limitations**

Moodle is a dynamic learning environment; it is not an Internet publishing tool or a so called Content Management System (CMS). There are many open source CMS's available which provide some excellent options for maintaining a big site where users can add their own stories and comment on each other. Often they have so many possibilities that it makes them actually quite hard to use.

The problem with Moodle is that it lacks a lot of the features that CMS’s have. It especially misses the flexibility in allowing you to put certain things on the page in a certain location and turning particular blocks of information on or off (although this functionality is planned to be added in Moodle 2.0).

Another drawback is that Moodle is not visually oriented. It is not easy to work with pictures and keep on changing these. Although it technically is not impossible to add a picture in a forum message, it is highly impractical.

My suggestion then would be to create a good looking PR website with well laid out information and integrate Moodle’s interactive features into this site.

Finally, if you don’t want to use Moodle on your Internet site, consider using if for your intranet.

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Visualizing Internet Routing Changes

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Abstract :- Today’s Internet provides a global data delivery service to millions of end users and routing protocols play a critical role in this service. It is important to be able to identify and diagnose any problems occurring in Internet routing. However, the Internet’s sheer size makes this task difficult. One cannot easily extract out the most important or relevant routing information from the large amounts of data collected from multiple routers. To tackle this problem, we have developed Link-Rank, a tool to visualize Internet routing changes at the global scale. Link-Rank weighs links in a topological graph by the number of routes carried over each link and visually captures changes in link weights in the form of a topological graph with adjustable size. Using Link-Rank, network operators can easily observe important routing changes from massive amounts of routing data, discover otherwise unnoticed routing problems, understand the impact of topological events, and infer root causes of observed routing changes.

Index-Terms—Network visualization, information visualization, Internet routing, interactive graphics, data analysis, visual mining.

I. INTRODUCTION
TODAY’S Internet provides a global data delivery service to millions of end users. Network routing protocols play a critical role in this delivery service by steering data traffic toward their destinations. Effective diagnosis tools are imperative to enable network operators to identify routing problems in this global system. Several diagnosis tools, such as traceroute and BGPlay are available for analyzing routing changes regarding a single destination. However, a fiber cut may change the routes to a large number of destinations, resulting in significant network traffic movement which may, in turn, trigger routing dynamics in other areas. Thus, it is essential to be able to observe network routing changes at the Internet scale to understand the overall impact of a single topological event.

To this end, we have developed Link-Rank, a tool to visualize routing changes in the global Internet. Not only can a picture capture the meaning of “thousands of words,” but it can also lead to instant comprehension. However, a fundamental challenge facing the Link-Rank design is how to capture routing changes in a comprehensive visual picture, given the sheer size, the topological complexity, and the highly dynamic nature of the Internet routing system. Millions of routing updates are generated daily and there is no easy way to extract information about most important or most relevant routing changes. All the existing single destination diagnosis tools utilize a specific starting point and a given destination to trace the routing path or the path changes. To examine routing changes at large, however, one does not have a clear starting or ending point to focus on.

II. BACKGROUND OF INTER- NET ROUTING AND BORDER GATEWAY PROTOCOL

The Internet consists of a large number of networks called autonomous systems (AS). Each AS is assigned an AS number and contains one or multiple destination networks. Each destination network is represented by an IP address prefix. For example, the prefix 131.179.96.0/24 represents a network at UCLA and is part of AS 52 (UCLA’s AS number). As of March 2006, the Internet consists of more than 20,000 autonomous systems and more than 180,000 prefixes.
III. VISUALIZATION DESIGN

The fundamental objective of Link-Rank is to visualize routing changes. A major challenge we faced in this regard is scale, i.e., more than 180,000 destinations and 20,000 AS nodes. In addition, one has to deal with the large number of BGP updates.

3.1 Rank-Change Graph

The Link-Rank graph from an observation point weighs a link by the number of routes using that link. This notion of ranking a link with number of routes translates to the name Link-Rank. In the Internet, a single AS cannot see the complete Internet topology nor can it know the routes taken by all the other ASes. Thus, the weight associated with the edge in a Link-Rank graph is relative to the observation point and does not tell us how many total routes in the entire Internet use this link.

Fig. 5. Components of Link-Rank.

The thickness of the edges in the Rank-change graph represents the magnitude of weight change. With links of varying thickness, one can easily spot links with high losses or gains. In addition to varying the edge thickness, the size of the nodes varies based on the amount of weight change of edges and the number of such edges adjacent to it. This scaling of nodes helps to identify ASs with high routing activity.

3.2 Components of Link-Rank

The three components of the Link-Rank tool are shown in Fig. 5. An important component is the input filter block that controls when the Rank-change graphs are constructed. In Fig. 3, we saw the Rank-change graph for a single route change. In reality, input filters are needed to enable Link-Rank to scale in regard to topology size and number of BGP updates. One input filter involves picking a specific set of prefixes and examining the routing changes for these prefixes. Another input filter is a threshold-based scheme and is the filter used in all our case studies explained later in this paper. In this threshold-based scheme, we maintain the instantaneous link weight for each link in the topology seen by an observation point. In addition, we maintain the change in weight since the last Rank-change graph was generated. The link weight, as well as the change in weight, is updated for all links affected by each BGP update message. A Rank-change graph is generated when the weight of any link changes by more than a preset threshold (default is 50).

3.3 Activity Plots: Summarizing Weight Changes

Activity plots summarize routing changes represented by Rank-change graphs along the time dimension. An activity plot is a series of red and green bars on alternate sides of a horizontal axis of time. With an activity plot, a user can identify time periods of high routing activity and then investigate those specific periods in more detail. We first explain how a single activity bar is plotted. Fig. 6 shows a Rank-change graph similar to Fig. 2. Given a Rank-change graph, we first find the total gain and total loss by adding the weight changes of the green and red links, respectively. In this case, the total rank gain is 200 (100 each on links (44,33) and (33,55)) and the total rank loss is 100. We plot red and green bars proportional to the total loss and gain, respectively, as shown in Fig. 6. In this case, the green bar is longer than the red bar. A higher gain (green) than loss (red) could be due to a combination of longer new paths as in Fig. 6 and new routes being announced.
IV. DISCOVERY AND ANALYSIS USING LINK-RANK

In this section, we use examples to show how Link-Rank can be used to discover and analyze routing events.

4.1 Case I: Capturing Link Instabilities

Around March 2005, AS 7018 showed a lot of heavy activity, as shown in the second activity plot (router IP 12.0.1.63) in Fig. 10 showing activity for a period of one week. One task of the network operator is to find out whether this activity is because of a problem within AS 7018 or a problem beyond AS 7018. Another question to be answered is whether the entire activity is due to the same event or different events. We drilled down the activity from one week to a one hour period on 9 March 2005 shown in Fig. 11. Note, from Fig. 11 showing activity over one hour, that a Rank-change graph was generated almost every minute.

4.2 Case II: Root-Cause Identification

Root cause identification involves inferring the cause of an observed set of routing updates. For Case II, we picked a case where activity plots of many observation points showed spikes around the same time. Fig. 13 shows the activity plot of a few observation points from 18 October 2005 to 24 October 2005. One can easily spot spikes and dense activity in these plots from multiple observation points (around 21 October 2005).

4.3 Case III: Detecting and Visualizing Prefix Hijacking

Our final case study was picked in response to reports of routing problems on mailing lists and network operator forums. On 24 December 2004, customers of AS 6939 reported that they were unable to reach many Internet sites. However, the routing table from AS 6939 did not show any noticeable reduction in the number of entries, implying that routes were still reachable. If routes to all sites still existed, what else would have caused inability to reach the sites? By looking at activity plots, we saw a spike around the time of complaints, as shown in Fig. 16, an indication routing activity going on.
V. CONCLUSION

On the visualization front, we are exploring ways of improving the node layout in the Rank-change graph. Some users expressed the desire to assign position constraints to selected nodes in the Rank-change graphs. We also observed that users often repositioned nodes to separate the green paths from the red paths. Incorporating position constraints and color of edges as input to the layout algorithm are interesting directions for future work. Another direction to deal with denser graphs is to be able to bring a subgraph to the forefront. In particular, we are exploring the idea of selecting an AS and bringing its connected components to the forefront. Yet another line of work involves better distinction of contributions from each observation point.

VI. REFERENCES


Automatic Mesh Generation for Finite Element Analysis

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Abstract—Finite element method applied to the EMF problems has been extremely successful in solving magnetic field problems. In order to evaluate sequence reactance's, excitation requirements under short circuit and full load conditions, transient characteristics and eddy current effects in case of A.C Machines and commutation characteristics in D.C Machines the finite element technique and the subsequent result retrieval can be divided into three sections: preprocessing, processing and post-processing. Preprocessing involves the preparation of data such as nodal coordinates, connectivity, boundary conditions and loading material information. Processors are programs for constructing the system algebraic equations. Post-processing is the activity of converting mathematical solutions into engineering result.

Key Words: Node; triangulation; adaptive mesh generation.

I. INTRODUCTION

Finite element method is a numerical analysis Technique for obtaining approximate solution to wide variety of engineering problems. In this method of analysis complex region defining continuous is discretized into simple geometry shapes called finite elements. The finite element method envisions solution region as build up of many small interconnected sub regions or elements. A finite element model of a problem gives a piecewise approximations to the governing equations.

Finite element method was originally developed for the analysis of aircraft structure. However general nature of its theory make it applicable to wide variety boundary value problems in engineering. Applications of FEM can be divided into three categories depending upon boundary value problems:

1. Steady State Problems.
2. Eigen Value Problems.
3. Propagation or Transient Problems.

II. FINITE ELEMENT METHOD IN ELECTRICAL ENGINEERING

In order to evaluate sequence reactance’s, excitation requirements under short circuit conditions, transient characteristics and eddy current effects in case of A.C Machines, iron and stray load losses, load regulation and commutation characteristics in D.C Machines, insulation strength and dielectric withstand of surge voltages of various parts of electric machinery, it is imperative that electric and magnetic effects under various conditions are predicted accurately (Silvester & Ferrari, 1980).

Of all the numerical methods in present day use the most successful method appears to be that of finite element method which provides a stable sequential methodology to discretize and solve for models with quite complex shapes (Kaur, 1999). The finite element technique and its subsequent result retrieval can be divided into three sections:

- Preprocessing
- Processing
- Postprocessing

III. PREPROCESSING

Preprocessing involves the preparation of data such as nodal coordinates, connectivity, boundary conditions and loading material information. A major step in preprocessing consists of describing the geometric shapes and size of the object or situation to be analyzed and stating how the object is to be discretized for purpose of analysis.

IV. PROCESSING

Solvers are programs for constructing the system algebraic equations which model the physical situation mathematically and produces solution.
V. POSTPROCESSING

Postprocessing is the activity of converting mathematical solutions into engineering results. Various operations required in a selection of postprocessing tasks, in attempt to exhibit unity in the processing requirements that underlie the great diversity of application needs.

VI. AUTOMATIC MESH GENERATION

Automatic mesh generation is basically a part of the refinement algorithm. In automatic mesh generation the user supplies the input data plus accuracy parameter and the algorithm shall generate adaptively an optimal mesh that achieves the desired accuracy (Weatherill and Hassan (1994). Where in it shall be possible to add points to the mesh recursively and also to refine mesh anywhere without producing elements of distorted shapes. Adaptive finite coupling of two different methods, viz mesh generation and error analysis. If this is done automatically without user intervention, the process is called Self-Adaptive.

To start the problem to be analyzed is described by very crude finite elements mesh, and a rough solution is produced. Error estimates are made for this solution and a new more refined mesh is produced.

The main steps in automatic meshing consists of:

- Node Generation
- Formation Of Elements
- Mesh Optimization
- Mesh Refinement

VII. NODE GENERATION

In continuum problem of any dimension, the field variable possess infinitely values, because it is a function of each generic point in the body or sub region. Consequently the problem is one with an infinite numbers of unknown. The approximating functions to estimate unknowns are defined in terms of value of field variables at specified points called nodal points. Nodes usually lie on the element boundaries where adjacent elements are considered to be connected. Node points should be placed in region wherever values of variables are sought or specified. Nodes should be more closely spaced in region where the variable parameters is expected to vary rapidly.

VIII. FORMATION OF ELEMENTS

The discretization of the continuum region into elements reduces the number of unknown values to finite number of unknowns and by expressing the unknown field variable in terms of assumed approximating functions within each elements. Triangularization of given domain can be done either by Automatic point creation or by Incorporating voids in given domain. For mesh generation the boundary of domain is defined by the points associated connectivities (Boender, 1994). Consider boundary line segment on which points have been distributed which encloses a domain. It is required to distribute points within region so as to construct a smooth distribution of points. For each point on boundary a typical length of scale for the point can be calculated as average of the two lengths of the connected edges. No point should be placed within a distance comparable to defined length scale since it would inevitably define a badly formed triangles. Hence for each point it is appropriate to define region T(i) within which no interior point should be placed. So points can be placed anywhere within the interior but not inside any of region T(i) already identified. Hence points are placed at the centroid of each of formed triangles and then rest is performed to determine if any of points lie within any of T(i) must be rejected. Once a point has been inserted, it too must have associated with it length scale which defines an effective region T(i) for point exclusion (Boender, 1994). A newly inserted point takes a length scale from interpolation of length scales from nodes which form the triangle. In this way a smooth transition between boundaries of interior points can be insured. This process of point insertion continues until no point can be added because the union of all T(i) covers the entire interior domain.

The details of the implementation of this procedure in 2-D are:

1) Compute the point distribution function for each boundary point \( r(o) = (x,y) \) i.e. for the point dpq \( \sum \frac{[ r(i) – r(o) ]}{|r(o)|} \) where it is assumed that point o is surrounded by m points \( i = 1, M \).
2) Generate Delaunay triangularization of boundary points.
3) Initialize the number of interior field point created, \( N = 0 \).
4) For all the triangles within the domain:
   a. Define a prospective point Q to be centroid of the triangle.
   b. Derive point distribution, dpq for the point Q, by interpolating the point distribution function from the nodes of triangles, m = 1, 2, 3.
   c. Compute the distance dm, m = 1, 2, 3 from prospective point Q to each of three points of triangle.
   d. If \( \{ dm < \alpha*dpq \} \) for any m = 1,2,3 then reject point; return to beginning of step 4.
   e. If \( \{ dm > \alpha*dpq \} \) for all m = 1,2,3 then compute the distance \( \text{sj} \), \( j = 1,2,3 \) from the prospective point Q to other points to be inserted, \( \text{pj} \), \( j = 1, \ldots, N \).
   f. If \( \{ \text{sj} < \beta*dpq \} \) then then reject point; return to beginning of step 4.
   g. If \( \{ \text{sj} > \beta*dpq \} \) then accept the point Q.
for insertion by Delaunay triangulation algorithm and include Q in the list \( P_j \), \( j = 1 \ldots N \).

h. Assign the interpolated value of the point distribution function, \( dpq \) to the new node, \( P_n \).

i. Select the next triangles if \( N = 0 \).

5) Perform Delaunay triangulation of
   a. derived points, \( P_j \), \( j = 1 \ldots N \).
   b. Go to step 3.

6) Smooth the mesh.

The coefficient \( \alpha \) controls the grid point density by changing the allowable shape of all triangles and \( \beta \) has influence on the triangulation by not allowing points within specified distances of each other to be inserted in the same sweep of the triangles within the field.

IX. MESH OPTIMIZATION

Nodes have been generated at the centroid of each triangle are called prospective points, as it is not sure whether they will be accepted or rejected. So dual pass method i.e is \( \alpha \) criterion and \( \beta \) criterion is used to filter out some of these prospective points.

X. MESH REFINEMENT

Mesh quality is an important condition for FEM mesh to ensure that good FEM approximation to the sought solution is calculated. The first essential condition is that the distortion \( D \) of the elements measured by the ratio of element size \( H \) and the radius \( R \) of the largest ball in the element. The distortion should be smaller than 5.

Triangular elements are optimum for use as finite elements when they are equilateral in shape. In order to obtain an accurate solution with an efficient use of nodes it is therefore necessary that the adapted refinement procedure avoids the generation of thin elements, especially those close to 180 degrees.

In the past the Delaunay’s algorithm has been the approached use to regenerate the mesh after each refinement step. For elements close to material boundaries this method will not guarantee the removal of thin elements (Boender, 1994; Zienkiewicz and Talyor, 1997). It has therefore has been suggested nodes be selectively added to the mesh after the error refinement stage, in conjunction with Delaunay’s algorithm, so as to maintain the smallest angle above as seed node, which corresponds to the mid point of the longest side. Furthermore, in the adaptive finite element setting the availability of mesh refinement algorithm capable of modifying the mesh in course computations is critical aspect of entire numerical solution process.

XI. RESULTS

![Fig 2. Input Domain for Triangulation](image1)

![Fig 3. Triangulation of given Domain after Second Run](image2)

![Fig 4. Final Triangulation Of Given Domain](image3)

XII. CONCLUSIONS

The development of advance technologies and the increase in dimensions and costs of many engineering systems have made necessary a parallel development of more general and accurate computation technique. It has become increasingly important to obtain a deeper knowledge of the spatial distribution of vector and tensor fields, either for improved accuracy in evaluating integral parameters or to determine and localize maximum values which generally denote critical stress conditions in materials.

The most successful numerical method appears to be that of...
finite element method. Which provides a stable sequential methodology to discretise and solve for models with quite complex shapes. The normal procedure is to use the differential form of governing equations by applying variation or Galerkin weighted residual method, which in turn leads to an algebraic system of equations characterized by a large sparse matrix. The variation method consists of formulating the partial differential equations of field problems in terms of variational expression called the energy functional. In most engineering applications, this expression can be identified with stored energy in systems in general the euler equation of this functional will yield original differential equation. The minimization of energy functional is implemented in the finite element method, whereby the potential function approximating the true solution is discrete into subregions of field region.

So the user supplies the input data plus an accuracy parameter and the algorithm shall generate adaptively an optimal mesh that achieves the desired accuracy. Its also possible to add points to mesh recursively and also to refine the mesh anywhere without producing elements of distorted shape. This is important because the error introduced into finite elements solution is very much related to the size and distribution of elements in mesh. The commercially available programs makes no attempt to estimate this errors, therefore production of good finite elements, meshes remains a very much related to the art of use where experience and familiarity plays a large part.

XIII. REFERENCES
Bit Error Rate Comparison in MIMO-OFDM Using Simulink

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Abstract- The demand of different multimedia services and different internet supported applications on mobile devices requires a high speed data rate and good service of quality[1]. This paper describes a brief overview of MIMO-OFDM antenna system using SIMULINK. In this paper the Bit Error Rate (BER) were compared for MIMO OFDM system using different number of antennas at the transmitter and receiver, the simulation results shows that the BER improved to agreeable value when the number of antennas increased on the transmitter and receiver side. From the simulation results it is concluded that BER performance of 4 Tx-4 Rx antenna system > BER performance of 2 Tx-2 Rx antenna system > BER performance of 1Tx-1Rx antenna system. By improving the BER, we will get the better Quality of Service.

Keywords: MIMO; OFDM; BER.

1 INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) is a promising technique to perform multicarrier modulation with maximum utilization of bandwidth and high performance characteristics profile against fading in multipath communication. On the other hand, MIMO (Multiple Input and Multiple Output) in combination with other schemes which can increase capacity, reliability, support to internet services and multimedia application. MIMO with OFDM reduces the equalization complexities by transmitting different data on different frequency levels to gain spectral efficiency and error recovery features, which will offer high spatial rate by transmitting data on multiple antennas and transmission in Non-Line-of sight (NLOS). Thus the MIMO-OFDM technique is used to achieve diversity[5]. The MIMO-OFDM is the reproductive and highly famous services for Wireless broad band access. The combination of MIMO and OFDM accumulates the purpose of each and every scheme that will provide the high throughput. The block diagram of MIMO-OFDM system is shown in figure.

II. SIMULATION MODELS

The simulation model includes Bernoulli Binary Generator which is used to generate information signal appropriate with the standard for MIMO from SIMULINK library. Then the data goes to IFFT block which acts as serial to parallel converter. The signal is then modulated using QPSK modulation technique. Then the stream of data passing through Rayleigh channel is converted to serial data by FFT block. Then serial data is converted to frame format and demodulated by QAM demodulation block.
The BER is calculated for varying Eb/No by using BER calculation block as shown in figure1.

Then the simulation is performed by using two transmitting and two Receiving antennas. The system includes demultiplexing the single bit stream into two streams by using a demultiplexer. Then each stream is modulated, converted to parallel form by IFFT and transmitted independently to the receiver. At the receiving end data is again multiplexed by using a multiplexer. Then the data is converted into serial form by using FFT. The Bit Error Rate is calculated for varying Eb/No by using BER calculation block as shown in Figure3. Then the graph is plotted between Eb/No and Bit Error Rate for different number of transmitter and receiver.

III RESULTS

Figure 5 indicate the results for 1 Tx-1 Rx MIMO systems. The BER is improved by increasing the number of antennas on the receiver side. Because higher of the number of receivers can receive multiple copies of transmitted information from transmitter and result is in higher diversity order.

The minimum BER is 0.55.

For 2x2 MIMO systems the simulation is performed which is shown in figure 6. From the figure 6 we can see that the simulated result of 2x2 MIMO systems is much better than SISO system. The BER is improved versus signal to noise ratio. This is done by increasing the number of antennas on the receiver side. The bit error rate for simulated 2x2 MIMO systems is goes down from 0.55 to 0.52.
For the 4x4 MIMO systems the simulation is performed which is computed in figure 7. From the figure 7 we can see that the simulated result of the 4x4 MIMO systems is better than 2x2 MIMO system. As we have increased the number of antennas on the receiving side the BER improved to agreeable value. It is clear from the figure that the bit error rate comes down from 0.55 to 0.50. So we can conclude that when we increasing the number of receivers the BER also improved.

Then all the results are compared as shown in figure 8. From the simulation results it is concluded that: BER performance of 4 Tx-4 Rx system > BER performance of 2 Tx-2 Rx system > BER performance of 1Tx-1Rx.

It is very clear from the results that as number of antennas are increasing on receiver side the BER is largely improve, for increment in number of antenna at transmitter side also play important role in improvement of BER. In figure 8 the comparison is shown of the three simulated results which can be seen that the BER performance of the higher number of antennas on the receiver side is much better than the lesser antennas.

IV CONCLUSION

The paper gives an overview of the MIMO-OFDM systems and discusses their benefits enabling an increase in the system capacity and an increase of system reliability. It provides a higher throughput and a wider coverage range to its users. We compared the performance of the system using both SISO and MIMO technologies and find that the Bit Error Rate decreases as the number of transmitting and receiving antennas is increased. From the simulation results it is concluded that: BER performance of 4 Tx-4 Rx system > BER performance of 2 Tx-2 Rx system > BER performance of 1Tx-1Rx.

V REFERENCES

TECHNICAL SESSION – II
Developments and Challenges in Optical Wireless Communication Systems

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Abstract: Optical wireless communications offer a viable alternative to radio frequency (RF) communication for indoor use and other applications where high performance links are needed. These systems use infrared technology (IR), which has significant advantages over RF. Both, radio frequency (RF) and infrared (IR) radiation are possible options in implementing wireless systems. Unfortunately, the RF can support only limited bandwidth because of restricted spectrum availability and interference; while this restriction does not apply to IR. Thus, optical wireless (IR) technology seems to be ideal for wireless communication systems of the future. This paper presents a review of the most significant issues related to infrared communication technology, which will enable the realization of future high performance and cost-effective indoor optical wireless systems. Several possible configurations for indoor optical wireless systems are presented as well as their advantages and limitations discussed.

KEY WORDS: Optical Communication; Wireless Communication; Infrared (IR) Technology; Radio Frequency (RF); WLAN; Optical Sources; Optical Detectors.

I. INTRODUCTION

The number of personal computers and personal digital assistants for indoor use are rapidly growing in offices, manufacturing floors, shopping areas and warehouses. In near future, one will find very often several such devices clustered within small indoor areas. This will result in the need for flexible interconnection through the distributed or centralized data communication systems. The traditional way to meet this requirement is to use wired physical connections. But, wired physical connections have some inherent problems, in setting up and in its expansion. Further, these need more space, time to setup, monetary investment in copper, maintenance etc. Wireless systems offer an attractive alternative.

Optical wireless (IR) technology for wireless communication systems can provide cable free communication at very high bit rates (a few Gbps as compared to tens of Mbps supported by radio). In indoor optical wireless systems, laser diodes (LDs) or light emitting diodes (LEDs) are used as transmitter and photo-diodes as the receivers for optical signals. These opto-electronic devices are cheaper as compared to RF-diodes as well as wireline systems. Further, IR transmission does not interfere with existing RF systems and is not governed by Federal Communications Commission (FCC) regulations. The IR signal does not penetrate walls, thus providing a degree of privacy within the office area. In addition to privacy, this feature of IR systems makes it easier to build a cell-based network. For example, in an office building each room would be a cell and there would be no interference between the cells. Therefore, all units can be identical in a cellular architecture as compared to RF configuration in which the operating frequencies of neighbouring cells have to be different. Due to the above reasons, optical wireless systems are becoming more popular in various operating environments, such as houses (consumer electronics), offices, medical facilities, manufacturing plants, and business establishments.

Although infrared offers significant advantages as a medium for indoor communication, it also has drawbacks. Several aspects impair the performance of indoor IR transmission systems. Some of the causes of impairments are: i) speed limitations of the opto-electronic devices, ii) high path losses leading to the requirement of higher transmission power levels, iii) multipath dispersion, iv) receiver noise, v) shot noise induced by the background ambient light, and vi) the interference induced by the artificial light sources. The concern of eye safety and power consumption limits the average transmitter power. For these reasons, the indoor optical wireless systems are not easy to design and hence new design solutions need to be explored. In this paper, current status and research trends in optical wireless communications has been studied, with main focus on indoor optical wireless (IR) systems.

II. INDOOR OPTICAL WIRELESS SYSTEMS

System Overview

Since the late 1970’s, significant research has been done on the applications of optical wireless (IR) technology to high-speed indoor data communications; this is still an active area of research. Also, in the past several years, extensive effort
has been devoted to understanding and implementing optical wireless technique for long distance inter-satellite systems (outdoor applications). But it is the indoor applications that are the driving force behind optical wireless. The first indoor optical wireless system was developed in 1979. This system used the infrared radiation which was spread in all directions. Such systems are called diffused infrared systems. Since then several products using IR radiation have been successfully commercialized. The advancement of inexpensive opto-electronic devices, such as LEDs and LDs, p-intrinsic-n (PIN) photo-diodes and avalanche photo-diodes (APDs) and various optical components, has resulted in the improvement of these systems. Indoor optical wireless systems have been used in many applications in the past few years, ranging from simple remote controls in home to more complex wireless local area networks. Many other applications are envisaged for the future, including data networking in the indoor environment and the delivery of broadband multimedia services to mobile users within such an environment together with general connectivity to base networks. Several companies have introduced data communication products using optical wireless technology and many other computer communication products are entering the market.

An Indoor Optical Wireless System
A block diagram of a typical indoor optical wireless system is illustrated in Fig.1. A basic optical wireless system consists of a transmitter (using LEDs or LDs), free space as the propagation medium and the receiver (using APDs or PIN diodes). Information, typically in the form of digital data, is input to electronic circuitry that modulates the transmitting light source (LEDs/LDs). The source output passes through an optical system (typically has telescope and optical diplexer) into the free space (propagation medium). The received signal also comes through the optical system and passes along the optical signal detectors (PIN diodes/APDs) and thereafter to signal processing electronics. The wavelength band from 780nm to 950nm is the best choice for indoor optical wireless systems. In this range, low cost LEDs and LDs are readily available. Also, this band coincides with the peak responsivity of inexpensive, low-capacitance silicon photodiodes. The optical wireless system uses IR technology in which links are based on intensity modulation and direct detection (IM/DD) of the optical carrier. Intensity modulation is performed by varying the drive current of LED or LD (direct modulation). Direct detection is performed by PIN photo-diodes or APDs which produce an electric current proportional to the incident optical power.

Transmitter: For indoor optical wireless transmitter, LDs are preferable over LEDs because they have higher optical power outputs, broader modulation bandwidths and linear electrical to optical signal conversion characteristics. Linearity in signal conversion is particularly important when sophisticated modulation schemes such as multi-subcarrier modulation or multilevel signaling are used. But due to safety reasons (eye safety) laser diode cannot be used directly for the indoor IR systems, where radiation can enter a human eye quite easily. LDs are highly directional radiation sources and can deliver very high power within a small area on the retina thereby resulting in permanent blindness. On the other hand, LEDs are large-area emitters and thus can be operated safely at relatively higher powers. They are also less expensive and more reliable. Consequently, LEDs are the preferred light source for most indoor applications. To compensate for the lower powers, array of LEDs can be used. However, LEDs cannot be used beyond 100 Mbps due to the limitations imposed by the mechanism by which they emit light, whereas LDs can be used for transmission at bit rates of the order of a few Gbps.

Propagation Medium: Like any wireless system, the link power budget for an optical wireless system is strongly dependent on atmospheric loss along the path of the propagation. Since indoor atmosphere is free of environmental degradation, such as mist, fog, particulate matter, clouds etc., indoor optical wireless systems encounter only free space loss and signal fading.

Free Space Loss: It is that part of the transmitted power, which is lost or not captured by the receiver’s aperture (Fig.2). A typical figure for a point-to-point system that operates with a slightly diverging beam would be 20dB,
whereas an indoor system using a wide-angle beam could have a free space loss of 40dB or more.

Signal Fading: This can be observed in both indoor and outdoor optical wireless systems. The reason for this is reception of signals via different paths by the receiver. Some of these interfere destructively (i.e. they are out of phase) so that the received signal power effectively decreases. This type of degradation is also known as multi-path signal fading.

Receiver: As mentioned earlier, there are two basic detectors; the PIN diodes and the APDs. PIN receivers are commonly used due to their lower cost, tolerance to wide temperature fluctuations and operation with an inexpensive low-bias voltage power supply. PIN receivers are about 10 to 15 dB less sensitive than APD receivers. Increasing the transmitter power and using larger receiver lens diameter can compensate the reduced sensitivity of these receivers. On the other hand, the increased power margin afforded by the APDs provides a more robust communication link, which reduces the criticality of accurate aiming of lenses. This allows in reduction of transmitter power. In addition to this, the better internal gain of APDs increases the Signal-to-Noise Ratio (SNR). However, the APD receivers are costly and need high operating voltages.

III. TRANSMISSION TECHNIQUES

Several transmission techniques are possible for indoor optical wireless systems; these techniques may be classified according to the degree of directionality of transmitter and receiver. A transmitter and receiver may have a narrow or broad radiation pattern or field of view (FOV) and can be combined to make directed, non-directed, or hybrid systems.

Directed beam infrared (DBIR) radiation
In DBIR system, the optical beam travels directly without any reflection from the transmitter to the receiver. The optical wireless link using this technique is established between two fixed data terminals with highly directional transmitter and receiver at both ends of the link. As there is no mobility, the beam aperture angle and the FOV of the transmitter and the receiver respectively can be reduced. As a result, this technique of infrared transmission minimizes path loss and maximizes power efficiency and systems using this technique can achieve higher transmission rates. The main drawback of this technique is the lack of mobility, and susceptibility to blocking by personnel and machines. The narrow beams also create pointing problems. The beam-width should be chosen such that any inexperienced operator should be able to manually aim the transmitter towards the receiver unit.

Diffuse infrared (DFIR) radiation
In DFIR system, the transmitters send optical signals in a wide angle to the ceiling and after one or several reflections the signals arrive at the receivers. This is the most desirable configuration from a users’ point of view, since no alignment is required prior to use, and the systems do not require a line-of-sight path for transmission. However, systems using this technique have a higher path loss than their DBIR counterparts, requiring higher transmitter power levels and receivers with larger light collection area. Another challenging problem in this technique is the multipath dispersion. When a short duration pulse is transmitted in a wide angle, it travels through multiple paths, resulting in a broadened pulse. This effect is known as multipath dispersion. This causes inter-symbol- interference (ISI) at higher data rates or in larger cell system. In this configuration, the data rate depends on the room size and the reflection coefficients of the surfaces inside the room.

IV. DESIGN CHALLENGES

Achieving a high electrical signal to noise ratio (SNR) is the single biggest problem facing the designer of an infrared system. The difficulty arises due to two reasons. Firstly, the SNR of an IM/DD system depends upon the square of the average power of the received optical signal. This implies that one should transmit at relatively higher power levels, even though available transmitter power may be limited due to considerations of eye safety regulations and power consumption. It also implies that one should design the system to minimize path loss, and employ a receiver having a large light-collection area. Secondly, in many environments there exists intense ambient infrared noise, which introduces white shot noise and low-frequency cyclostationary noise into the receiver. Besides ambient noise, the bandwidth of wireless infrared systems is also limited due to inter-symbol interference produced by the multipath dispersion of the optical channel. Thus the eye safety requirement, power consumption of portable devices, interference from ambient light sources and multipath characteristics of the channel for diffused radiation mainly limit the data transfer rate with indoor optical wireless systems.

Eye Safety
Eye safety consideration puts limit on the amount of optical power that should be emitted by the transmitter, thus limiting the coverage of an optical wireless system. Both indoor and outdoor optical wireless systems can pose a hazard if LDs are operated at high output power. The eye safety standards are set by International Electro-technical Commission (IEC), where LDs are classified based on their total emitted power. They dictate that all transmitters must
be eye safe under all conditions and launch power must not exceed 0.5 mW for the systems employing laser sources. Some LDs operating safe by passing their beam through a transmissive diffuser, such as a thin plate of translucent plastic. Efficiencies of about 70 percent can be achieved by using such type of diffusers. Computer-generated holograms (CGHs) offer a means to generate arbitrary radiation patterns with efficiencies approaching 100 percent. These holograms break up the wave front of the optical beam in a designated pattern. This diffuses the image of the laser-spot on the retina of the eye.

Interference from ambient light sources
The dominant source of noise in indoor optical wireless systems is ambient light, which is typically a combination of fluorescent light, sunlight, and incandescent light. All three modes of infrared propagation suffer from the presence of ambient light. The illumination sources of indoor environments radiate in the same wavelengths as the infrared data signal. Also, typical intensity levels of the ambient light collected at the photo detector are usually much higher than data signal intensity levels. Ambient light provokes shot noise due to the random nature of the photo-detection process. Moreover, artificial light provokes interference due to periodic variations of light intensity. These variations can occur at a frequency double the power line frequency, and at the switching frequency of electronic ballasts of the fluorescent lamps. In general, for low and moderate data rates the ambient noise is the main factor degrading the performance of wireless IR systems.

Multipath characteristics of the channel for diffused radiation
Channel dispersion associated with multipath propagation is another major issue in indoor optical wireless systems. A multipath phenomenon occurs when the transmitted signal follows different paths on its way to the receiver due to its reflection by walls, ceilings and other objects. Multipath phenomena can cause inter-symbol-interference (ISI). Diffusive systems are more prone to multipath effects than directed beam systems. This is because of their larger beam widths leading to more potential reflectors, and the larger FOV of their detectors resulting in more reflected light being detected. As the speed of transmission increases to 10 Mbps and beyond, the ISI caused by the multipath dispersion becomes a major degrading factor.

VI. CONCLUSIONS
The emergence of portable information terminals in work and living environment of future is expected to accelerate the introduction of high capacity wireless systems. Such portable terminals should have access to all the services that will be available on wired networks. Unlike their wired counterparts, portable devices are subject to severe limitations on power consumption, size, and weight. This paper has provided a review of the main issues associated with the physical layer of a wireless infrared communications system. It has highlighted the significant problems of high ambient light levels and restrictions on transmit power and discussed some of the techniques for mitigating these effects.

To summarize, there are three generic system configurations for indoor optical wireless applications, namely: directed beam infrared (DBIR), diffuse infrared (DFIR) and quasi-diffuse infrared (QDIR). There are no physical layer technological challenges in low speed-DBIR systems. The major concerns in these systems are at the protocol level and the commercial issues of achieving integration with existing computer architectures at sufficiently low cost for consumer acceptance. The design and implementation of other system configurations are more challenging. Cellular systems will typically require a holographic diffuser or other means of beam shaping to define the cell coverage. Typically, relatively large area detectors will be required at the receivers because any concentrator gain will be limited by field of view considerations. Thus, techniques for mitigating the large detector capacitance, such as bootstrapping may be used to achieve shot-noise limited operation at bit rates in excess of around 10 Mbps. DFIR systems provide the maximum scope in the market, but adaptive equalizers need to be used to support data rates in excess of 10-20 Mbps. To counter the high link losses, large transmit powers are needed, which require the use of extended sources or multiple point sources. At the receiver, hemispherical concentrators are used to collect the signal from a wide range of angles. QDIR systems offer the potential for extremely high bit rate transmission. Owing to the highly directive nature of the link, large optical concentration ratios can be exploited. This also allows relatively small area detectors to be used, as it will be the concentrator area that collects the signal.

Although, optical wireless products are already a commercial reality, they have yet to fully exploit all the potential benefits offered by the medium. The majority of these products comply with the international standards promoted by the IrDA for data rates up to 4 Mbps. At present, indoor optical wireless systems operating at data rates up to 4 Mbps are commercially available. With the recent standardization of a 16 Mbps data rate option called Very Fast Infrared (VFIR), optical wireless can be extended to the applications requiring connectivity beyond 4 Mbps. Hence infrared will play a significant role in future high-capacity indoor wireless systems.
VII. REFERENCES


Design and Simulation of MIMO-OFDM Transceiver System Using Different Modulation Schemes for Wireless Link

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Abstract:- Orthogonal Frequency Division Multiplexing (OFDM) is predicted to be implemented in future broadcasting and Wireless Local Area Network (WLAN) systems due to its robustness in transmitting a high data rate. With the rapid growth of digital communication in recent years, the need for high speed data transmission is increased. OFDM is a promising solution for achieving high data rates in mobile environment, due to its resistance to ISI, which is a common problem found in high speed data communication. A multiple-input multiple-output (MIMO) communication System combined with the orthogonal frequency division multiplexing (OFDM) modulation technique can achieve reliable high data rate transmission over broadband wireless channels. Differential M-ary Phase Shift Keying (Mary DPSK) modulation scheme such as Differential Quadrature Phase Shift Keying (DQPSK) in additive white Gaussian noise (AWGN) channel and multilevel quadrature amplitude modulation (M-QAM) in flat Rayleigh fading channel have been implemented in the proposed MIMO-OFDM.

Key words: OFDM; WLAN; MIMO-OFDM; MIMO-OFDM System Model; MIMO-OFDM Performance; BER; SNR.

1. INTRODUCTION

OFDM has become very popular since its inception. This is used in many communication systems. OFDM is one of the dominant techniques of present day wireless communication and also for future usage in mobile industries. The key requirements for future mobile communications include much higher peak data rate, spectrum efficiency, and user capacity in high mobility environments. It is necessary to notice that the spectrum efficiency advantages of OFDM are mainly achieved at an operation point of relative high SNR. This is a quite different from CDMA, which is mostly interference limited. Thus severe problem arises with the high frequency reuse factor of CDMA which may not be available for OFDM techniques. OFDM is a kind of Multi Carrier Transmission system where a single data stream is transmitted over a number of subcarriers. The performance analysis of this system for various modulation schemes under different noise channels is an important issue while choosing this for communication. OFDM is simply defined as a form of multi-carrier modulation where the carrier spacing is carefully selected so that each sub carrier is orthogonal to the other sub carriers. Two signals are orthogonal if their dot product is zero. That is, two signals are taken and multiplied together. If their integral over an interval is zero, then two signals are orthogonal in that interval. Orthogonality can be achieved by carefully selecting carrier spacing, such as letting the carrier spacing be equal to the reciprocal of the useful symbol period. As the sub carriers are orthogonal, the spectrum of each carrier has a null at the center frequency of each of the other carriers in the system. Orthogonal Frequency Division Multiplexing (OFDM) is a promising technique to perform multicarrier modulation with maximum utilization of bandwidth and high performance characteristics profile against fading in multipath communication. On the other hand, MIMO (Multiple Input and Multiple Output) in combination with other schemes which can increase capacity, reliability, support to internet services and multimedia application. MIMO with OFDM reduces the equalization complexities by transmitting different data on different frequency levels to gain spectral efficiency and error recovery features, which will offer high spatial rate by transmitting data on multiple antennas and transmission in Non-Line-of-sight (NLOS). Thus the MIMO-OFDM technique is used to achieve diversity. It will utilize the three basic parameters that
is frequency (OFDM), time (STC) and MIMO (Multiple Input Multiple Output) in spatial (MIMO). The MIMO-OFDM is the reproductive and highly famous services for Wireless broad band access. The combination of MIMO and OFDM accumulates the purpose of each and every scheme that will provide the high throughput.

Large-scale deployment of affordable, easy-to-use radio communication networks have given consumer the ability to be in continues contact. Mobile communication has gone through generations of evolution to bring enhanced and value-added features and services to consumers. Second generation (2G), 2.5G, and third generation (3G) standards of mobile systems are being deployed while efforts are ongoing toward the development and standardization of beyond 3G (B3G) systems and, ultimately, to the much talk about fourth generation (4G). Researchers are currently developing frameworks for future 4G networks. Different research programs, such as Mobile VCE, MIRAI, and DoCoMo, have their own visions on 4G features and implementations. Some key features (mainly from the users’ point of view) of 4G networks are stated as follows:

- High usability: anytime, anywhere, and with any technology
- Support for multimedia services at low transmission cost
- Personalization
- Integrated services

For satisfying this demand, one of the main issues is to choose a multiple access technology for efficient share of the available scarce bandwidth among a large number of users, which can offer higher data rate and cope with the harsh mobile environment. There are many indicators that make an OFDM-based scheme a strong candidate as multiple access technique for the next generation of downlink receivers. The main advantages of OFDM over other communication modes are that it solves the problem of Inter Symbol Interference (ISI), has high bandwidth efficiency, scalable to high data rates, flexible modulation scheme which can be made adaptive, good at minimizing the effects of time dispersion, no requirement of channel equalization, no need for phase lock of the local oscillators stem. Besides, OFDM is easier to implement than code division multiple access (CDMA) by small companies, as CDMA networks need more experienced engineers. Since the specification of next generation mobile systems not yet ratified and Mobile worldwide interoperability for microwave access (WiMAX) technology is expected to be included in the framework of the IMT-Advanced, this study aimed to provide a comprehensive study of the performance of 802.16e based OFDM. The performance evaluation was mainly concentrated on the effect of multipath channel on the PHY layer compare to Additive White Gaussian Noise (AWGN) channel for different modulation and code rate.

II. MODEL DESIGN OF MIMO-OFDM TRANSCEIVER

The MIMO-OFDM system is modeled using MATLAB/SIMULUNK to allow various parameters of the system to be varied and tested. The system model for MIMO-OFDM with M-PSK mapping is shown in Figure 1, representing the following blocks. M-PSK block can be replaced by M-QAM block for further comparison.

![Fig. 1. MIMO-OFDM Transceiver Block Diagram](image)

MIMO technology has attracted attention in wireless communications, because it offers significant increases in data throughput and link range without additional bandwidth or transmit power. It achieves this by higher spectral efficiency (more bits per second per hertz of bandwidth) and link reliability or diversity (reduced fading). Because of these properties, MIMO is an important part of modern wireless communication standards such as IEEE 802.11n (Wifi), 4G, 3GPP Long Term Evolution, WiMAX and HSPA+. MIMO technology is also starting to gain adoption in non-wireless communications systems. One example is the new home networking standard ITU-T G.9963, which defines a powerline communications system that uses MIMO techniques to transmit multiple signals over multiple AC wires (phase, neutral and ground).
**Binary source:** The random Bernoulli binary generator generates binary data that is frame based. In data output, 48 samples per frame are used, and data rate is 1 Mbps.

**Data mapping:** The input data stream is available serially, converted into parallel stream according to digital modulation scheme. The data is transmitted in parallel by assigning each data word to one carrier in the transmission. Once each subcarrier has been allocated symbols, they are phase mapped according to modulation scheme, which is then represented by a complex In-phase and Quadrature-phase (I-Q) vector. Consider QPSK mapping in M-PSK block of proposed model, which maps 2 bits per symbol into phase. Each combination of 2 bits of data corresponds to a unique I-Q vector. In M-PSK block, by changing bits per symbol, we can map the data for 8-PSK, 16-PSK etc. By moving to higher order constellation, it is possible to transmit more bits per symbol in parallel resulting in high speed communication.

**IFFT-Frequency domain to time domain conversion:** The IFFT converts frequency domain data into time domain signal and at the same time maintains the orthogonality of subcarriers. The real signal output can be generated by arranging conjugate subcarriers. In this stage, IFFT mapping, zero pad, and selector blocks are included. Zero pad block adds zeros to adjust the IFFT bin size of length L, as the number of subcarriers may be less than bin size. Selector block reorders the subcarriers. The IFFT bin setting implemented for complex OFDM signal for the given design. The IFFT block computes the Inverse Fast Fourier Transform (IFFT) of length L points, where L must be a power of 2.

**Modulation scheme:** It is one of the advantage of OFDM that different modulation scheme can be applied to each sub channel depends on channel condition, data rate, robustness, throughput and channel bandwidth. There could be different modulation scheme applied specified by complex number i.e. QPSK, 16 QAM, 64 QAM. Modulation to each sub channel can be made adaptive after getting information and estimation of channel at transmitter.

**Guard period:** The effect of ISI on an OFDM signal can be eliminated by the addition of a guard period at the start of each symbol. This guard period is a cyclic copy that extends the length of the symbol waveform. The guard period adds time overhead, decreasing the overall spectral efficiency of the system. Guard duration should be longer than channel delay spread. After the guard band has been added, the symbols are converted into serial form. One frame length duration $T = T_s + T_g$, where $T_s = NT$, $N =$ number of carriers. This is the OFDM base band signal, which can be up converted to required transmission frequency. An AWGN channel model is then applied to transmitted signal.

**III. BER FOR M-QAM**

Quadrature Amplitude Modulation (QAM) schemes like 16-QAM and 64-QAM are used in typical wireless digital communications and 256-QAM, 512-QAM, 1024-QAM are used in Wifi. At the modulator, the data bit stream is split into the in phase (I) and quadrature (Q) bit streams. The I and Q components together are mapped to complex symbols using Gray coding. The demodulator splits the complex symbols into I and Q components and puts them into a decision device (demapper), where they are demodulated independently against their respective decision boundaries.

**IV. SIMULATION RESULTS**

The performance of a data transmission system is usually analyzed and measured in terms of the probability of error at given bit rate and SNR. The parameter Eb/No, where Eb is bit energy and No is noise energy, is adjusted every time by changing noise in the designed channel. For particular Eb/No value, system is simulated and corresponding probability of error is noted. The proposed design is simulated with necessary parameter changes for QPSK and QAM. As shown in Fig. 3 and 4, if we go on increasing the Eb/No value, BER reduces. In comparison of BER performance for M-PSK, it is observed that use of a higher M-ary constellation is better for high capacity transmission but the drawback is that the points on constellation are closer which makes the transmission less robust to errors with same SNR. The MIMO-OFDM with
QAM simulation are analyzed for BER performance and compared with QPSK system simulation as shown in Fig. 4.

Fig. 3. BER versus Eb/No(dB) for MIMO-OFDM system using QAM modulation.

Fig. 3 shows the BER variation with respect to change in SNR for MIMO-OFDM system using QAM modulation. It has been observed that, initially BER is almost constant for increasing value of SNR. After that the value of BER decreases as SNR increased as shown. Finally, there is large reduction in the value of BER with respect to change in SNR value.

Fig. 4. BER versus Eb/No(dB) for MIMO-OFDM system using QPSK modulation.

Fig. 4 shows the BER variation with respect to change in SNR for MIMO-OFDM system using QPSK modulation. It has been observed that, initially BER reduces with a very large value for increasing value of SNR. After that the value of BER increases as SNR increased as shown. Finally, again, there is small reduction in the value of BER with respect to change in SNR value.

V. CONCLUSION

MIMO-OFDM is a powerful modulation technique used for high data rate, and is able to eliminate ISI. It is computationally efficient due to the use of FFT techniques to implement modulation and demodulation functions. The performance of MIMO-OFDM is tested for two digital modulation techniques namely QPSK and QAM using MATLAB/SIMULINK toolbox. MIMO-OFDM system with QPSK scheme is suitable for low capacity, short distance application. While the OFDM with higher M-ary modulation scheme is used for large capacity, long distance application at the cost of slight increase in Eb/No. The comparison of QPSK and QAM indicates that, BER is large in QPSK as compared to QAM and it generally depends on applications. We conclude that QAM modulated MIMO - OFDM system achieves better BER results than QPSK and other modulated MIMO - OFDM systems for the same bandwidth efficiency.

VI. REFERENCES


An Improved Threshold Value for Image Denoising Using Wavelet Transforms

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ABSTRACT: The denoising of a natural image suffered from some noise is a long established problem in signal or image processing field. Many image denoising techniques based on filtering and wavelet thresholding have been published in earlier research papers and each technique has its own assumptions, advantages and limitations. Image filtering and wavelet thresholding algorithms are applied on different image samples to eliminate noise which is either present in the image during capturing or injected into the image during transmission. This paper deals with Performance comparison of Median filter, Wiener filter, penalized thresholding, global thresholding and proposed thresholding in Image de-noising for Gaussian noise, Salt & Pepper noise.

Keywords: Wavelet-transform; MATLAB; Threshold function; Gaussian noise; Salt & Pepper noise; Median filter; Wiener Filter; PSNR.

I. INTRODUCTION

In several applications, it might be essential to analyze a given signal. The structure and features of the given signal may be better understood by transforming the data into another domain. There are several transforms available like the Fourier transform, Hilbert transform, wavelet transform, etc. However the Fourier transform gives only the frequency-amplitude representation of the raw signal. So we cannot use the Fourier transform in applications which require both time as well as frequency information at the same time. The Short Time Fourier Transform (STFT) was developed to overcome this drawback. The following equation can be used to compute a STFT.

\[
STFT(t, f) = \int [x(t) \cdot \omega^*(t - T)] \cdot e^{j2\pi ft} \, dt
\]

Where x(t) is the signal itself, \( \omega(t) \) is the window function and * is the complex conjugate.

It is different to the FT as it is computed for particular windows in time individually, rather than computing overall time (which can be alternatively thought of as an infinitely large window).

II. MEDIAN FILTER

The Median Filter is performed by taking the magnitude of all of the vectors within a mask and sorted according to the magnitudes. The pixel with the median magnitude is then used to replace the pixel studied. The Simple Median Filter has an advantage over the Mean filter since:

(a) Median of the data is taken instead of the mean of an image. The pixel with the median magnitude is then used to replace the pixel studied. The median of a set is more robust with respect to the presence of noise [12].

(b) Median is much less sensitive than the mean to extreme values (called outliers), therefore, median filtering is able to remove these outliers without reducing the sharpness of an image.

The median filter is given by -

\[
\text{Median filter}(x_1 \ldots x_N) = \text{Median}(|x_1|^2 \ldots \ldots |x_N|^2)
\]

III. WIENER FILTER

The goal of the Wiener filter is to filter out noise that has corrupted a signal. It is based on a statistical approach. Typical filters are designed for a desired frequency response. The Wiener filter approaches filtering from a different angle. One is assumed to have knowledge of the spectral properties of the original signal and the noise, and one seeks the LTI filter whose output would come as close to the original signal as possible. Wiener filters are characterized by the following:

Assumption: signal and (additive) noise are stationary linear random processes with known spectral characteristics.

Requirement: the filter must be physically realizable, i.e. causal (this requirement can be dropped, resulting in a non-causal solution).

Performance criteria: minimum mean-square error.

The Wiener filter is:

\[
G(u, v) = \frac{H^*(u, v)}{|H(u, v)|^2 Ps(u, v) + Pn(u, v))}
\]

Where

- H(u, v) = Degradation function
- H*(u, v) = Complex conjugate of degradation function
- Pn(u, v) = Power Spectral Density of Noise
- Ps(u, v) = Power Spectral Density of un-degraded image.
IV. WAVELET THRESHOLD DENOISING PRINCIPAL

In the wavelet domain, it can make the signal energy concentrate in a few large wavelet coefficients, while the noise energy is distributed throughout the wavelet domain. Therefore, by wavelet decomposition, the signal amplitude of the wavelet coefficients of magnitude greater than the noise factor, we can also say that the relatively large amplitude of the wavelet coefficients is mainly signal, while the relatively small amplitude coefficient is largely noise. Thus, by using threshold approach we can keep the signal coefficient, reducing most of the noise figure coefficient to zero. If its threshold is bigger than the specified threshold, it can be seen that this factor contains a signal component and is the result of both signal and noise, which shall be maintained, if its threshold is less than the specified threshold, it can be shown that this factor does not contain the signal component, but only the result of noise which should be filtered out [11]. The soft and hard threshold function method proposed by Donoho has been widely used in practice. In the hard threshold method, the wavelet coefficients processed by the threshold value have discontinuous point on the threshold $\lambda$ and $-\lambda$, which may cause Gibbs shock to the useful reconstructed signal. In the soft-thresholding method, its continuity is good, but when the wavelet coefficients are greater than the threshold value, there will be a constant bias between the wavelet coefficients that have been processed and the original wavelet coefficients, making it impossible to maintain the original features of the images effectively.

V. GLOBAL THRESHOLD FUNCTION

After several decades of research & development, it has been found that shrinkage function is of many types, such as, soft shrinkage function, hard shrinkage function[3], firm shrinkage function[4], hyper-trim shrinkage function[5], multi-parameter best basis thresholding shrinkage function[6], Yasser shrinkage function [7]. All these thresholds and shrinkage functions promoted the application of wavelets in signal denoising extremely. The soft- and hard-thresholding schemes are defined by:

Hard-Thresholding:

The Hard-Thresholding function keeps the input if it is larger than the threshold; otherwise, it is set to zero. It is described as:

$$W_{j,k}^* = \begin{cases} w_{j,k}, & |w_{j,k}| \geq \lambda \\ 0, & |w_{j,k}| < \lambda \end{cases} \quad \text{(1)}$$

Soft- thresholding:

The soft-thresholding function has a somewhat different rule from the hard-thresholding function. It shrinks the wavelet coefficients whose values are less than threshold value, and keeps the wavelet coefficients whose values are larger than threshold value [8], which is the reason why it is also called the wavelet shrinkage function.

$$W_{j,k}^* = \begin{cases} \text{sgn}(w_{j,k})(|w_{j,k}|-\lambda), & |w_{j,k}| \geq \lambda \\ 0, & |w_{j,k}| < \lambda \end{cases} \quad \text{(2)}$$

Where $\text{sgn}(\cdot)$ is a sign function, $w_{j,k}$ stands for wavelet coefficients, $w_{j,k}^*$ stands for wavelet coefficients after treatment, $\lambda$ stands for threshold value and it can be expressed as follows:

$$\lambda = \sigma \sqrt{2 \ln(N)} \quad \text{(3)}$$

$$\sigma = \text{median}(|c|)/0.6745 \quad \text{(4)}$$

where $N$ is the image size, $\sigma$ is the standard deviation of the additive noise and $c$ is the detail coefficient of wavelet transform.

The soft-thresholding rule is chosen over hard-thresholding, for the soft-thresholding method yields more visually pleasant images over hard thresholding.

VI. PENALIZED THRESHOLDING

In this, the value of threshold is obtained by a wavelet coefficients selection rule using a penalization method provided by Birge-Massart.

MATLAB code for Penalized Threshold

```matlab
THR=wbmpen(C, L, Sigma, Alpha)
```

Where

[C,L] is the wavelet decomposition structure of the signal or image to be de-noised.

SIGMA is the standard deviation of the zero mean Gaussian white noise in de-noising model (see wnoisest for more information).

ALPHA is a tuning parameter for the penalty term. It must be a real number greater than 1. The sparsity of the wavelet representation of the de-noised signal or image grows with ALPHA. Typically ALPHA = 2.
VII. PROPOSED THRESHOLD
Finding an optimized value ($\lambda$) for threshold is a major problem. A small threshold will surpass all the noise coefficients so the denoised signal is still noisy. Conversely a large threshold value makes more number of coefficients as zero which leads to smooth signal and destroys details that may cause blur and artifacts [11]. So, optimum threshold value should be found out, which is adaptive to different sub band characteristics. Here we select an efficient threshold value for different types of noise to get high value of PSNR as compared to previously explained methods.

The threshold value which we are using here is 55 (Using heat and trial method).

VIII. IMAGE NOISE
Image noise is the random variation of brightness or color information in images produced by the sensor and circuitry of a scanner or digital camera. Image noise can also originate in film grain and in the unavoidable shot noise of an ideal photon detector [9]. Image noise is generally regarded as an undesirable by-product of image capture. Although these unwanted fluctuations became known as "noise" by analogy with unwanted sound they are inaudible and actually beneficial in some applications, such as dithering. The types of noise which are mostly present in images are:-

Gaussian noise:
The standard model of amplifier noise is additive, Gaussian, independent at each pixel and independent of the signal intensity. In color cameras where more amplification is used in the blue color channel than in the green or red channel, there can be more noise in the blue channel. Amplifier noise is a major part of the "read noise" of an image sensor, that is, of the constant noise level in dark areas of the image.

Salt-and-pepper noise:
An image containing salt-and-pepper noise will have dark pixels in bright regions and bright pixels in dark regions [9]. This type of noise can be caused by dead pixels, analog-to-digital converter errors, bit errors in transmission, etc. This can be eliminated in large part by using dark frame subtraction and by interpolating around dark/bright pixels.

IX. SIMULATION RESULTS
The Original Image is natural image, adding three types of Noise (Gaussian noise, Speckle noise and Salt & Pepper noise) and De-noised image using Median filter, Wiener filter, Penalized Threshold, Global Threshold and Proposed Threshold and comparisions among them is given below:-
vi) image denoising using wiener filter (for salt &pepper noise)

vii) image denoising using penalized threshold (for Gaussian noise)

Table which shows the Performance analysis of Median filter, Wiener filter, penalized threshold, global threshold and proposed threshold for different type of noise is given below:

<table>
<thead>
<tr>
<th>Types of noise</th>
<th>Penalized threshold</th>
<th>Wiener filter</th>
<th>Median filter</th>
<th>Global thresholding</th>
<th>Proposed threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt &amp; pepper</td>
<td>23.4923</td>
<td>26.7013</td>
<td>31.4058</td>
<td>31.4058</td>
<td>47.7422</td>
</tr>
<tr>
<td>Gaussian</td>
<td>47.8929</td>
<td>28.0713</td>
<td>26.7564</td>
<td>47.9475</td>
<td>48.0236</td>
</tr>
</tbody>
</table>

Table: PSNR of test image corrupted by different types of noise using various denoising methods

X. CONCLUSION

In this paper, we have proposed a new threshold technique in which a gray scale image in ‘jpg’ format is injected noise of different types such as Gaussian and Salt & Pepper. Further, the noised image is denoised by using different filtering and denoising techniques. From the results (figure (iv) to figure (xiii)) we conclude that:

The proposed threshold mentioned in this paper shows better performance over other techniques. Thus we can say that the proposed threshold may find applications in image recognition system, image compression, medical ultrasounds and a host of other applications.

XI. REFERENCES

Investigation of Handover in WCDMA

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ABSTRACT—Third generation wireless system is based on the WCDMA access technique. In this technique, all users share the same bandwidth simultaneously but with different codes. So in Soft Handoff (WCDMA) new user will demand new OVSF codes. This behavior effectively reduces the total number of available OVSF codes in each cell. The effective available OVSF codes in each cell decreases as the percentage of calls in soft handover increases. Due to their blocking property these codes cannot be used efficiently. So this paper presents a new non-orthogonal variable spreading factor (NOVSF) codes to support quite large number code candidates for more user used in multi-rate next-generation wireless system.

Keywords: WCDMA; UMTS; DS-CDMA; Soft Handoff; OVSF Codes; NOVSF Codes; Code Blocking

1. INTRODUCTION

The third generation (3G) wireless standards UMTS/IMT-2000 use the wideband CDMA (WCDMA) to support high data rate and variable bit rate services with different quality of service (QoS) requirements. In WCDMA, all users share the same carrier under the direct sequence CDMA (DS-CDMA) principle [1]. In the 3GPP specifications, orthogonal variable spreading factor (OVSF) codes are used as channelization codes for data spreading on both downlink and uplink. OVSF codes also determine the data rates allocated to calls. Because OVSF codes require a single RAKE combiner at the receiver, they are preferable to multiples of orthogonal constant spreading factor (SF) codes which need multiple RAKE combiners at the receiver.

When a particular code is used in OVSF, its descendant and ancestor codes cannot be used simultaneously because their encoded sequences become indistinguishable. Therefore, the OVSF code tree has a limited number of available codes. Because one OVSF code tree, along with one scrambling code, is used for transmissions from a single source that may be a base station or mobile station, the same OVSF code tree is used for the downlink transmissions and therefore the base station must carefully assign the OVSF codes to the downlink transmissions. The asynchronous uplink transmissions do not suffer from this limitation since each mobile station as a single source uses a unique scrambling code with the spreading codes of its OVSF code tree, where scrambling code makes signals from different mobile stations separable from each other. But, if the uplink is synchronous, the OVSF code limitations of the downlink are also valid for the uplink. The use of OVSF codes in downlink and synchronous uplink guarantees that there is no intra-cell interference in a flat fading channel. Since the maximum number of OVSF codes is hard-limited, the efficient assignment of OVSF codes has a significant impact on resource utilization.

Any two OVSF codes are orthogonal if and only if one of them is not a parent code of the other. Therefore, when an OVSF code is assigned, it blocks its entire ancestor and descendant codes from assignment because they are not orthogonal. This results in a major drawback of OVSF codes, called blocking property: a new call cannot be supported because there is no available free code with the requested SF, even if the network has excess capacity to support it. To alleviate the effects of the blocking property of OVSF codes, various schemes such as code reassignment schemes, time sharing of channels, and statistical multiplexing of busy data traffic are proposed in the literature.

This paper presents non-blocking OVSF (NOVSF) codes. NOVSF codes are non-blocking in the sense that no code assignment blocks the assignment of any other code. All NOVSF codes are orthogonal to each other and, therefore, can be assigned simultaneously as far as orthogonality is concerned.

II. UMTS MODEL & OVSF CODES

UMTS CODE ALLOCATION SCHEME: Figure 1 depicts the UMTS code allocation in a cell where every user can transmit his data in one or several channels after multiplying each channel by an orthogonal code. We sum all these channels to constitute the data flow that is multiplied by the unique scrambling code assigned to the user by the base station.
In Fig 1. Each user transmits on a unique scrambling code. All services (voice, data or both) are multiplexed on the scrambling sequence by using separate OVSF codes.

OVSF CODE GENERATION AND BLOCKING PROPERTY: The WCDMA standard defines an 8-layer OVSF code tree in the forward link. The SF from layers 1 to 8 are 512, 256, 128, 64, 32, 16, 8, and 4, respectively. The corresponding data rates handled are R, 2R, 4R, 8R, 16R, 32R, 64R and 128R (where R is the basic data rate 7.5 kbps). The OVSF code tree is generated using the Walsh code procedure explained in Ref. 7. For input code A the two children are [A, A] and [A, –A]. In the second step assume [A, A] as B and [A, –A] as C. The code B and C further generate children {[B, B], [B, –B]} and {[C, C], [C, –C]}, respectively. The procedure is repeated eight times to generate 8 layer OVSF code tree as in WCDMA system. Figure 1 shows an OVSF code tree with the SF varying from 1 to 8. It can handle four different data rates R, 2R, 4R and 8R. As explained earlier, in the OVSF scheme a code can be given to the coming user if all descendents and ancestors of the code from root to leaf is free.

Accordingly, only one code can be assigned to a UE in the path from the root to leaf. The code with the relatively smaller SF is used for user with relatively higher data rate, so that the overall bandwidth (data rate SF) of the system is same.

Table 1.1 summarizes the spreading factors, symbol rates, and bit rates for WCDMA physical channels.

The spreading factor 512 is used on the downlink only. The chip rate for all spreading factors is 3.84 Mbps.

Fig 2.1 shows the assignment of code C4; 1 shown in Fig 2.1 blocks the assignment of its ancestor codes (i.e., C2;1 and C1;1) and descendant codes (i.e., C8;1 and C8;2). The circle and cross signs on the links indicate the assigned and blocked codes, respectively.
To alleviate code-blocking problem and improve the utilization of OVSF codes, code various schemes such as code reassignment schemes, time sharing of channels and statistical multiplexing of bursty data traffic are proposed. These heuristic algorithms often lead to chain of code reassignments that result in a lot of overhead because many receivers need to be informed of new code reassignments.

III. NON-BLOCKING OVSF CODES

The basic ideas behind the proposed NOVSF codes are discussed next by describing four different cases. In every case, all the codes are orthogonal to each other. They differ from each other in the range of SF and whether time multiplexing is applied.

**Technique 1: NOVSF codes with four initial orthogonal codes.** In this case, as shown in Fig. 3.1, there are initially four orthogonal codes, namely, A, B, C, and D. Using these four orthogonal codes, a binary code tree is constructed as follows. Code A is made the root code with SF=4 in the layer 1 of the tree. For the tree layer 2, the following two orthogonal codes with SF=8 are generated from code B: (B,B) and (B,−B). Similarly, four codes are generated from code C and are placed on layer 3 of the tree. Finally, eight generated codes from D are placed on layer 4 of the tree. All the codes of the tree are orthogonal to each other and, they can be very desirable codes for broadband fixed wireless networks where maximum SF should not exceed 32. Indeed, what is required is to have a code tree of four layers in this case, but the SF of codes at any one of these four layers can be equal to any power of 2 ranging between 4 and 512, depending on the requested data rates of users. For instance, the SFs of the code tree could be 16, 4, 32, and 64 at some instant of.

**Technique 2: NOVSF codes with eight initial orthogonal codes with SF from 8 to 512.** In this case, as shown in Fig. 3.2, there are initially eight orthogonal codes, namely, A, B, C, D, E, F, G, and H. Using the first seven orthogonal codes, a binary code tree is constructed as follows. Code A is made the root code with SF=8 in the layer 1 of the tree. For the tree layer 2, the following two orthogonal codes with SF=16 are generated from code B: (B,B) and (B,−B). Similarly, four codes four codes are generated from code C and are placed on layer 3 of the tree. As illustrated in Fig. 3.2 codes D, E, F, and G generate 8, 16, 32, and 64 codes, respectively, and are placed on layers 4, 5, 6, and 7, respectively. Code H can be used as a standby code in any tree layer whenever more codes are needed. Indeed, each one of the eight codes A, B, C, D, E, F, G, and H can have any SF depending on the requested data rates.

**Technique 3: NOVSF codes with SF=4 employing time multiplexing.** In this case, as shown in Figure 3.3, there are initially four orthogonal codes of SF=4, namely, A, B, C, and D. Each code is associated with a time-slot number and cycle length, in addition to the SF of the code. Cycle-length is simply the sum of the time slots in a cycle. The time-slot number is the label of the time slot in a cycle. When a code is not shared in time, its cycle-length becomes equal to one. Thus, a code is assigned to a communication channel along with its time-slot and cycle-length. There are mainly two reasons why a code may be shared in time. One reason is to have better utilization of codes, which leads to an improvement in spectral efficiency of WCDMA. Another reason to share a code in time is to help rate matching techniques such as repetition or puncturing to achieve the requested data rates. Note that repetition or puncturing is used to adjust the channel-coding rate of each transport channel to match the coded bit rates to one of a limited set of rates on the physical channel.

In this figure, it is assumed that SF ranges from 4 to 32. But, SF can indeed range from 4 to 512. For instance, the SFs of the tree layers may be 4, 8, 32, and 128.
Each of these eight codes has 64 time slot. In Figure 4, code A with $SF = 8$ is shared by two communication channels such that channels 1 and 2 employ code A in time slots 1 and 2, respectively. No time multiplexing is applied for code B. Codes (B, B) and (B, -B) of $SF = 8$ such that are generated from code B are assigned to channels 3 and 4, respectively. Similarly, code D is not shared in time either. But, code C is shared by three channels. Since the number of channels that share C in different time slots is equal to three, it may be easier to support different data rates generate all NOVSF codes that can be represented as nodes (other than the root node) in a balanced binary tree.

Figure S1 suggest that as the new call arrival rate increases these OVSF Codes provide the Blocking to the new call. So as the new call arrival increases OVSF Codes provide more blocking probability to them.

IV. SIMULATION & RESULTS

Event driven simulation has been considered for getting results. The call arrival process is assumed to be poison with mean arrival rate $\lambda$ varying from 1 to 128 call/unit time. The possible OVSF & NOVSF code rate considered are R, 2R, 4R and 8R, corresponding to four different classes. Simulation results are presented to show the call blocking probability of OVSF and NOVSF Code.

\[
\text{Pb} (%) = \frac{\text{No. of Call Blocked}}{\text{Total no. of Calls}}
\]

As the graphs of Blocking probability Vs New call arrival rate (request/minute) show that NOVSF codes produce less code blocking then OVSF codes, hence we can assign NOVSF code easily to the new user during handover process leading to increased system capacity and high code utilization. Therefore, non blocking OVSF codes are better option for channelization codes in W-CDMA system in near future.
Abstract - Context-free grammars (CFGs) are widely used and are suitable for the definition of a wide range of programming languages. A common requirement is that grammar should be unambiguous. The problem of ambiguity in CFGs is undecidable in general, but various methods have been developed to detect ambiguity. In this paper, different ambiguity detection methods are compared.

Keywords: Context-free grammars; automata; ambiguity; ambiguity detection methods.

I. INTRODUCTION

Context-free grammars (CFGs) are widely used in various fields, like for instance programming language development, natural language processing, or bioinformatics (Basten, 2010). Context-free grammars are an important form of source code, both for the development of source code analysis and manipulation tools, and for prototyping (domain specific) languages (Klint, Lämmel, and Verhoef, 2005). In bioinformatics, context-free grammars in various guises have important applications, for example in sequence comparison, motif search, and RNA secondary structure analysis (Giegerich, Meyer, and Steffen, 2004) and (Durbin, Eddy, Krogh, and Mitchison, 1998). They are suitable for the definition of a wide range of languages, but their possible ambiguity can hinder their use. The presence of ambiguities in a context-free grammar hampers the reliability or the performance of the tools build from it (Schmitz, 2007).

A CFG is said to be ambiguous if it allows multiple derivations for the same string. If a grammar is ambiguous this often indicates a grammar bug that needs to be fixed. It is, however, very hard to establish whether a grammar is ambiguous or not. Ambiguity detection tools are used to statically try and find ambiguities. To be practical, such tools should (1) provide feedback that is comprehensible to the grammar developer, and (2) come up with an answer within reasonable time (Basten and Storm, 2010). Despite the fact the CFG ambiguity problem is undecidable in general (Basten, 2010), (Cantor, 1962), (Chomsky and Schützenberger, 1963), (Floyd, 1962) various detection schemes exist. They can be divided into two categories:

1) Exhaustive searching: (Axelsson, Heljanko, and Lange, 2008) start generating all sentences in the language of a grammar and check if they have multiple parse trees. If an ambiguous sentence is found, the productions involved in the ambiguity can be derived from the parse trees. Generating strings of increasing length is of exponential complexity and will not terminate if the grammar is unambiguous. These methods are accurate and suffer from the problem of halting.

2) Approximative searching: (Schmitz, 2007) the grammar is approximated into an alternative form (Brabrand, Giegerich, and Møller, 2010) that that can be analyzed in finite time. These methods always terminate but at the expense of precision. The ambiguity reports of these tools are hard to understand. The approximations may result in two types of errors: false negatives if some ambiguities are left undetected, or false positives if some detected “ambiguities” are not actual ones. They do not halt.

II. PRELIMINARIES

Context-Free Grammars

A context-free grammar $G$ is a 4-tuple $(N, T, P, S)$ consisting of:
- $N$, a finite set of non terminals,
- $T$, a finite set of terminals (the alphabet),
- $P$, a finite subset of $N \times (N \cup T)^*$, called the production rules,
- $S$, the start symbol, an element from $N$.

A production $(A, a)$ in $P$ is written as $A \rightarrow a$. We use the function $\text{pid} : P \rightarrow N$ to relate each production to a unique identifier. An item indicates a position in the right hand side of a production using a dot. Items are written like $A \rightarrow a\beta$. The relation $\text{deriv}$ denotes direct derivation, or derivation in one step. Given the string $aBy$ and a production rule $B \rightarrow \beta$, we can write $aBy \text{ deriv} \beta$ (read $aBy$ directly derives $\beta$). The symbol $\ast$ means “derives in zero or more steps”. A sequence of derivation steps is simply called a derivation. Strings in $V\ast$ are called sentential forms. We call the set of sentential forms that can be derived from $S$ of a grammar $G$, the sentential language of $G$, denoted $S(G)$. A sentential form in $T\ast$ is called a sentence. The set of all sentences that
can be derived from $S$ of a grammar $G$ is called the \textit{language} of $G$, denoted $L(G)$.

We assume every nonterminal $A$ is \textit{reachable} from $S$, that is $\exists \ aAB \in S(G)$. We also assume every nonterminal is \textit{productive}, meaning $\exists \ u : A \ast u$.

The \textit{parse tree} of a sentential form $\alpha$ describes how $\alpha$ is derived from $S$, but disregards the order of the derivation steps.

\textbf{Automata}:

An automaton is a 5-tuple $< Q, \Sigma, q_0, \delta, A >$

Where, $Q$: a non-empty finite set of states present in the finite control ($q_0, q_1, \ldots, q_n$)

$\Sigma$: a non-empty finite set of input symbols

$q$: starting state, $q \in Q$

$F$: a non-empty set of final or accepting states

$\delta$: transition function

$\delta$ is a function. Thus for each state $q$ of $Q$ and for each symbol $a$ of $\Sigma$, $\delta(q, a)$ must be specified.

\textbf{Ambiguity:} A grammar is called ambiguous if at least one sentence in its language can be derived from the start symbol in multiple ways. Such a sentence is also called ambiguous. Figure 1 shows two derivation trees of an ambiguous sentence of the following grammar:


\begin{figure}[h]
    \centering
    \includegraphics[width=\textwidth]{parse_trees.png}
    \caption{example of two parse trees of the sentence ‘1+2*3’}
\end{figure}

\textit{Vertical and horizontal ambiguity}

\textbf{A vertically ambiguous grammar.}

$Z : A \ ‘y’$

$| ‘x’ B ;$

$A : ‘x’ ‘a’ ;$

$B : ‘a’ ‘y’ ;$

The string xay can be parsed in two ways by choosing either the first or the second production of $Z$. The name \textit{vertical} ambiguity comes from the fact that productions are often written on separate lines as in this example.

\textbf{A horizontally ambiguous grammar.}

$Z : ‘x’ A \ ‘y’ ;$

$A : ‘a’$

Also here, the string xay can be parsed in two ways, by parsing the a either in ‘x’ A (using the first production of A and the second of B) or in B (using the second production of A and the first of B). Here, the ambiguity is at a split-point between entities on the right-hand side of a particular production, hence the name \textit{horizontal} ambiguity.

\textbf{III. DETECTION METHODS}

1) \textit{RU Testing:} The Regular Unambiguity(RU) Test was introduced by Schmitz. The RU Test is an approximative test for the existence of two parse trees for the same string, allowing only false positives (Schmitz, 2007).

2) \textit{NU Testing:} This approximative method always terminates and can provide relatively accurate results in little time. The method can be tuned to trade accuracy for performance. Its memory usage grows to impractical levels much faster than its running time. For example, with the best available accuracy, it took more than 3Gb to fully analyze Java (Basten and Vinju, 2010). A downside is that its reports can be hard to understand due to their abstractness. It enables the identification of a larger set of irrelevant parse trees. From these parse trees, we can also identify a larger set of harmless production rules and tree patterns. The approximation it applies is always conservative, so it can only find a grammar to be \textit{unambiguous} or \textit{potentially ambiguous} (Basten, 2010).

3) \textit{AMBER:} The exhaustive derivation generator Amber (Schröer, 2001) was the most practical in finding ambiguities for real programming languages. The main reasons for this are its accurate reports that contain examples of ambiguous strings, and its impressive efficiency. But its drawback was its possible non-termination. It uses an Earley parser (Earley, 1970) to generate all possible strings of a grammar and checks for duplicates. All possible paths through the parse automaton are systematically followed which results in the generation of all derivations of the grammar. It is also possible to bound the search space and make the searching stop at a certain point. One can specify the maximum length of the generated strings, or the maximum number of strings it should generate. This last option is useful in combination with another option that specifies the percentage of possible expansions to apply each step. This will result in a random search which will reach strings of greater length earlier. AMBER will not terminate on recursive grammars unless a maximum
string length is given. With its default parameters this method can correctly identify ambiguities, but it cannot report non-ambiguity. This also holds when it compares the incomplete sentential forms too. In the case of a bounded search or a random search, the method might report false negatives, because it overlooks certain derivations. This method is scalable in two ways: 1) Sentential forms holding nonterminals can also be compared, and 2) the percentage of possible derivations to expand each level is adjustable.

The ambiguity report returned is hard to interpret.

4) **AMBIDEXTER**: It combines exhaustive and approximative searching to benefit from both their strengths(Basten and Storm, 2010). The goal is to produce precise and comprehensible ambiguity reports as fast as possible. We use approximative filtering to narrow down the search space for an exhaustive checker. This also allows us to detect both ambiguity and unambiguity. The tool operates in two stages:

**4.1) Harmless production filtering**: Harmless productions are productions that cannot be involved in ambiguity. Using an extension of the approximative technique of (Klint, Lämmel, and Verhoef, 2005) such productions are identified and removed from the grammar.

**4.2) Derivation generator**: for the productions that are not identified as harmless, an exhaustive derivation generator is applied to detect remaining ambiguities. As a result, AMBIDEXTER leverages the strengths of both approaches to ambiguity detection:

- Unambiguity is detected if all productions are identified as harmless.
- Comprehensible ambiguity reports are produced as a consequence of employing a derivation generator.
- Performance is improved because the production filtering reduces the derivation generator’s search space.

5) **LR(k) and LR-Regular Testing**: One of the strongest ambiguity tests available is the LR-Regular condition(Heilbrunner, 1983). Instead of merely checking the k next symbols of lookahead, a LRR parser considers regular equivalence classes on the entire remaining input to infer its decisions. Practical implementations (Farré and G’alvez, 2001) and (Bermudez and Schimpf, 1990) of the LRR parsing method actually compute, for each inadequate LR state, a finite state automaton that attempts to discriminate between the x and z regular lookaheads. A parse table is used to look up the action to perform for the current lookahead, or the next state to go to after the reduction of a nonterminal. The possible actions are shifting an input symbol, reducing with a production rule, accepting the input string or reporting an error.

The class of grammars that can be deterministically parsed with this algorithm are called LR(k) grammars. This means there is a value of k for which a parse table can be constructed of the grammar, without conflicts. A conflict is an entry in the parse table where multiple actions are possible in a state for the same lookahead. These are either shift/reduce or reduce/reduce conflicts. A conflict means there is no deterministic choice to be made at a certain point during parsing. A parse table without conflicts will always result in a single derivation for every string in the language of the grammar. So if a grammar is LR(k) then it is unambiguous. Unfortunately the class of LR(k) grammars is smaller than the class of unambiguous grammars. If a grammar is not LR(k) this is no guarantee for ambiguity. Testing if a grammar is in the LR(k) class can be done by generating its parse table for a certain value of k. If the parse table contains no conflicts then the grammar is LR(k). This test can also be used as an ambiguity detection method. It can be used to look for a value of k for which a parse table can be generated without conflicts. It will have to be applied with increasing k. If a k is found for which the test passes then the grammar is known to be unambiguous. If the input grammar is LR(k) for some value of k, then the test will eventually pass. If the grammar is not LR(k) for any k, then the search will continue forever. The LR(k) test can only report non-ambiguity, because in the case of an ambiguous grammar it does not terminate. It also does not terminate on unambiguous grammars that are not LR(k). If it does terminate then its report about the unambiguity of a grammar is 100% correct.

IV. COMPARISON OF DETECTION METHODS

The comparison of RU test, AMBER, NU test and Ambidexter is shown in table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RU</th>
<th>AMBER</th>
<th>NU</th>
<th>AMBIDEXTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Approximative</td>
<td>Exhaustive</td>
<td>Approximative</td>
<td>Combination of both</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Less</td>
<td>High</td>
<td>More than RU</td>
<td>High</td>
</tr>
<tr>
<td>Guarantee of termination</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Memory Requirements</td>
<td>Less</td>
<td>Less</td>
<td>High</td>
<td>Less</td>
</tr>
<tr>
<td>Results delivered</td>
<td>False positives</td>
<td>Ambiguities</td>
<td>Unambiguities or potential ambiguities</td>
<td>Ambiguities and unambiguities</td>
</tr>
<tr>
<td>Reports generated</td>
<td>Abstract</td>
<td>Abstract</td>
<td>Abstract</td>
<td>Detailed</td>
</tr>
</tbody>
</table>

Table 1: comparison of detection methods
Type: RU and NU are approximative methods of ambiguity detection. AMBER is based on an exhaustive method of ambiguity detection. AMBIDEXTER combines exhaustive and approximative searching to benefit from both their strengths.

Accuracy: RU is not much accurate method, NU is more accurate than RU. AMBER and AMBIDEXTER provide higher accuracy.

Termination: There is no guarantee of termination in RU and AMBER. On the other hand, termination is guaranteed in NU and AMBIDEXTER.

Memory Requirements: NU consumes much more memory than all other methods.

Results Delivered: RU method reports false positives. AMBER is used to find ambiguities only. NU can only find a grammar to be unambiguous or potentially ambiguous. AMBIDEXTER can find both ambiguities and unambiguities.

Reports Generated: RU, AMBER and NU provide abstract reports which are hard to understand. AMBIDEXTER generates detailed reports.

V. CONCLUSIONS

Context-free grammars are useful in various fields but their possible ambiguity can hinder their uses. This paper gives an overview of some ambiguity detection methods and compares all of them. To be able to efficiently use the context-free grammars, some new approach is required which would provide more accurate results and in which the termination is guaranteed.

VI. REFERENCES


Slurry Erosion of Thermal Spray Coatings and Stainless Steels for Hydraulic Machinery

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2B.B.S.E.C FATEHGARHSABIB (Punjab)

Abstract: The slurry erosion of two coatings applied by High velocity oxy fuel (H.V.O.F) processes onto shot-blasted 16Cr5Ni steel was studied, and the results were compared to those obtained with 16Cr5Ni, which are commonly used for hydraulic turbines and accessories. The adherence of the coatings to the substrate was measured according to ASTM C 633 standard, while the microstructure and worn surfaces were characterized by optical and scanning electron microscopy. Slurry erosion tests were carried out in a modified impact test rig, in which the samples were placed conveniently to ensure grazing incidence of the particles. The slurry was composed of distilled water and quartz sand particles with an average diameter between 155 and 200 μm (AFS 50/70) and the solids content was 30000 ppm in all the tests. The mean impact velocity of the slurry was 35 m/s and the erosion resistance was determined from the mass loss results. The coated surfaces showed higher erosion resistance than the uncoated stainless steels, with the lower volume losses measured for the Cr2O3 deposit. SEM analysis of the worn surfaces revealed intense plastic deformation in both coated and bare stainless steels, with little evidence of brittle fracture in the microstructure. The measured adhesive strength of the coatings was considered acceptable for the processes employed.

Keywords: Slurry erosion; Microstructure; Thermal spray coatings; Hydraulic turbines

I. INTRODUCTION

Erosive wear is caused in the solid bodies by the action of sliding or impact of solids, liquids, gases or a combination of these [1]. Manifestations of solid particle erosion in service usually include thinning of components, a macroscopic scooping appearance following the gas/particle flow field, surface roughening, lack of the directional grooving characteristic of abrasion and in some but not all cases, the formation of ripple patterns on metals [2]. Solid particle erosion is an important material degradation mechanism encountered in a number of engineering systems such as thermal power plants, aircraft gas turbine engines, pneumatic bulk transport, hydropower plants systems, coal liquefaction/gasification plants and ore or coal slurry pipelines[3,4]. Stainless steels are widely used in hydroelectric power plants due to their good corrosion properties and acceptable resistance to solid particle erosion, since many components are in contact with aqueous solutions containing hard particles that impact against the surface causing significant material loss (slurry erosion condition). The magnitude of the damage caused is a consequence of the amount, type and size of solid particles in the flow, together with the mechanical properties of the surfaces, physical chemical properties of the water and operating conditions [1,2]. Slurry erosion problems are particularly important during rainy seasons due to the increase in the number of solid particles impacting the surfaces, especially in systems where an exhaustive filtration process is not possible. This is the case of the Francis turbines installed in a hydroelectric power plant in Nathpa jhakri, himachal Pradesh where intense erosive wear has led to changes in surface texture and loss of adjustment between the liners and the spiral case, as can be seen in Fig. 1. The angles whereas for angles close to 90° the dominant effects are low-cycle fatigue and accumulation of plastic deformation up to a critical value that promotes material detaching [3,4]. In addition, corrosive attack and boundary layer effects develop when the particles are carried by a liquid, configuring a much more intricate situation that is affected by the rheological properties of the carrying fluid such as its density and viscosity [5,6]. A cost-effective way to improve the slurry erosion resistance of the components is the application of thermally sprayed coatings [7,8]. The term thermal spray describes a family of processes that use chemical or electrical energy to melt (or soften) and accelerate particles of a material which is then deposited on a surface [9]. The coatings may have a good erosion resistance depending on the chemical and mechanical properties of the material deposited the surface preparation prior to application and the deposition conditions [7–9].

The high-velocity oxy-fuel (HVOF) process belongs to the family of thermal spraying techniques, and is widely used in many industries to protect the components against erosion, corrosion and wear. Particle degradation and open porosity are the two important factors that affect corrosion and erosion resistance. HVOF processing did not degrade significantly the composition of the consumable and has been shown to produce coatings with low porosity, low oxide content, better density, better coating cohesive strength and bond strength than many thermal spray processes [11,12].
II. EXPERIMENTAL PROCEDURE

2.1. Substrate material and Development of coating

Steel 16Cr5Ni steel which is used as material for Hydro power plants in some plants in northern part of India has been used as a substrate in the study. The specimens with approximate dimensions of 40mm×40mm×5mm were cut from the turbine material for erosion studies. Samples were grinded with SiC papers down to 180 grit and Shot -blasted with SiO₂ before being HVOF sprayed to develop better adhesion between the substrate and the coating. Stainless steels commonly used for turbines and hydraulic accessories were used, namely 16Cr5Ni steel, whose nominal chemical compositions are shown in Table 1. Also, two commercial powders, Cr₂O₃ and CrC+NiCr were deposited onto 16Cr5Ni steel by High Velocity oxy fuel (HVOF) processes, respectively spraying was carried out using a HIPOJET 2100 equipment (M/S Metallizing Equipment Co.Pvt. Ltd., Jodhpur, India), which utilize the supersonic jet generated by the combustion of liquid petroleum gas (LPG) and oxygen mixture. LPG fuel gas is cheap and readily available as compared to other fuels used for HVOF spraying. The spraying parameters employed during HVOF deposition are listed in Table 1. All the process parameters, including the spray distance were kept constant throughout the coating process.

<table>
<thead>
<tr>
<th>Spray parameters employed for HVOF spray process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen flow rate</td>
</tr>
<tr>
<td>Fuel (LPG) flow rate</td>
</tr>
<tr>
<td>Air-flow rate</td>
</tr>
<tr>
<td>Spray distance</td>
</tr>
<tr>
<td>Powder feed rate</td>
</tr>
<tr>
<td>Fuel pressure</td>
</tr>
<tr>
<td>Oxygen pressure</td>
</tr>
<tr>
<td>Air pressure</td>
</tr>
</tbody>
</table>

2.2. Microstructure and chemical characterization

The microstructure characterization was done in a JEOL 5910LV SEM. The porosity of the coatings was measured by digital image analysis. Vickers hardness and micro-hardness measurements were performed by using a Wolpert hardness tester (HV62.5 kg f) and a Shimadzu micro-hardness tester (HV300 g, 15 s), respectively. Localized chemical analyses of the specimens were done with an EDS spectrometer coupled to the SEM. The 16Cr5Ni stainless steel samples were taken from the liner of a Francis turbine that presented accelerated wear damage, while the
specimens of ASTM A743 grade CA6NM stainless steel and the coatings were prepared in laboratory.

2.3. Slurry erosion tests

The slurry erosion tests were carried out in a modified JET IMPACT TEST RIG, in which the specimens were submitted to wear conditions similar to those of the liners of Francis hydraulic turbines. Fig. 2 shows the configuration of the testing machine, which is composed of a commercial centrifugal pump connected to an electrical motor, a flow discharging apparatus and an isothermal bath to control the slurry temperature. The samples were located at the outlet of the centrifugal pump to ensure grazing incidence of the particles (see Fig. 2). The slurry was composed of distilled water and quartz particles with a mean diameter between 150 and 200 μm (AFS 50/70) and the solids content was 30 ppm. The mean impact velocity of the slurry was 5.5 m/s and the erosion resistance was determined from the mass loss results. Mass losses were measured every 30 min by using a scale with 0.01 mg resolution.

2.4. Analysis of worn surfaces

<table>
<thead>
<tr>
<th>Material</th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>Cr</th>
<th>Ni</th>
<th>P</th>
<th>S</th>
<th>Mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>16Cr5Ni</td>
<td>0.06</td>
<td>0.80 max.</td>
<td>1.0</td>
<td>0.035</td>
<td>0.025</td>
<td>15.00 – 17.00</td>
<td>0.70 – 1.50</td>
<td>4.00 – 6.00</td>
</tr>
<tr>
<td>Cr2O3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CrC+NiCr</td>
<td>30.81</td>
<td>-</td>
<td>-</td>
<td>18.36</td>
<td>50.84</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Fig. 2. Slurry erosion testing machine. General aspect of the device, detail of sample-holder and detail of positioning of the samples in the centrifugal pump.
III. RESULTS AND DISCUSSION

3.1. Microstructure

3.1.2. Cr$_2$O$_3$ Coating

The microstructure of a typical coating with a thickness of coating 200µm. The bonding layer is composed by a soft, nickel-rich matrix (191 HV average hardness) containing elongated chromium oxide particles (1530 HV25 g f, 15 s). The measured average volume fractions of Cr$_2$O$_3$ particles and pores were 11% and 7%, respectively. The wear-resistant Cr$_2$O$_3$ coating is composed of hard, Cr particles (1211 HV average hardness) and softer Ni–Cr regions (639 HV average hardness), together with a number of unmelted particles and pores. The volume fraction of pores was estimated to 15% by digital image processing of SEM images. This porosity amount is acceptable for HVOF coatings [10]. The ASTMC633 tests reported a mean adhesive strength of 6.8MPa with total detachment of the bond pass. This average value is in agreement with literature for the HVOF process [9,10] and it is an indication of acceptable quality of the coating.

3.1.3. CrC-NiCr coating

The thickness of the coating was circa average 165 µm. The microstructure of the wear-resistant coating CrC-NiCr (238 HV300 g, 15 s) is a distribution of chromium carbides in a high carbon steel matrix. The measured volume fraction of chromium carbides and porosity were 12% and 15%, respectively.

3.2. Examination of worn surfaces

Detailed ploughing as the main wear mechanisms observed at the surface of all the stainless steels tested and the Cr$_2$O$_3$ coating, being these marks more evident and evenly distributed in the stainless steel samples. On the other hand, the worn surfaces of the CrC-NiCr coatings showed a differential response as a function of the phases present in the microstructure, as shown in Fig. 9. Chromium and oxides in Cr$_2$O$_3$ and Cr/Co areas in CrC-NiCr coatings contributed to increase the wear resistance due to their high hardness and Young modulus. As the testing time increased the hard phases were gradually exposed to the erosive particles and the main wear mechanism changed from micro cutting of matrix to spalling of hard phases. Evidences of brittle fracture were observed in the CrC-NiCr coating, as can be seen in. Nevertheless, the analysis of the coatings before the slurry erosion tests reveals that similar cracks are formed as a consequence of the thermal spray process employed, due to the high cooling speeds and the thermal coefficient mismatch between ccr/Co particles and Ni–Cr regions. Unmelted particles and droplets can also be observed before the surface is submitted to the slurry wear tests, but these features are removed during the tests due to their low adhereance to the substrate. A significant increase in micro-hardness was observed in the stainless steels surfaces after the slurry erosion tests, probably as a consequence of both martensitic transformation of retained austenite and work hardening effect.

Fig 7. a. morphology of the sand particle used in the tests (b)EDS of sand grains (C)grain size distribution before and after the test in micrometers
3.3. Degradation of abrasive particles

The typical morphology of abrasive particles before the tests and the change in size distribution as a consequence of the erosive process are presented in Fig. 7. Note that after the tests the distribution is shifted to smaller grain sizes, which reveals fragmentation of the particles and subsequent loss of their ability to erode the surface of the samples.

3.4. Mass loss

The mass loss of all the samples in the slurry erosion tests is shown in Fig. 8. The reported values were calculated from the measured cumulative mass losses divided by surface unit area and time of impacting of particles of each of the materials studied, namely 1.

Generally speaking, the uncoated stainless steels reported higher volume losses than the thermal sprayed coatings. The Cr2O3 coating showed the best erosion resistance, while the CrC-NiCr steel reported the higher mass losses of the tested materials with coating.

It is worth noticing that the uncoated stainless steels presented similar volume losses during the first stages of the tests (see error bars in Fig. 8). Nevertheless, after 90 min testing the 16CR5NI samples undoubtedly showed better erosion resistance, probably due to the differences in microstructure such as the presence of hard chromium carbides precipitated at grain boundaries.

IV. CONCLUSIONS

The Cr2O3 coating applied by HVOF process onto 16CR5NI stainless steel reported the best slurry erosion resistance of the studied materials, mainly as a consequence of the combined properties of hard, wear-resistant particles and a ductile metallic matrix.

The studied coatings showed ability to deform plastically when submitted to slurry erosion conditions, with little evidence of mass removal by brittle fracture mechanisms. Unmelted particles and droplets are easily removed from the surface, but this does not affect the overall performance of the coatings in terms of volume loss and main wear mechanisms.

The applied coatings are an interesting alternative to enhance the wear resistance of components used in hydraulic machines, in particular under grazing incidence conditions and moderate-to-low mean impact velocities.

V. REFERENCES


Testability of Software System

Manu Phogat, Dr. Dharmender Kumar
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Abstract: This paper investigates factors of the testability of object-oriented software systems. The starting point is given by a study of the literature to obtain both an initial model of testability and existing OO metrics related to testability. The goal of this paper is to define and evaluate a set of metrics that can be used to assess the testability of the classes of an Object Oriented System.

I. INTRODUCTION

What is it that makes code hard to test? Why is one class easier to test than another? How can I tell that I’m writing a class that will be hard to test? What contributes to a class’ testability? How can I quantify this notion? Software testability is affected by many different factors, including the required validity, the process and tools used, the representation of the requirements, and so on — in the next section we will survey what has been written on this topic so far. This paper investigates testability from the perspective of unit testing, where our units consist of the classes of an object-oriented software system. Our approach is to evaluate a set of object-oriented metrics with respect to their capabilities to predict the Effort needed for testing. We choose this approach because metrics are a good driver for the investigation of aspects of software.

1.1 Testability

The ISO defines testability as “attributes of software that bear on the effort needed to validate the software product” [2]. Binder [1] offers an analysis of the various factors that contribute to a system’s testability.

Major Factors

Testing Criterion. A major factor of the test effort picture is the degree of validity that the software is required to have. Based on the validity requirements, a project uses a testing criterion (or code coverage criterion) that specifies which parts of the software have to be tested. In effect, a testing criterion will establish a lower bound on the validity of the software, and an upper bound on the number of test cases required.

Documentation. There are many reasons why a software system should be accompanied by documentation of several kinds.

Implementation. The implementation is the target of all testing, and thus the extent to which the implementation allows itself to be tested is a key factor of the testing effort.

Test Suite. Factors of the test suite itself also determine the effort required to test. Desirable features of test suites are correctness, automated execution and reuse of test cases.

Test Tools. The presence of appropriate test tools can alleviate many problems that originate in other parts of the ‘fish bone’ figure. For example, easy-to-use tools will demand less of the staff responsible for testing.

Process Capability. The organizational structure, staff and resources supporting a certain activity are typically referred to collectively as a (business) process. Properties of the testing process obviously have great influence on the effort required to perform testing.

II. RELATED WORK

A number of testability theories have been published in the literature. Voas et al. [4] defines software testability as the probability that a piece of software will fail on its next execution during testing, provided it contains a fault. This fault sensitivity is obtained by multiplying the probabilities that (1) the location containing the fault is executed; (2) the fault corrupts the program’s state; and (3) the corrupted state gets propagated to the output. High fault sensitivity indicates high testability and vice versa.

III. OBJECT-ORIENTED TECHNOLOGY:

A way to develop and package Software that draws heavily from common experience and the manner in which real world objects relate to each other.

Object-Oriented Systems: All programming languages, tools and methodologies that support Object-Oriented Technology. The main properties of object-oriented technology are following:
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- Objects
- Classes
- Data abstraction and encapsulation
- Inheritance
- Polymorphism
- Dynamic binding

Benefits of object-oriented system:

The Advantage or benefits of object oriented system are following:

- The use of objects as basic modules assists the designer to model complex real-world systems (Model Complexity).
- The flexibility of object-oriented code allows a rapid response to changes in their requirements.
- The reuse of standard components reduces both the development time for new applications and the volume of code generated.

IV. SOFTWARE TESTABILITY MEASUREMENT

Generally speaking, software testability measurement refers to the activities and methods that study, analyze, and measure software testability during a software product life cycle. In the past, there were a number of research efforts addressing software testability measurement. Their focus was on how to measure software testability at the beginning of a software test phase. Once software is implemented, it is necessary to make an assessment to decide which software components are likely to be more difficult and time-consuming in testing due to their poor component testability. If such a measure could be applied at the beginning of a software testing phase, much more effective testing resources allocation and prioritizing could be possible.

4.1 Measurement of Software Testability

In the past few years, a number of methods have been proposed to measure and analyze the testability of software [7, 8-9]. They can be classified into the following groups:

- Program-based measurement methods for software testability [7];
- Model-based measurement methods for software testability [8,9];
- Dependability assessment methods for software testability [7].

4.1.1 Program Based Testability Measurement

Since a fault can lie anywhere in a program, all places in the source code are taken into consideration while estimating the program testability. J.-C. Lin et al. [8] proposed a program-based method to measure software testability by considering the single faults in a program.

Arithmetic Expressions: Limited to single changes to a location. It is similar to mutations in mutation testing;

Assignment Predicates: An incorrect variable/constant substitution, for example, a variable substituted incorrectly for a constant, a constant substituted incorrectly for variable, or a wrong operator

Boolean Predicates: A wrong variable/constant substitution, wrong equality/inequality operator substitution, or exchanging operator and with operator or. The basic idea of this approach is similar to software mutation testing.

4.1.2 Model Based Testability Measurement

Another measurement approach of software testability is proposed based on a well-defined model: such as a data flow model [8]. This approach consists of three steps:

- Step #1: Normalizing a program before the testability measurement using a systematic tool. Normalizing a program can make the measurements of testability more precise and reasonable.
- Step #2: Identifying the testable elements of the targeted program based on its normalized data flow model.
- Step #3: Measuring the program testability based on data flow testing criteria.

4.1.3 Dependency Based Testability Measurement

Clearly, the two previous approaches need program source code and/or a program-based model to support software testability measurement. A. Bertolino and L. Strigni [7] proposed a black-box approach, where the software testability measurement is performed based on the dependency relationships between program inputs and outputs. The basic idea is to perform an oracle in a manual (or systematic) mode to decide whether a given program behave correctly on a given test.

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V. GOAL

In this paper working definition of testability is “Testability of a program is a degree of simplicity of the program”. In this work we are trying to understand the simplicity in the form of complexity. Means if system’s complexity is increase that means its simplicity decrease and the effort of testing (Testability) will increase.

5.1 Testability Measurement

Several techniques have been made for development of meaningful testability [10, 11, and 12] but here we are using the testability measurement techniques of John McGregor and S. Srinivas [13]. They mentioned that Testability of a method into the class depends upon the visibility component. Testability of method is

\[ TM = constant \times (VC) \]

Testability of the class is

\[ \theta = \min (TM) \]

The definition of the visibility component (VC) is

\[ VC = \frac{\text{Possible Input}}{\text{Possible Output}} \]

Before doing implementation we are defining our input, output and constant for testability analysis work and also taking some assumption for this work.

Assumption:

1. Not consider system parameter
2. Consider only concrete class.
3. All method overloading and over ridding allow.
4. Not consider static method but treat public static void main as a starting point.
5. Not consider abstract method.

The input, output and constant for the java class will be as follows

Input:

1. All parameter into the class.
2. Parameters pass into the method signature.
3. All class method parameter of the parent class excluding system parameter.
4. All method of interface implementation.

Output:

1. The return value of the method
2. Any exception either checked or unchecked by the method

3. All implicit parameter & object attribute define in the class

Constant

1. Final
2. Literal
3. Static final variable is also effectively used as a constant.

5.2 Complexity Measurement

Cyclomatic complexity is software metric (measurement). It was developed by Thomas J. McCabe [14] and is used to measure the complexity of a program. It directly measures the number of linearly independent paths through a program's source code. Cyclomatic complexity is computed using the control flow graph of the program: the nodes of the graph correspond to the commands of a program, and a directed edge connects two nodes if the second command might be executed immediately after the first command.

The cyclomatic complexity of a flow graph is as follows

\[ M = E - N + 2P \]

Where

- \( M \) = Cyclomatic complexity
- \( E \) = Number of edges of the graph
- \( N \) = Number of nodes of the graph
- \( P \) = Number of connected components.

Example:

1. Vending Machine
2. public class VendingMachine
3. {
4. final private int COIN = 25;
5. final private int VALUE = 50;
6. private int totValue;
7. private int currValue;
8. private Dispenser d;
9. public VendingMachine()
10. {
11. totValue = 0;
12. currValue = 0;
13. d = new Dispenser();
14. public void insert()
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15. {
16. currValue += COIN;
17. System.out.println("Current value = " + currValue);
18. }
19. public void return()
20. {
21. if (currValue == 0)
22. System.err.println("no coins to return");
23. else
24. {
25. System.out.println("Take your coins");
26. currValue = 0;}
27. }
28. public void vend(int selection)
29. {
30. int expense;
31. expense = d.dispense(currValue, selection);
32. totValue += expense;
33. currValue -= expense;
34. System.out.println("Current value = " + currValue);
35. }
36. }

Step 1. Testability Analysis

<table>
<thead>
<tr>
<th>S.No</th>
<th>Method Name</th>
<th>VC(ζ)</th>
<th>TM(η)</th>
<th>Class Testability (θ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VendingMachine()</td>
<td>3/3=1</td>
<td>2*1=2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>void insert()</td>
<td>3/3=1</td>
<td>2*1=2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>void return()</td>
<td>3/3=1</td>
<td>2*1=2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>void vend()</td>
<td>4/4=1</td>
<td>2*1=2</td>
<td>2</td>
</tr>
</tbody>
</table>

Step 2. Cyclometric Complexity

Control graph of vending machine

The cyclomatic complexity of a control flow graph is as follows

In control graph of vending machine the number of edges are 14 and number of nodes are 12, putting these values in the formula we will get the cyclomatic complexity 4.

\[ M = E - N + 2P \]

VI. CONCLUSION

Software testability is an important factor during the software development life cycle. This paper gives the view that testability is the degree of the simplicity of the program and it will increase as the complexity of the program will increases and its complexity will depends on whole software development life cycle. It also emphasis is on the measurement of testability, its measuring technique and related work of the testability and in last we presents our approach of measuring testability with using some example.

VII. REFERENCES

Comparison with Different Speech Enhancing Algorithms and Application to Speech Processing

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Abstract: Speech processing play a major role in our life such as speech, voice communication, telephone system and speaker recognition etc. However in most of the cases the main problem is background noise which degrades the performance of speech processing system. So various filtering techniques are used to remove the problem of noise but most commonly used technique is Kalman filtering technique. It provides an efficient computational recursive solution for estimating and resolving redundant error containing in speech. The aim of this paper is to compare various noise reduction techniques and generate the reconstructed output speech signal from the input signal by using Kalman filtering technique with the help of MATLAB software.

Keyword: Kalman filter; Speech processing; MATLAB software; noise.

I. INTRODUCTION

In speech processing, a filter is a device or a process to remove the unwanted component of frequency in order to suppress the interfering signal and reduce the background noise [1]. They are classified as: Analog or digital, Discrete-time or continuous time, Linear or non-linear, time-invariant or time-variant, Passive or Active filter, Infinite impulse response(IIR) or finite impulse response(FIR). Filter for removing the noise from the data

I. Wiener filter
II. Kalman filter

In speech processing, the Wiener filter [2] is a filter which is proposed by Norbert Wiener in the 1940, the main aim of this filter is to remove the noise from the signal by comparison with a desired noiseless signal. An analogous derivation of the derivation of discrete-time Wiener filter was Kolmogorov and published in 1941. Wiener Kolmogorov filter use the power spectral density in the frequency domain to characterize the dynamic and statistical properties of a dynamic process.

This filter give rise to many other famous filter known as Kalman filter. Kalman filter is a mathematical model proposed by Rudolf E. Kalman[3]. Its main purpose is to estimate the state of a linear dynamic system which is corrupted by white noise. The resulting estimator is mathematically optimal means resulting output signal is similar to input signal

I.I VARIOUS SPEECH ENHANCING ALGORITHMS: There are various speech enhancing algorithms: 1. Least Mean Square algorithms 2. Spectral Subtraction algorithms 3. Kalman Filtering algorithms

I.II Least mean square algorithms: LMS algorithms is an adaptive filter used to find the filter coefficient that relate to producing the least mean squares of the error signal (difference between the desired and actual signal).

In Fig. 1 Least Mean Square Algorithms block diagram

I.III Spectral Subtraction Algorithms: It is a method to enhance the speech signal in the presence of additive noise. Fig. 2 shows the block diagram of spectral subtraction system.
In spectral subtraction, input signal is segmented into frames and multiplied with a hamming window. We obtain the DFT of these frames and separate magnitude and phase from speech.

The noise power estimation and computation of spectral weighting takes place on magnitude. Once the noise estimate is subtracted from speech spectrum magnitude, it is recombined with the original phase of the noisy signal. IDFT is taken and outputs is obtained by overlap and add method.

### I.IV Kalman filtering algorithms

Kalman filtering algorithms solve the problem of the LMS and spectral subtraction algorithms. Kalman filter is an adaptive least square error filter that gives the optimal solution for estimating a signal in the presence of noise.[4] Kalman filter theory is based on state space approach in which state equation models the dynamics of the signal generation process. For a signal $x(k)$ and noisy observation $y(k)$

$$x(k) = Ax(k-1) + w(k-1)$$

$$y(k) = Hx(k) + n(k)$$

$x(k)$ = P dimensional signal vector or state parameter at time k

$A$ = P*P dimensional state transition matrix that relates the state of

Process at time k-1 & k

$W(k)$ = Process noise

$Q$ = Process noise covariance

$y(k)$ = M dimensional noisy observation vector

$n(k)$ = M dimensional noisy vector

$R$ = M*M covariance matrix of n(k)

### III. Theory of Kalman Filter and Its Application in Various Field:

<table>
<thead>
<tr>
<th>Type of Algorithms</th>
<th>LMS ALGORITHM</th>
<th>SPECTRAL SUBTRACTION ALGORITHM</th>
<th>KALMAN FILTER ALGORITHM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td>LMS provide signal processing in the form of echo and noise cancellation</td>
<td>spectral subtraction efficiently remove the residual amount of external noise</td>
<td>Kalman Filters’ performance declines rapidly with increasing noise</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>It provides only a trivial enhancement of speech signal.</td>
<td>It suffers from the undesirable musical noise effect.</td>
<td>Kalman Filter efficiently remove the noise from the speech signal with out remove the any relevant part of speech signal.</td>
</tr>
</tbody>
</table>
The Kalman filter is a tool that can estimate the variables of a wide range of processes. In mathematical terms, Kalman filter estimates the states of a linear system. The Kalman filter not only works well in practice, but it is theoretically attractive because it can be shown that of all possible filters, it is the one that minimizes the variance of the estimation error. Its most immediate application have been for the control of complex dynamic system such as continuous manufacturing process, air craft, ships, space craft etc.

For all these application Kalman filter provide a means for inferring the missing information from indirect and noisy measurements. The Kalman filter is used for predicting the likely future courses of dynamic systems such as flow of river during flood, the trajectories of celestial bodies or the prices of traded commodities [5].

Fig 3 shows block diagram of Kalman filter.

Kalman filter is also known as an effective speech enhancement technique in which speech signal is modeled as AR process and represented in state space domain. Kalman filter first estimate the noise and driving variances and parameter of signal model, then estimate the speech signal.

IV. WORKING OF KALMAN FILTER

Firstly, it estimates a process by using a form of feedback control loop whereby the filter estimates the process state at some time and then obtains feedback in the form of (noisy) measurements. These equations for the Kalman filter fall into two groups: “Time Update equations” and “Measurement Update equations”.

The time update equations are responsible for projecting forward (in time) the current state and error covariance estimates to obtain the priori estimates for the next time step. The measurement update equations are responsible for the feedback i.e. for incorporating a new measurement into the priori estimate to obtain an improved posteriori estimate. The predictor-correction algorithm for solving numerical problem is shown in fig 4 below.

The time update equations is known as “predictor” equations, while the measurement update equations is known as “corrector” equations.

Filter parameter are Q and R i.e. measurement noise covariance and process noise covariance. The measurement noise covariance is measured before operation of the filter when it comes to the actual implementation of Kalman filter. Generally, measuring the measurement noise covariance is practically possible due to the fact that the necessary requirement to measure the process noise covariance Q (while operating the filter). To measure the process noise covariance Q is more difficult due to the reason that the process to be estimated is unable to be directly observed. Under conditions where Q and R in fact constant, both the
estimation error covariance $P_k$ and the Kalman gain $K_k$ will stabilize quickly and then remain constant.

V. RESULT AND DISCUSSION FOR THE APPLICATION OF KALMAN FILTER IN SPEECH PROCESSING

The following results are obtained by setting 5th order Kalman coefficients, -0.8, 0.2, -0.6, 0.7 and -0.4. This is followed by an input of random generated noise.

$$y_k = (-0.8)y_{k-1} + (0.2)y_{k-2} + (-0.6)y_{k-3} + (0.7)y_{k-4} + (-0.4)y_{k-5} + w_k$$

(2)

Table 5.1 Different Coefficient at Different Iterations

<table>
<thead>
<tr>
<th>Coefficient/Iterations</th>
<th>1st Set</th>
<th>2nd Set</th>
<th>3rd Set</th>
<th>4th Set</th>
<th>5th Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 2000</td>
<td>-0.7</td>
<td>0.3</td>
<td>-0.6</td>
<td>0.7</td>
<td>-0.5</td>
</tr>
<tr>
<td>2001 to 4000</td>
<td>-0.5</td>
<td>0.5</td>
<td>-0.3</td>
<td>0.5</td>
<td>-0.3</td>
</tr>
<tr>
<td>4001 to 6000</td>
<td>-0.52</td>
<td>0.3</td>
<td>-0.5</td>
<td>0.4</td>
<td>-0.6</td>
</tr>
<tr>
<td>6001 to 8000</td>
<td>-0.55</td>
<td>0.5</td>
<td>-0.4</td>
<td>0.2</td>
<td>-0.5</td>
</tr>
<tr>
<td>8001 to 10000</td>
<td>-0.5</td>
<td>0.6</td>
<td>-0.2</td>
<td>0.3</td>
<td>-0.3</td>
</tr>
</tbody>
</table>

Simulation Result for various sample of speech processing using Kalman Filter:

VI. CONCLUSION

In this paper, First we have discussed various speech enhancing algorithms and then apply Kalman filter for speech processing for removing the back ground noise. The purpose of this approach is to reconstruct an output speech signal from its input speech signal. Furthermore, the results have also shown that Kalman filter could be tuned to provide optimal performance. With the introduction of tuning parameters Q & R, output speech signals can be obtained similar to the input speech signals. Moreover, a test for cross correlation had also been conducted during this paper for measuring the similarity of the input and output speech signals.

VII. REFERENCES

ABSTRACT: As the use of commercial web applications is increasing, it has become more crucial to have a high level of performance and being able to confirm that our application meets user's demands. This paper is about the quest for a performance monitoring tool which uses web performance metrics to keep the track of response time. The purpose is to define the capacity metrics for web applications and to implement these in open source tool as well as commercial tool, measuring the capacity of web application using concurrent virtual user in order to find a point at which application loses its performance. I propose a way to get similar approach by monitoring the process and analysis their results do the comparative analysis of both commercial and open source performance testing tools.

KEY WORDS: Performance Testing; Web application ; Web Metrics; Performance Metrics; Load Generator; Apache JMeter Tool ; WAPT Pro.

I. INTRODUCTION

Developers typically measure a Web application’s quality of service in terms of response time, throughput, and availability. Poor QoS (Quality of Services) translates into frustrated customers, which can lead to bad opportunities.[1] One way to assess such performance is through load testing, which assess how the website supports its expected workload by running specified set of scripts that emulate behaviour at different load levels. We firstly analyses and research the types, indicators and testing methods of the Performance testing of the web, and then we put forward some testing process and methods to the available tools. There are a wide range of load generation tools available into market, both commercial and open source. [9 List of tools] While most open source tools effectively operate as “load generating engines”, they miserably lag behind commercial tools with respect to features like automatic scenario recording, script debugging, customizable reports etc. Such feature often proves in favour of these commercial products. In this paper, we examine the challenges faced during the performance test scripting phase of web applications using open source load generation tools and compare them with Commercial tools. We have created an experimental set up within we measured the performance factors with both Tools. Here we describes our experimental setup and presents common approach for determining the load capabilities and performance evaluation of application under a commercial as well as open source load generation tools. In this paper the focus goes on the performance tools used, paying particular attention to two relatively performance test analyzer tools, Apache Jmeter (Free open source) [7] and WAPT Pro (Licensed Commercial Tool) [8]. Here we document how these tools are used to evaluate performance concepts through practical exercises, and draw the differences between these two, based on the sample results of web application running under these tools. Section 2 presents the Web performance engineering concepts with respect to types of testing applied to know performance of a web application. Section 3 describes the main features of the tools used for the practical work, and motivation of their choice. Sections 4 present observations and section 5 gives conclusions upon the aspects presented in this paper.

II. PERFORMANCE ENGINEERING

The concepts presented in this section relates to the performance metrics, as well as the software performance engineering (SPE) methodology that are followed for the practical exercise of testing an application. Studied from the books and research papers, we introduce the most common performance metrics used to characterise the performance behaviour of a system and an application. Overall Performance is defined as the time between the submission of a request from a user and the completion of the response [3]. In effect, it is the mean response time that a single HTTP request of a web application system spends from end to end. This measure is one of the critical factors in the evaluation of any web applications [5]. A performance test can help determine whether the product meets the performance goals. For performance test reporting, four types of information may be provide: [2]

1. Latency for each type of request
2. Throughput information, or how much load server received (for example, requests per second)
3. Server-side resource utilization (such as CPU usage, memory consumption, and so on.
4. Test run configurations
Typical performance metrics are Response Time, System Throughput, System Resource Utilization, the Number of Concurrent Users, HTTP Transactions / sec and the Number of Sessions / sec, Network Traffic Statistics, Resource Request Queue Length and other indicators to measure Web performance. For details, kindly refer [1]. Kunhua Zhu junhui Li suggests a number of different goals considering performance testing, including following:

- Test cases need to be designed towards performance criteria rather than functional correctness criteria.
- Metrics need to be defined to get quantitative results out of performance tests.
- The comparison of different hardware platforms or architectures for a given application.

Performance testing deals with verifying whether the system meets its performance requirements under various workloads [2]. The workload of a system denotes how many users the application can handle at any given time. In order to allow performance analysis of the system, various workloads are generated and behaviour under these workloads is recorded in testing phase. Usually, load testing involves generation of simulated requests to the system using load generation tools.

### III. PERFORMANCE: LESS APPROACH

While conducting Performance Testing with any objective in mind, our main focus is number of concurrent users, business pattern, hardware and software resources, test duration, and volume of data. The result from such test plan could be average, max, median of response time, throughput in min/sec, and resource utilization. Based on these results, some of the indirect results like reliability, capacity, and scalability of the system are measured. These results can be achieved by conducting the LESS (Load, Endurance, Stress, and Spike) testing approach [5]. Load testing: is used to determine whether the system is capable of handling various anticipated activities performed concurrently by different users. Endurance testing deals with the reliability of the system. This testing is conducted for different durations to find out the health of the system in terms of its consistent performance. It is conducted either on a normal load or on a stress load. Stress testing goes one step beyond the load testing and identifies the system’s capability to handle the peak load. In stress testing, think time is not important as the system is stressed with more concurrent users beyond the expected load. Spike testing is conducted to test the system suddenly for a short duration. Each surge the system has to face is called a spike. Following Figure 2.1 provides the basic objectives of these testing efforts. Each test targets different goals. Like load testing is to check the system with an expected load, stress testing to check the maximum load that the system can support, spike testing to determine how the system behaves at sudden load surge, and endurance testing to ensure how the system behaves if the stress load is exerted on a system for a longer time.

<table>
<thead>
<tr>
<th>Types of testing</th>
<th>Number of concurrent users and ramping up</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Testing</td>
<td>1 User → 50 Users → 100 Users → 250 Users → 500 Users → ... → 1000 Users</td>
<td>12 Hours</td>
</tr>
<tr>
<td>Stress Testing</td>
<td>1 User → 50 Users → 100 Users → 250 Users → 500 Users → ... → 1000 Users → Beyond 1000 Users</td>
<td>12 Hours</td>
</tr>
<tr>
<td>Spike Testing</td>
<td>1 User → 50 Users → Beyond 1000 Users</td>
<td>12 Hours → 10 Hours → 8 Hours → Hour → Minutes</td>
</tr>
<tr>
<td>Endurance Testing</td>
<td>Maximum Users</td>
<td>12 Hours → Longer duration (days)</td>
</tr>
</tbody>
</table>

Fig 1: LESS with ramp up of concurrent users

### TOOLS

This section introduces the tools for conducting PT on an application, developed on JAVA Platform and carries out Performance Testing using both tools open source and commercial performance test analyser test tool. Apache JMeter [7], and WAPT Pro [8]. And also drives the motivations of their choice among several available tools.

**APACHE JMETER**:Apache JMeter is a performance testing tool from Apache, has widely accepted as a performance testing tool for Web applications. It can be used to simulate heavy concurrent load on a J2EE application and to analyse the overall performance under various load types. During testing a graphical analysis of the performance metrics (e.g. throughput, response time, HTTP Response per sec) are measured.

### III. EXPERIMENTAL APPROACH FOR TESTING COMPONENTS OF WEB APPLICATION

The scripting phase depends on the tool selection process. Typically, the tool selection activity is carried out during the planning phase. Once the tool is identified the activity of scripting load generation scenarios starts, which contains a process of identifying performance bottlenecks in our application. The steps involved depicted below in the figure 2:
IV. PRACTICAL EXERCISE

The proposed approach discussed above has been implemented inside JMeter and WAPT Pro and do a comparative analysis of these based on the generated reports and graphs. Following planning is carried out in both Tools.

Planning a load test Process:

- Identifying System Configuration
- Identifying Key User Scenario
- Identifying Workload
- Identifying Metrics

**OBSERVATIONS**

We chose to display the different parameters on the charts - throughput (green line), median (purple line) and average (blue line). And modified the parameters of the test as per needed. To simulate a higher load on a server increased the number of threads to 10,20,45,50 up to 500 and compare server response time. And results are captured in the graphs forms in following fig.

**CONCLUSION**

The aim of this research was to perform a comparative study of the performance characteristics of JMeter and WAPT Pro. Through qualitative experiments performance was evaluated running in browser Internet Explorer. Evaluation was based on three aspects of performance: Application Behaviour under load, resources performance and computational speed. The experiments have demonstrated JMeter somehow performs better than WAPT. I am listing out observations posed by JMeter and WAPT with right use of approach and efficient process. Both tools provide almost same features with different terminology, Effective reduction in scripting and debugging time. BUT in JMeter and another Web Applications Testing (WAPT) I have noticed several results under JMeter are hard time explaining, and WAPT gives good descriptive reports and good GUI. JMeter runs fine with simulating up to 300 hundred users and WAPT slows down while crossing 130 users load and doesn’t provide any data for standard deviation of running process. All CMM Level 5 organizations prefer to have these commercial tools instead of using open source for the load testing because of the following reasons:

a) Ease of use –Commercial automation tools are much simpler and easy to use
b) Technical Support: Commercial automation tools provides support to the corporate world
c) Most commercial tools matches the pace of technologies changes, they usually support Web/GUI technologies(.Net, MFC, WPF, etc)
d) Commercial tools are integrated or can be integrated test case management tools or automation infrastructure as WAPT provides.

Organization below CMM Level 5 opts for such open source tool where JMeter fulfils their need as it’s a pure Java tool, Platform independent because of JVM.

REFERENCES


Energy Efficient Lighting Methodology

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ABSTRACT: Generally the buildings, offices, rooms etc. are designed without taking into consideration of the use of energy efficient lighting system. These buildings consume more energy as the energy required by energy efficient structure designed for the same. This paper deals with the concepts & approaches of the lighting methodology, basic terms of lighting and lighting design techniques. This methodology will help us to determine the present lighting status & lighting parameters used to analyze the performance of the lighting system of a room and minimizing the energy cost & energy wastage with the help of soft computing technique (.Net).

I. INTRODUCTION
Good energy management begins with an energy audit. Energy audit is one of the most important tools for energy conservation and for achieving energy efficiency. It provides the means to identify the areas of leakage, wastage or inefficient use [1]. It helps in identifying measures suitable for reduction the energy losses & misuse of energy. Thus, it helps in effective management of energy consumption and can lead to significant cost and energy savings as well as increases comfort, lower maintenance costs and extended equipment life etc.

However in this paper we have considered two blocks of the Deenbandhu Chhotu Ram University of Science & Technology, Murthal. A comprehensive study of these two blocks namely C.V. Raman Block, Workshop Block regarding the lighting system is carried out. Approximate 30% of all electricity used in the DCRUST in form of lighting. This paper presents the performance of lighting system of the both blocks of the University. Lighting methodology is being used to calculate the lighting parameters and determine the energy wastage & regions behind the poor illuminance level in these blocks. A lighting design based software tool is being implemented in this paper that gives the directly the energy wastage, RI, ILER etc. The survey found that University may not installed correct energy-efficient lamps and design yet, so university often facing the problem of energy efficiency & fully utilization of used energy till now, if this methodology implemented properly 15-25% savings can be achieved. Hence reduction in energy losses & minimizing the overall energy cost.

II. Equipments Used In Lighting Methodology System (LUX Meter)
The LUX meter is an important tool for the measurement of the illuminance level. Figure 1 shows the image of LUX meter. Lux meters corrected for V-lambda are used for measurement of illuminance [3]. Most lux meters consist of a body, a sensor with a photo cell, and a display panel. The sensor is placed under the light source. The light that falls on the photo cell has energy, which is transferred by the photo cell into electric current. The more light is absorbed by the cell, the higher the generated current. The meter reads the electrical current and calculates the appropriate value of either Lux or Foot candles. This value is shown on the display panel.

![Figure 1: Lux meter](image)

III. INPUT DATA COLLECTION
The raw data such as room length, room width, mounting height, numbers of fixture, and average illuminance in rooms of these two blocks C.V. Raman Block (Electric/Electronics Engineering Block), Workshop Block is to be collected from the survey of DCRUST (MURTHAL). Table 1 shows the basic detail of these parameters of the ground floors of the C.V. Raman block. It found that University approximate 200 days in a year & 5-8 hours per day use of lighting source. T5 lamps (28 watt with 5 watt circuit loss additional) & Fluorescent tube light with eclectic choke (40 watt with 11 watt circuit loss additional) are used in both blocks.
IV. CALCULATION OF LIGHTING PARAMETERS

Methodology/procedure used for finding these lighting parameter & performance of the lighting system as shown below:

1st Step Floor Area = Length X Width

2nd Step Room Index (RI) = \( \frac{L \times W}{H_m(L+W)} \)

Where

L = Length of the interior
W = Width of the interior
Hm = Mounting height

Room Index is 0.96 for the given length or widths of the interior 9 points are selected for the measurement of illuminance value.

3rd Step Total Circuit Watts: Measure the power consumption of lamps are calculated, if all lamps are supplied from a single source of power, total of all light fittings can be measured. If total power is not measurable, try to measure power consumption of at least 1 or 2 lamps and calculate the total power consumption.

Total Circuit Watts = Number of lamps X (Wattage of lamp + Circuit loss)

4th Step Watts per square metre = (Total Circuit Watts / Area) W/m²

5th Step Average Illuminance: Measure illuminance using a calibrated lux meter at each point; calculate the average value of measured illuminance at all points. If E1, E2… En is illuminance measurement at points 1, 2… n

Average Illuminance, \( E_{av} = \frac{E_1 + E_2 + E_3 + \ldots + E_n}{n} \)

6th Step Correction Factor value: Usually lux meter are calibrated under the “standard light tungsten source of 2856 K” precisely. If these are used under different type of light source, the following correction factors shown in table 3 are used [13].

<table>
<thead>
<tr>
<th>Light Source</th>
<th>Correction Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury Lamp</td>
<td>1.14</td>
</tr>
<tr>
<td>Fluorescent Lamp</td>
<td>1.08</td>
</tr>
<tr>
<td>Sodium Lamp</td>
<td>1.22</td>
</tr>
<tr>
<td>Day Light</td>
<td>1.00</td>
</tr>
<tr>
<td>Metal Halide Lamp</td>
<td>1.00</td>
</tr>
</tbody>
</table>

7th Step Net Illuminance value = Average Illuminance X Correction Factor

8th Step Lux per watt square metre = Net Illuminance value / Watts per square metre

9th Step Target Lux =Target lux value is obtain from the table 4 for the different types of applications and room index values [9].

Table 4 Target lux/W/m² Values for maintained illuminance on Horizontal plane for different -2 applications

<table>
<thead>
<tr>
<th>Room Index</th>
<th>Commercial Lighting</th>
<th>Industrial Lighting</th>
<th>Industrial Lighting CRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>53</td>
<td>49</td>
<td>67</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
<td>48</td>
<td>66</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>46</td>
<td>65</td>
</tr>
<tr>
<td>2.5</td>
<td>48</td>
<td>44</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>46</td>
<td>42</td>
<td>61</td>
</tr>
<tr>
<td>1.5</td>
<td>43</td>
<td>39</td>
<td>58</td>
</tr>
<tr>
<td>1.25</td>
<td>40</td>
<td>36</td>
<td>55</td>
</tr>
<tr>
<td>1</td>
<td>36</td>
<td>33</td>
<td>52</td>
</tr>
</tbody>
</table>

10th Step Installed Load Efficacy Ratio: Lux per watt square metre / Target Lux
V. SOFTWARE COMPUTATION WITH LIGHTING METHODOLOGY

The Lighting analysis parameters calculated above can also be computed with the help of soft computing technique (.NET) for improving the desired results & understanding for the layman purpose. Figure 3 shows the lighting guide software used for calculating the lighting parameters

VI. RESULTS

After collecting data and lighting methodology is implemented & analyzed the various lighting parameters i.e. total used energy, wattage per square metre, installed load efficiency ratio etc. of the both blocks C.V. Raman Block and Workshop Block of the Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonipat) Haryana. It was found that 20 % of the used energy of the University is going in wastage because of the poor designing of the lighting system. Finally some recommendations are suggested to improve the lighting system efficiency and minimizing the energy cost of the DCRUST.

- Reduced the mounting height of the fixture up to 1.5 metre
- Cleaning(Remove Dust)of the lamps regular interval
- Use of energy efficient lamps like CFL, T12
- Use of electronic choke rather than use of magnetic ballast
- Avoid the use of cartons during sunny day
- Replacement of fluorescent tube light of Workshop block

Table 1: Input data

<table>
<thead>
<tr>
<th>Room Name</th>
<th>Length (m)</th>
<th>Width (m)</th>
<th>No. of fixtures</th>
<th>No. of WAD</th>
<th>Day/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. V. Raman Block Ground floor</td>
<td>3.05</td>
<td>3.05</td>
<td>3</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>C. V. Workshop Block Ground floor</td>
<td>6.55</td>
<td>6.55</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>C. V. Raman Block First floor</td>
<td>6.55</td>
<td>6.55</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>C. V. Workshop Block First floor</td>
<td>6.55</td>
<td>6.55</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 1: C. V. RAMAN Block Ground floor details

VII. CONCLUSION & FUTURE SCOPE

The survey of the DCRUST University’s two blocks found that the lighting system installed in the University is not energy efficient. To improve the illuminance level the lighting methodology is carried out. This paper present an idea that indicates aspects will lead to a lighting solution that respects the visual performance, visual comfort and visual ambience requirements, taking also into account the applicability of the best available technology. This survey also provides additional information like cleaning of lamps, causes of low illuminance, change of fixture design and target Lux level for achieving the energy efficient operation of the lighting system. This survey deals with only two blocks of the University, if such kind of methodology is implemented for all the blocks of the DCRUST, large saving can be achieved and the fully utilization of used energy & reduction in electricity bill is possible.

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Powering Implantable Pacemakers Using Glucose Bio-Fuel Cells

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Abstract- A pacemaker is a medical device using electrical impulses to regulate the beating of human heart. Battery is a type of electrochemical cell which converts stored chemical energy into electrical energy but with a limited life. Both artificial pacemakers and implantable cardioverter defibrillators (ICDs) are working on this basis. GBFCs are living cells that harnesses glucose and dioxygen from the body to produce electricity. In other words, implanted medical devices could be powered by human bodies instead of batteries. To solve the limitation brought from using battery drive pacemaker, GBFC could be used as an energy drive.

Keywords: Pacemaker; glucose bio-fuel cells; battery; Implantable Cardioverter Defibrillator

I. INTRODUCTION

Heart is the key to our health. A common treatment for patients having heart rhythm disorders is the installation of pacemakers together with implantable cardioverter defibrillators (ICDs). Although the technique of implanting pacemakers and ICDs is well-developed, traditional chemical batteries as the power supply arises a number of technical problems such as chemical leakage, degeneration, operations for changing new batteries, etc. Without any chemical batteries, we cannot power these implantable devices. Batteries used in Implantable cardiac pacemakers-present unique challenges to their developers and manufacturers in terms of high levels of safety and reliability. In addition, the batteries must have longevity to avoid frequent replacements. A cardiac pacemaker uses half of its battery power for cardiac stimulation and the other half for housekeeping tasks such as monitoring and data logging.

II. ARTIFICIAL PACEMAKER

Pacemaker is a small, battery-operated electronic biomedical device that capable to normalize the human heartbeats when its natural regulating mechanisms break down. It provides electric impulses that mimic the natural human heartbeats. The device is inserted under the skin to help the heart to contract and to pump blood throughout the body at an appropriate rate. Pacemaker normally implanted in human chest cavity where its electrode has direct contact with the heart. The electronic circuitry in pacemaker will determine a pacing pulse through a sensing device. The sensor will turns the signal off when the heartbeat is above a certain level, and turns the signal back on when the heartbeat is under par. The pacemaker unit delivers an electrical pulse with the proper intensity to the proper location to stimulate the heart at a desired rate.

The cardiac pacemaker comprises of a pulse generator and a lead system. The pulse generator houses electrical components responsible for generating the pulse (via output circuits) at the proper time (via timing and control circuits) based on events sensed (via sensing circuits). It also contains a power supply (battery) and may include other elements such as telemetry for testability and programmability and memory (ROM or RAM) to store data for diagnostic purposes. Pacing lead is a flexible insulated wire that connected to a pacemaker. The lead is capable to hold the twist and bend of the wire caused by body movement and motion by the heart itself. Pacing lead carries a tiny
electrical pulse from pacemaker to the heart and relays information about the heart’s electrical activity back to the device.

### III. BATTERIES FOR ARTIFICIAL CARDIAC PACEMAKERS

The battery occupies major portion of the pulse generator in terms of weight, volume, and size. The most important factor for a cardiac pacemaker battery is its reliability. Unlike many consumer products, batteries in implantable devices cannot be replaced. They are hard wired at the time of manufacture before the device is hermetically sealed. From that point on, the battery is expected to power the device during final testing at the factory, during the shelf life and throughout the useful life of the device while it is implanted. In general the power source of the implantable device is the only component, which has a known predictable service life, which in turn determines the service life of the implanted device itself.

### IV. BATTERY PERFORMANCE PARAMETERS

The definitions for some of the important parts of a battery and its performance parameters like voltage, duty cycle, temperature, shelf life, service life, safety and reliability, internal resistance, specific energy (watt-hours/kg), specific power (watts/kg), etc are well known. A good battery design is a compromise between various performance parameters to meet the requirements of the specific application. Critical factors in selecting a cardiac pacemaker battery technology are: minimum and maximum voltage, initial, average, and maximum discharge current, continuous or intermittent operation (size and duration of current pulses), long shelf and service life, high specific energy and specific power, impact, and good performance in a variety of conditions (temperatures, duty cycles, etc.). Cardiac pacemaker battery design poses special challenges in development of biocompatible materials, corrosion and sealing, light weight and flat type, high reliability, accurate end of life battery predictions, etc. The most commonly used power sources are:

(a) **Rechargeable (secondary batteries) nickel-cadmium batteries**

These were used in the beginning (in 1958) of pacemaker implants in human beings. They were inductively recharged by the transmission of energy to the implanted receiver. The cell voltage was 1.25 V and the capacity was 190 mAh. The major problems were two fold; the first being very short life time and the second was to place the responsibility for recharging in the hands of patients, which is not a good medical practice. It was well known that primary or non-rechargeable batteries would give longer lifetime compared to secondary batteries. There are still some rechargeable pacemakers in use though not sold any more.

(b) **Mercury-zinc batteries**

Some of the early pulse generators constructed mainly from discrete components were powered by series-wired mercury-zinc batteries. Three to six cells in series provided 4-8 V. They were widely used at that time (around 1960s). Such mercury-zinc batteries were cast in epoxy, which was porous to the discharge of the battery released hydrogen and permitted its dissipation, which required venting and hence could not be hermetically sealed. This allowed fluid leakage into the pacemaker at times that caused electrical shorting and premature failure. The terminal voltage decay characteristic of the mercury-zinc battery is such that normal battery depletion results in little change in the terminal voltage until the end of battery’s useful life. This makes failure difficult to anticipate. This battery was improved in its design and still the life was only about two years with an abrupt drop in voltage as they become depleted. No device of this type is currently in use.

(c) **Nuclear batteries**

Nuclear batteries were tried successfully for some period. Practical nuclear batteries use plutonium (238Pu). It has a half-life of 87 years so the output degrades only by 11% in 10 years. However it is highly toxic and 1μg in the blood stream could be fatal. Early pacemakers used metallic plutonium whereas later ones used ceramic plutonium oxide. The plutonium emits alpha particles, which impact upon the container and generate heat. Thermopiles of dissimilar p- or n-doped bismuth telluride generate the electricity for the pacemaker circuits. Though these nuclear power sources had very long life, they were large and created problems when travelling between states and countries due to the presence of their radioactive fuel. They also must be removed at the time of death and returned for proper disposal. Nuclear powered pacemakers are no longer sold but still a small number of implanted nuclear devices that remain in use. Nuclear power sources became obsolete with the development of lithium batteries.

### V. INDUCTIVE POWERING SYSTEM

As reliability and longevity of the power source is an issue of concern so research is underway for using other means of energy sources such as solar, vibrations and inductive coupling, the inductive coupling providing a noninvasive means of energy source, and is hence considered the most reliable contender. This is designed to deliver power from an in vitro primary source to an in vivo implantable device through a dermal skin layer via time-varying electromagnetic fields. It eliminates the serious risk of
infection associated with a direct connection through the skin, an advantage recognized decades ago.

Here, the simulation of inductive coupling using MATLAB exploring its frequency response is explained. The block diagram of inductive power harvesting circuit using magnetic coupling is divided into two parts: the primary coil system located at a point external human body and the secondary coil is fabricated mounted on implantable that picks up power to be used by the implanted device fitted inside animals’ body as shown in Figure 2 while the coupling part is shown in Figure 3.

The primary system is modeled by an inductor, parasitic resistance R1 and capacitance CP1. While in the secondary system, the inductance is modeled by an inductor and parasitic capacitance RL and capacitance CP2 which represents a resistive sensor. There is a mutual inductance between two inductors when two circuits are closed to each other resulting to the impedance of the secondary circuit. The impedance is measured in response to the channel frequency response. The aim of the simulation analysis is to analyze the effect of varying resistive load and varying magnetic coefficient of coupling in response to the channel of frequency.

Figure 4 and 5 illustrates the frequency response of the transformer for multiple values of loads (RL) and various magnetic coupling factors (k). Figure 4 shows the frequency response versus gain in dB when the resistor load is varies from 50Ω to 450Ω and other parameters such as coupling factor and mutual inductance are kept constant. Varying magnetic coupling also has been investigated as shown in Figure 5. There is degradation in power and data transmission from primary to secondary system with varying magnetic coupling factor. From the result obtained, we can see that there is degradation in power and data transmission from primary to secondary system with varying resistor load as shown in negative value of dB in gain. The transformer shows the maximum gain at the frequency range of 1 to 10 MHz.
VI. GLUCOSE BIOFUEL CELLS AS A POWER SOURCE FOR ARTIFICIAL PACEMAKER

The concept of powering medical devices with the body’s own cellular fuel isn't new, but previous attempts to create a biofuel cell have failed, primarily because the enzymes needed to harvest energy from glucose require more acidic conditions than the body provides. So scientists at Joseph Fourier University in Grenoble decided that if the body wouldn't accommodate the enzymes, they would create an environment that would accommodate the enzymes. The team put the enzymes inside graphite discs that provide the proper acidity, and then placed those discs in dialysis bags to insulate them from outside conditions. Glucose and oxygen can flow into the device, but the enzymes remain confined, keeping them alive and generating electrical charge.

After surgically implanting devices in two rats, the team was able to achieve a maximum power of 6.5 microwatts, which isn't so bad considering pacemakers only require 10 microwatts to keep the heart ticking properly. In one rat the power hovered around 2 microwatts for 11 days, while the other rat's urine showed signs of glucose oxidation for three months.

Of course, a working biofuel cell powering a medical implant would have to last far more than three months and supply a steady flow of much higher power, so for now batteries - and the periodic surgeries that allow them to be swapped -- will have to do. But the breakthrough could lead to medical devices that simply run on the body's own power supply, replacing the need for expensive batteries and frequent incisions. Such a bio-power plant could be used to power everything from insulin pumps and pacemakers to drug delivery mechanisms and permanent biosensors.

A Bio-Battery that generates electricity from carbohydrates (sugar) utilizing enzymes as its catalyst, through the application of power generation principles found in living organisms. It is an Enzymatic Biofuel Cell Battery. Test cells of this bio battery have achieved power output of 50 mW, currently the world’s highest level for passive-type Bio-Batteries. In order to realize the world’s highest power output, Sony developed a system of breaking down sugar to generate electricity that involves efficiently immobilizing enzymes and the mediator (electronic conduction materials) while retaining the activity of the enzymes at the anode. Sony also developed a new cathode structure which efficiently supplies oxygen to the electrode while ensuring that the appropriate water content is maintained. Optimizing the electrolyte for these two technologies has enabled these power output levels to be reached.

Sugar is a naturally occurring energy source produced by plants through photosynthesis. It is therefore regenerative, and can be found in most areas of the earth, underlining the potential for sugar-based bio batteries as an ecologically-friendly energy device of the future. Glucose is broken down on the anode side of the battery, producing protons (H+) and electrons (e-). The protons (H+) are transferred to the cathode side through the separator, while the electrons (e-) are transported to the cathode side through the mediator, which transfers them to the external circuit. The cathode uses the enzymes to drive an oxygen-reduction reaction which ultimately produces water using both the protons (H+) and the electrons (e-) transferred from the anode. These reactions at the anode and cathode generate electric energy by creating proton (H+) and electron (e-) flow in the cell system.

VII. CONCLUSION

The design of wireless transmission of power and data using magnetic coupling inductor has been simulated using MATLAB. An analysis on the effect of varies resistive load with constant coupling coefficient and varies coupling coefficient with constant resistive load has been highlighted in this paper. The system operates with satisfactory power and can transmit both data and provide power to the secondary system. The power transmitted as a function of frequency shows that the circuit is able to work well over a high frequency for data transmission and power transmission both at the same time.

While many technological challenges still remain, Bio Battery has great potential as a next-generation energy device. Advantages include its excellent harmony with the environment as a product fueled by a carbohydrate (glucose) having high energy density.
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MATLAB/Simulink Implementation for Torque Ripple Reduction Technique Employed for PMSM Drive

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ABSTRACT: This paper describes the implementation of Direct Torque Control (DTC) of Permanent Magnet Synchronous Motor (PMSM) drive with three level inverter. The basic theory of operation for the control technique is presented. A MATLAB/SIMULINK model is developed to verify the reduction in torque ripple content of the PMSM drive It also helps in decreasing the phase voltage harmonic contents resulting in low THD of the motor voltage and current, and subsequently reduces torque and flux ripples. The result is compared with two level inverter.

Keywords: Direct Torque Control, Permanent Magnet Synchronous Motor, Torque ripples.

I. INTRODUCTION

Permanent Magnet Synchronous Motor has gained popularity especially in the automation sector due to its compact size, high efficiency, and faster response. As reliability and cost of modern PMSM drives are of importance, advanced control techniques have been developed. Direct Torque control technique is proving a viable control strategy for PMSM drive. This technique eliminates the current controller and reduces the dependence on motor parameters. In direct torque control technique, the stator voltage vectors are selected according to the difference between the reference value and actual value of torque and stator flux linkages in order to reduce the torque and flux errors within the prefixed band limits. In this paper, a mathematical model of PMSM has been developed first. Then, a simulation model of DTC of PMSM using three-level inverter is simulated using MATLAB/SIMULINK. Finally results are compared with two-level inverter model.

II. SYSTEM IMPLEMENTATION FOR PMSM

At present, the control techniques normally employed in ac drives are: vector control and Direct Torque control. Direct Torque control, as the name suggest, control the electromagnetic torque and flux linkage directly and independently by the use of six or eight voltage space vectors. The voltage vector selection for controlling the stator flux linkage and amplitude is normally done by diving voltage vector plane into eight regions.

Stator flux estimation method:

The stator flux is estimated using the following equations:

\[ \lambda_s = \int (V_s - R_i_s) dt \]

Using the above equation, the amplitude of the flux and the region where the flux is present, can be estimated.

Torque estimation method:

Electromagnetic torque is estimated using stator linking flux components and measured stator currents using the following equations:

\[ T_e = \frac{3P}{4} \left( \lambda_d i_q - \lambda_q i_d \right) \]

The magnitude of stator flux and electromagnetic torque are compared with their reference values using the corresponding hysteresis controller. Hysteresis controllers are employed to maintain the torque and stator flux within a prescribed limit. The output of these controllers, in addition to the location of stator linkage flux in particular sector is fed to a switching table to select a voltage vector producing
desired torque. Fig. 1 shows the DTC system incorporating the flux and torque estimators, flux and torque hysteresis controllers, switching table and Three Level inverter.

To determine the proper applied voltage vectors, information from the torque and flux hysteresis outputs, as well as stator flux vector position, are used so that circular stator flux vector trajectory is divided into six symmetrical sections according to the non zero voltage vectors as shown in Fig. 2

To determine the proper applied voltage vectors, information from the torque and flux hysteresis outputs, as well as stator flux vector position, are used so that circular stator flux vector trajectory is divided into six symmetrical sections according to the non zero voltage vectors as shown in Fig. 2.

The switching table for controlling both the amplitude and rotating direction of the stator flux linkage is given in Table I.

<table>
<thead>
<tr>
<th>$\varphi$</th>
<th>$\tau$</th>
<th>$V(100)$</th>
<th>$V(010)$</th>
<th>$V(110)$</th>
<th>$V(001)$</th>
<th>$V(101)$</th>
<th>$V(011)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau = 1$</td>
<td>$\varphi = 1$</td>
<td>$V(010)$</td>
<td>$V(110)$</td>
<td>$V(001)$</td>
<td>$V(101)$</td>
<td>$V(011)$</td>
<td></td>
</tr>
<tr>
<td>$\tau = 0$</td>
<td>$\varphi = 0$</td>
<td>$V(010)$</td>
<td>$V(110)$</td>
<td>$V(001)$</td>
<td>$V(101)$</td>
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</tbody>
</table>

The output of the torque hysteresis comparator is denoted as $\tau$, the output of the flux hysteresis comparator as $\psi$ and the flux linkage sector is denoted as $\theta$. The torque hysteresis comparator is a two valued comparator; $\tau = 0$ means that the actual value of the torque is above the reference and out of the hysteresis limit and $\tau = 1$ means that the actual value is below the reference and out of the hysteresis limit. The flux hysteresis comparator is a two valued comparator as well where $\psi = 1$ means that the actual value of the flux linkage is below the reference and out of the hysteresis limit and $\psi = 0$ means that the actual value of the flux linkage is above the reference and out of the hysteresis limit. We define $\psi$ and $\tau$ to be the outputs of the hysteresis controllers for flux and torque, respectively, and $\theta(1)$ - $\theta(6)$ as the sector numbers to be used in defining the stator flux linkage positions. In Table I, if $\psi = 1$, then the actual flux linkage is smaller than the reference value. On the other hand, if $\psi = 0$, then the actual flux linkage is greater than the reference value. The same is true for the torque.

The selected voltage vector is applied to the permanent magnet synchronous motor drive using three-level neutral clamped VSI. Fig. 3 shows a simplified circuit diagram of the inverter used.

Fig. 2

The switching table for controlling both the amplitude and rotating direction of the stator flux linkage is given in Table I.
The eight different voltage configurations are obtained using the three independent legs of the inverter. In this topology, the neutral point is obtained by connecting a DC voltage source to the capacitive voltage divider formed by using two capacitors.

The operation of the switches can be represented using the switching states shown in the Table II.

<table>
<thead>
<tr>
<th>Switching State</th>
<th>Device Switching Status (Phase A)</th>
<th>Inverter Terminal Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_1</td>
<td>On</td>
<td>E</td>
</tr>
<tr>
<td>S_2</td>
<td>Off</td>
<td>0</td>
</tr>
<tr>
<td>S_3</td>
<td>Off</td>
<td>-E</td>
</tr>
</tbody>
</table>

Switching state ‘P’ denotes that the motor terminals are connected to inverter voltage E whereas ‘N’ and ‘O’ denotes that the terminals are connected to –E and zero voltage respectively.

Control strategy adopted for selection of appropriate voltage vector is based on the Table III.

<table>
<thead>
<tr>
<th>Control strategy (θ sector)</th>
<th>V_{i1}</th>
<th>V_{i2}</th>
<th>V_{i3}</th>
<th>V_{i4}</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the basis of the sector \( \theta \) (\( \theta = 1, 2, \ldots, 6 \)) in which the stator flux linkage lies and of the magnitude of the errors of the torque and flux, a voltage space vector \( V_i \) (with \( i=1, 2, \ldots, 6 \)) is generated as shown in the Fig.4

III. SIMULATION AND RESULTS

MATLAB/Simulink model of the permanent magnet synchronous motor is developed using three-level inverter. The 2 pole motor parameters used for simulation are Stator resistance \( (R_s)= 9.76 \, \Omega \), Direct axis self inductance \( (L_{sd})=92 \, mH \), Quadrature axis self inductance \( (L_{sq}) = 126mH \), Rotor flux constant = 0.476wb, Motor Moment of Inertia = 0.000423 kg-m^2, Damping coefficient = 0.0004012 kg-m/s. The command signal for the torque is taken as a step change changing from 1N-m to 2N-m at 0.1s.

The simulation is performed using the actual values of the stator flux and torque and then comparing it in the respective hysteresis comparator. As shown in fig.5, the output of these two comparators, in addition to the sector selector is then applied to the switching table to obtain the best possible voltage vector.

The steady state flux linkage of permanent magnet synchronous motor is shown in Fig.6. Fig.7 shows the stator flux variation with time. Fig. 8(a) & Fig. 8 (b) shows the electromagnetic torque for two level and three level inverter respectively.
IV. CONCLUSION

In this paper, a simulation model using MATLAB/Simulink has been developed for the PMSM drives. The result obtained from the simulation shows that with the use of three-level inverter, more voltage space vectors are available as compared to the previous methods employed i.e. using two level inverter, which reduces the harmonic content in the stator voltages and currents hence decreases the torque ripple content in the PMSM drives.

REFRERENCES


Application of Monoliths in Automobiles and Industries

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ABSTRACT: Air pollution is a growing menace in today’s world. The two major sources of air pollution are transport and industries. In the transportation sector the gasoline and diesel driven vehicles, due to their increased number have over the period of time proven to be major source of air pollutants. In order to treat the pollutants released from these sources monoliths play a very crucial role. A review on the applications of the monolithic converters as pollution abatement devices and also its other uses in chemical industries, aircrafts, restaurants etc has been carried out in this paper. Monoliths have proved to be better than packed bed reactors in these fields of applications.

KEYWORDS: Monoliths, converter, automobiles, power plants, gas turbines, heterogeneous, combustion

I. INTRODUCTION
Monolithic catalyst supports can be an attractive replacement for conventional carriers in heterogeneous catalysts (Nijhuis et al, 2001). At the moment, the largest application of monoliths is in the automotive industry for the cleanup of exhaust gases. Other applications are the selective catalytic reduction of off-gases of power stations, the ozone destruction in airplanes (Nijhuis et al, 2001), combustion of fuels for gas turbines, boilers, heaters etc (Cybulski and Moulijn, 1994). As compared to the packed beds that were conventionally used for heterogeneous reactions monolith offer the distinct advantages of reduced pressure drops (roughly by two orders of magnitude (Groppi et al, 2000)), higher geometric surface area resulting in faster conversion of reactants.

II. MONOLITHIC PROPERTIES
Monolith channels may be arranged either in cross-flow structures or in parallel or nearly parallel structures. The shape of the channels can vary from circular, square, triangular, rectangular, trapezoidal, hexagonal, sinusoidal, condition for low backpressure (Williams, 2001) and for metallic supports this reaches upto 90%. The higher open area for metallic supports originates from the lower wall thickness (Cybulski and Moulijn, 1994).

Fig1. Monolith structure (Boger and Heibel, 2005)

III. APPLICATIONS OF MONOLITHS
Monoliths have over the period found various applications. Table 1 lists some of the major applications.
Table 1. Applications of cordierite cellular ceramic substrates (Williams, 2001)

<table>
<thead>
<tr>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive emission control</td>
</tr>
<tr>
<td>Diesel particulate filter</td>
</tr>
<tr>
<td>Stationary emission control</td>
</tr>
<tr>
<td>Woodstove combustor</td>
</tr>
<tr>
<td>Molten metal filter</td>
</tr>
<tr>
<td>Natural gas storage</td>
</tr>
<tr>
<td>Indoor air purification</td>
</tr>
<tr>
<td>Ozone abatement</td>
</tr>
<tr>
<td>Catalytic incineration</td>
</tr>
<tr>
<td>Industrial heat recovery</td>
</tr>
<tr>
<td>Ultrafiltration</td>
</tr>
<tr>
<td>Chemical process catalyst support</td>
</tr>
<tr>
<td>Water filtration</td>
</tr>
</tbody>
</table>

Three Way Catalysts: Three way catalysts are used in gasoline vehicles to bring about the simultaneous reduction of CO, HCs and NOX when operated at the stoichiometric air to fuel ratio. It is primarily used in the under-floor position in the exhaust; however, it is now being utilized in a close coupled position 3-5 inches below the exhaust ports in order to obtain rapid conversion of hydrocarbons for cold start operation. Monoliths having cell densities of the range 400-600cpsi with wall thickness of about 0.045in are used for this application. Platinum, palladium and rhodium are commonly used catalysts in such assemblies etc. The geometry of the channels affects the flow as well as the mass and heat transfer characteristics, and consequently, the performance of monolithic converters. In case of automobile afterburners it is usually circular or nearly oval while for off gas incineration it is circular or square (rectangular) (Cybulski and Moulijn, 1994). Monolithic substrates for automotive catalysts are generally made of cordierite and metal alloys. Ceramic monoliths are operated in an adiabatic mode while metallic monoliths exhibit radial noneven temperature profiles. Metallic monoliths have a larger open frontal area and lower thermal mass, which improves pressure drop and light-off behavior. Monolithic supports are washcoated with α-alumina or mixtures with base metal oxides. The washcoat surface area is approx 100-200 m²/g. Catalytic components such as mixtures of precious metals are deposited onto the internal surface of the washcoat by impregnation (Cybulski and Moulijn, 1994). The combination of high cell density, 31–186cells/cm² (200–1200cells/in²), with thin walls, 0.051–0.27mm (0.002–0.0105in), give rise to low back pressure in automotive exhaust systems. This combination also yields high open frontal area, 72–87% which is a necessary.

IV. DIESEL CATALYSTS

The diesel oxidation catalyst converts liquid particulate and gaseous CO and HCs in the exhausts of heavy-duty trucks, buses etc. Ceramic monoliths of varying cell densities (ranging from 200 - 400cpsi (Heck and Farrauto, 2001)) are used depending on the duty cycle of the engine. Lower cell density monoliths (larger cell diameters) of 200cpsi are used when the amount of dry particulate (soot) is expected to be high (Farrauto and Voss, 1996; Farrauto and Heck, 1999).

Platinum and Palladium were initially considered as catalysts for these reactions as they exhibit good low temperature activity for hydrocarbon conversion. However, they are also very active for the SO₂ oxidation reaction.

Diesel particulate filter: Is the most effective method to remove soot particles from diesel engine vehicle exhaust with filtration efficiencies up to 95% (Heck et al., 2001). Regeneration of the filter is critical for continuous engine and vehicle operation at low backpressure. Controlled on-board regeneration of diesel filters is an area that continues to be explored. Both passive and active techniques are under investigation. A diesel particulate filter is also a special type of monolithic reactor (Koltsakis, 1997) in which the alternate channels are plugged on the entrance face and the adjacent channels are plugged on the exit face. Filtration occurs when the particle laden exhaust gas is forced through the wall between adjacent channels.

Ozone Abatement in Aircraft: Commercial airlines use catalyzed metal monoliths in the air intake system to decompose ozone present in make up air. The light weight, lower melting alumina monoliths point (MP 200°C) coupled with low pressure drop makes this a cost-effective technology for insuring a clean and safe environment in the cabin.

Natural Gas Engines: Natural gas is a common fuel for heat generation. Palladium is found to be more effective catalyst even when compared to platinum for reduction of methane emissions. The catalytic combustion of methane over Pd/Al₂O₃ catalysts has been extensively studied (Lampert et al., 1997).

Ozone Destruction in Automobile Radiators: A recent application of a catalytically washcoated monolithic heat exchanger (metal radiator) for the decomposition of ozone present in ambient air has been commercialized and installed on specific models (Model Year 2000) of Volvo and Nissan. The base metal oxide is coated on the radiator using special binders to insure an adherent catalyzed layer (Farrauto and Heck, 2000).
Small Engines: Metal monoliths are catalyzed (generally using platinum group) and used as exhaust surfaces for the destruction of CO and HC generated in small engines such as motorcycles, chain saws, lawn mowers, boats etc. (Holmgren, 1998).

Denitrification of gases at coal-fired Power plants: Washcoated ceramic and metallic monoliths have found wide use in power plants in the selective catalytic reduction (SCR) of NO\textsubscript{x} using NH\textsubscript{3}. For coal fired power plants where ash and dust are present in high concentrations, large cell density extruded monoliths composed of only catalyst (V\textsubscript{2}O\textsubscript{5}-TiO\textsubscript{2} or zeolites) are used. If dust particles were to be retained in the monolith, the pressure drop would increase greatly (Cybulski and Moulijn, 1994). For low dust applications such as in gas turbines ceramic and metal monoliths washcoated are used. Abatement of CO and HC emissions from power plants is also accomplished with both metal and ceramic monoliths. The NO\textsubscript{x} adsorber is a washcoat containing barium, potassium, or other alkali/alkaline earth metal oxides as adsorbents. During adsorption, a nitrate is formed with the alkali oxide through conversion of NO to NO\textsubscript{2} with O\textsubscript{2} promoted by platinum. Stainless steel with MP of 800\degree C has been reported to be used in power plants (Heck et al., 2001).

Destruction of Volatile Organic Compounds from Restaurants: Volatile organic compounds are abated from chemical plants using high cell density metal or ceramic monoliths as catalyst supports for the oxidation of CO and HCs. Quite recently, restaurants have begun using lightweight metal monoliths in the exhaust shroud of cooking operations to abate harmful oils and gaseous compounds associated with cooking greases and oils. Since the exhausts operate on chimney draft low cell density metals are used to minimize pressure drop in the vent.

Catalytic Combustion: After many years of research and development catalytic combustion have now been commercialized for gas turbines, replacing the traditional burners. This technology involves combustion of fuels with large excesses of air thereby generating sufficient temperatures to operate the turbine, with virtually no emission of CO, HCs or NO\textsubscript{x}. Specially designed ceramic and metal monoliths are used for this purpose.

V. SOME OTHER APPLICATIONS

According to Heck et al., (2001) monoliths are used increasingly and the fields of its emerging applications include:

Hydrogen Generation for Fuel Cell: The proton exchange membrane (PEM) fuel cell is being intensely investigated for homes and vehicles promising high efficiency and clean power generation. The PEM fuel cell requires H\textsubscript{2} for the anode. Fuel processing of hydrocarbons to make H\textsubscript{2} will likely involve the use of ceramic or metal monoliths or heat exchangers catalyzed with the appropriate catalyst.

Steam Reforming of Hydrocarbons

\[
\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 2 \text{H}_2
\]

(1)

For the production of H\textsubscript{2} for ammonia and methanol plants, this reaction is carried out in a series of metal tubes containing a packed bed of Ni/Al\textsubscript{2}O\textsubscript{3} particulate. As the reaction is very slow and highly endothermic it requires supply of large amounts of heat to maintain the reaction rates. This is accomplished by packing a series of small diameter metal tubes containing steam reforming particulate catalysts surrounded by heat. An alternative process, which utilizes catalyzed ceramic monoliths, is autothermal reforming which combines catalytic partial oxidation with steam reforming in one monolithic reactor. This eliminates the limitations of heat transfer since the heat of the partial oxidation reaction is directly utilized by the steam reforming reaction.

\[
\text{CH}_4 + \text{O}_2 \rightarrow \text{CO} + 2\text{H}_2 + (-\Delta H)
\]

(2)

\[
\text{CH}_4 + \text{H}_2\text{O} + (-\Delta H) \rightarrow \text{CO} + 3\text{H}_2
\]

(3)

Water Gas Shift Catalysts

\[
\text{CO} + \text{H}_2\text{O} \rightarrow \text{H}_2 + \text{CO}_2
\]

(4)

This reaction being very slow requires large beds of particulate high temperature (Fe, Cr) and low temperature (Cu, Zn, Al) catalysts. Monolith catalysts can be used for this purpose, but offers a major disadvantage regarding the amount of catalyst that can be deposited on the walls of the monolith being significantly lower than the amount of particulate in the same volume. Therefore, the activity would not be sufficient and a larger bed would be required or a catalyst with significantly increased activity is needed.

Preferential Oxidation of CO: The fuel cell anode, i.e. Pt / C, is poisoned by traces of CO so it is necessary to reduce the CO below to about 10 ppm. (Korotkikh and Farrauto, 2000) study utilizes a ceramic monolith washcoated with a highly active and selective metal oxide promoted Pt catalyst, which reduces the CO from 5000 to less than 10 ppm while oxidizing about 5000 ppm of H\textsubscript{2} (i.e. selectivity of about 50%).
VI. OTHER CHEMICAL APPLICATIONS

At present, there is only one large-scale industrial application of monolithic catalysts in a multiphase process: the production of hydrogen peroxide using the anthraquinone process (Nijhuis et al 2001). In this process, anthraquinones are reduced in one reactor and oxidized in another, at which time hydrogen peroxide is produced. The quinone reduction reactor contains a monolithic palladium-based catalyst. The main reason for choosing a monolithic catalyst in this case is that the transport of fine catalyst particles with the liquid to the oxidation reactor can cause severe problems. An incomplete removal of particles prior to the transport of the reaction mixture to the oxidation reactor would cause the decomposition of hydrogen peroxide. Applying a structured catalyst reduces this risk significantly (Nijhuis et al 2001). Vinyl acetate is synthesized by the vapor phase reaction of ethylene, oxygen, and acetic acid over a monolith catalyst. For the vapor phase dehydrogenation of ethyl benzene to styrene an iron oxide honeycomb catalyst is used. Unreacted o-xylene and other intermediates are converted to phthahlic anhydride (PA) in a post-reactor containing a monolith catalyst located downstream of the main PA reactor in the Wacker low energy phthahlic anhydride process (Williams, 2001). The extruded base metal oxide monoliths along with reduced amounts of precious metals are being used in the production of nitric acid. Short contact time monoliths are under investigation for synthesis, gas generation and conversion of alkanes to olefins. Before this technology can be moved towards commercialization some issues need to be solved.

VII. ACKNOWLEDGEMENTS

The support of Prof. V. K. Srivastava (Ex-Dean and Professor, IIT Delhi) for his invaluable inputs and advice is gratefully acknowledged.

VIII. REFERENCES

Comparative Evaluation of Facility Layout Problem, Based on Material Handling Cost

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Abstract: This paper addresses the evaluation method for facility layout problem based on material handling cost. Evaluation is very important part of any problem solution tool. This is also important to decide on what bases the evaluation should be done of any problem, not only in engineering but also in other sectors. Facility layout plays an important role in any type of industry. While designing the facility layout for a new industry, the evaluation of the alternatives layouts should be done carefully with appropriate method. In this paper a method of evaluation based on material handling cost is taken with practical example of industry.

Key Words: Evaluation; facility layout; material handling cost; new industry;

I. INTRODUCTION
Facility layout planning seriously impacts on a company’s profitability. According to Grassie (2009), the selected layout establishes the physical relationship among facility activities. According to Tompkins and White (2010), since material handling activities account for 20-50 percent of a manufacturing company’s total operating budgets. If the facilities are arranged optimally, the manufacturer can reduce total product cost. Salvendy (2001) stated that an effective layout may minimize the material flows and distances between the department locations which lead to the reduction of material handling costs and improvement in cycle time. In this paper evaluation based on material handling cost is discussed.

II. MATERIAL HANDLING COST
It is the cost of handling the material on the shop floor, during the manufacturing process material flows from one machine to next machine until all the process are completed. The objective always to minimize the total material handling cost of the system. Hung, et al. (2010) proposed, to determine the material handling cost for one of the possible layout plans, the production volume, production routing, cost of travel between the machines/location should be known.

Material Handling Cost (MHC):

\[ MHC = \sum_{i=1}^{M} \sum_{j=1}^{M} F_{ij} C_{ij} D_{ij} \]

Where:
- \( F_{ij} \): flow between machines/departments i and j (i, j = 1, 2, 3, ..., M)
- \( C_{ij} \): unit material Handling cost between locations of machines/departments i and j (i, j = 1, 2, 3, ..., M)
- \( D_{ij} \): rectilinear distance between locations of machines/departments i and j

III. COMPARATIVE EVALUATION BASED ON MHC
There are various methods to solve the facility layout problem, in every method the evaluation stage comes, at this stage the available methods are to be evaluate on the basis of some criteria. This evaluation can be done on Material Handling Cost Criteria, for doing this the available alternatives is to be compare on the Total Material Handling Cost.

The following steps to be followed for evaluating by this method: Step1: collect the rectilinear distance between machine to machine or departments to departments, on shop floor for the layout alternatives. Step 2: collect the numbers flow between machines/departments per months. Step 3: calculate the unit material handling cost between the machines/departments. Step 4: calculate the MHC for all layout alternatives available and make a comparative table for total material handling cost obtain in last step for all the available alternatives. Step 5: select the layout with least material handling cost as solution.
CASE STUDY:
A case study is taken from the industry, ‘Indrason Precision Engineering Private Limited’, Located at Solan (HP). This company manufacturing tractors parts like, gears, gear box housings, rear axle housings, etc., It was new establish industry and for the facility layout problem of this industry, technique ‘Systematic Layout Planning’ by Muther was used, and at the evaluation stage of this problem solution technique ‘Comparative Evaluation Based On MHC’ was used, there were two layout alternatives at evaluation stage. In this paper the evaluation is shown only for two products, Gear Box Housings and Gears only.

Step 1: collect the rectilinear distance between machine to machine or departments to departments, on shop floor for the layout alternatives( Table 1 and Table 2 )

Step 2: collect the numbers of flow between machines/departments per months. (Table 3 )
So value of $F_{ij}$ for Gear Box Housing is 35 and for Gear it is 50

Step 3: calculate the unit material handling cost between the machines/departments.
At Indrason the material Handling was manual, $C_{ij} = Rs. 0.00633$ per meter distance

Step 4: calculate the MHC for all layout alternatives available with eq. (1), (Table 4)

Step 5: selection on the basis of results

RESULTS

The Total cost of material handling on layout alternative -1 is 131.32 and on the alternative-2 is 78.17, so on the basis of this comparison, it is clear that layout alternative-2 is better solution for the present problem of facility layout.
Evolutionary Technique for Network Routing

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ABSTRACT: Applying mathematics to a problem of the real world mostly means, at first, modeling the problem mathematically, maybe with hard restrictions, idealizations, or simplifications, then solving the mathematical problem, and finally drawing conclusions about the real problem based on the solutions of the mathematical problem. Since about 60 years, a shift of paradigms has taken place in some sense; the opposite way has come into fashion. The point is that the world has done well even in times when nothing about mathematical modeling was known. The one of the alternate ways is evolutionary computation, which encompasses three main components- Evolution strategies, Genetic Algorithms and Evolution programs. One such alternative is to use a GA-based routing algorithm. GA may be used for optimization of searching process for optimum path routing in a network for optimization of both the distance and the congestion problem in a network. The proposed GA structure for the problem at hand is encoded in Matlab.

KEYWORDS: Genetic Algorithm, Optimization, Crossover, Mutation, RVS, SVS, Encoding in GA.

I. INTRODUCTION

GA may be used for optimization of searching process for optimum path routing in a network for optimization of both the distance and the congestion problem in a network. The proposed GA structure for the problem at hand is encoded in Matlab. Evolutionary Computation is a rapidly expanding area of artificial intelligence research, with more than twenty international events per year and at least half a dozen journals, over a thousand EC related papers are published per year [Schwefel and Kursawe, 1998] Within EC there are three classes of EA; Evolutionary Programming, Evolution Strategies, and Genetic Algorithms. These classifications are based on the level in the hierarchy of evolution being modeled by the algorithm. Evolutionary Programming (EP) models evolution as a process of adaptive species. Evolution Strategies (ESs) models evolution as a process of the adaptive behavior of individuals. Thirdly, Genetic Algorithms (GAs) models evolution at the level of genetic chromosomes i.e. the basic instructions for making things. Evolutionary Computation (EC) is the study of computing techniques based on the guiding evolutionary principle of survival of the fittest. Evolutionary Algorithms (EAs) are powerful generic search algorithms capable of giving good solutions to complex problems. Some example areas in which EAs have been applied for problem solving and modeling include; optimization, automatic programming, machine learning, economics, immune systems, ecology, population genetics, evolution and learning, and social systems (see [Goldberg, 1989], [Ross and Corne, 1994], [Alander, 1995] and[Mitchell, 1996] for examples).

II. GENETIC ALGORITHMS: DEFINITIONS

GA’s are stochastic algorithms whose search methods model some natural phenomena: genetic inheritance and Darwinian strive for survival.

• GAs are search algorithms based on the mechanics of natural selection and natural genetics. They combine survival of the fittest among string structures with a structured yet randomized information exchange to form a search algorithm with some of the innovative flair of human search.

• GAs are a class of general purpose (domain independent) search methods which strike a remarkable balance between exploration and exploitation of the search space.

• GAs belong to the class of probabilistic algorithms, yet they are very different from random algorithms as they combine elements of directed and stochastic search. Because of this, GAs are more robust than existing directed search methods. Another important property of such genetic-based search methods is that they maintain a population of potential solutions - all other methods process a single point of the search space.

Algorithm:

GAs have the following structure:

\[ t := 0; \]

Compute initial population \( B_0 = (b_{1,0}, \ldots, b_{m,0}) \);

WHILE (stopping condition not fulfilled) DO

BEGIN
FOR $i := 1$ TO $m$ DO

select an individual $b_{i,t+1}$ from $B_t$;

FOR $i := 1$ TO $m - 1$ STEP 2 DO

IF Random[0, 1] _ pC THEN

cross $b_{i,t+1}$ with $b_{i+1,t+1}$;

FOR $i := 1$ TO $m$ DO

eventually mutate $b_{i,t+1}$;

t := t + 1
END

Selection Algorithm: For obvious reasons, this method is often called proportional selection

$$x := \text{Random}[0, 1];$$

$$i := 1;$$

WHILE $i < m \&\& x < \frac{\sum_{j=1}^{i} f(b_{j,t})}{\sum_{j=1}^{m} f(b_{j,t})}$ DO

$$i := i + 1;$$

select $b_{i,t};$

III. CROSS OVER

Crossover is a structured yet randomized information exchange between strings

IV. GOALS OF THE THESIS

GA-based routing algorithm has been found to be more scalable and insensitive to variations in network topologies. However, it is also known that GA-based routing algorithm is not fast enough for real-time computation [14]. minimum spanning tree (MST) of a graph is an important concept in the communication network design and other network-related problem. Given a graph with cost (or weight) associated with each edge, the MST problem is to find a spanning tree of the graph with minimal total cost. When the graph’s edge costs are fixed and the search is unconstrained, the well-known algorithm of Krushal [12] and Prim [13] can identify MST in times that are polynomial in the number of nodes [15].

We intend to use this huge stochastic optimization tool Optimum Path Routing Problem. GA may be used for optimization of searching process for optimum path routing in a network for optimization of both the distance and the congestion problem in a network. Congestion problem in a network is not treated for in reference, which we intend to take care of in the proposed GA structure for the problem at hand. The possible optimum path is one which is having minimum distance as well as the congestion factor is to be minimized through the path, a path with less congestion but having relatively larger distance may be selected as per the objective function, which takes care of both distance as well as the congestion in the path.

V. RESULT

The present application of GA is programmed in MATLAB. Variable length chromosomes with real coding are used. For the particular example taken here, a population size of 10 is taken. The algorithm explained in previous section is programmed for a network of total 56 nodes. Shortest path routing is the type of routing widely used in computer networks nowadays. Even though shortest path routing algorithms are well established, other alternative methods may have their own advantages. One such alternative is to use a GA-based routing algorithm. Based on previous research, GA-based routing algorithm has been found to be more scalable and insensitive to variations in network topologies. However, it is also known that GA-based routing algorithm is not fast enough for real-time computation [14]. We intend to use this huge stochastic optimization tool Optimum Path Routing Problem. GA may be used for optimization of searching process for optimum path routing.
VI. IMPLEMENTATION OF PROPOSED ALGORITHMS IN MATLAB

The present example is coded in Matlab. Real coding with variable length chromosomes is used. The chromosome size is variable for each chromosome and each chromosome represents a probable route having some distance and total congestion in the path. Number of nodes is fixed in the network with each node having a congestion factor associated to it having value between 0 and 1; 0 represents a totally free node while a 1 represents a totally congested node. The following process is used to encode the proposed GA for this problem.

OBJECTIVE FUNCTION: Objective function calculates the distances between nodes from the starting node to terminating node and also sums up the congestion factors of all the nodes in the path. Objective function assigns fitness to each chromosome by way of calculating the total path distance and the total congestion factor of the path represented by the chromosome. GA maximizes the objective function, which is reciprocal of the total sum of distance from starting node to ending node and total congestion factor through this path.

\[ T.D = \sum_{i=1}^{k} \sqrt{(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2} \quad \text{......... (i)} \]

\[ T.DF = \sum_{i=3}^{k} \sqrt{(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2} + w \sum_{i=3}^{k} C_i \quad \text{......... (ii)} \]

\[ \text{ObjFun} = 1/ \sum_{i=1}^{k} \sqrt{(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2} + w \sum_{i=3}^{k} C_i \quad \text{......... (iii)} \]

So the objective function calculates the above factor for each and every potential path i.e. the chromosome in a population.

OPTIMIZED PATH AND CONVERGENCE CURVE FOR GA

The starting node is taken as \( S=[0.0,5.0,0.1] \); and the ending node is \( E=[10.0,2.0,0.1] \). The Algorithm selected a path which optimizes the distance between the starting and ending node along with minimizing the total congestion on the path. The optimum path found by GA in present example is

\[ S=[0.0,5.0,0.1]; \quad [2.0,7.0,0.0]; \quad [4.0,4.0,0.2]; \quad [6.0,4.0,0.1]; \quad [9.0,3.0,0.2]; \quad E=[10.0,2.0,0.1]. \]

The nodes are selected by the algorithm for optimizing the distance along with the congestion on the path. A shorter path with higher congestion may be neglected while longer path with lesser congestion may be selected. The path selected is shown in the figure by bold line.

GA Converges when it reaches to a optimal solution. There may be many criterions to access the convergence of GA. When the average fitness of subsequent generations stops growing then GA either converged to an optimal solution or might have struck at some suboptimal point. A predefined number of runs may be taken as the stopping criterion for the GA. Here we have tested both the stopping criterion. In this particular application fixed number of runs may be used as the optimality of the solution is visible from the output if all the chromosomes in the final population are same. The convergence curve for the GA is shown in figure--
VII. CONCLUSION

The implementation of the present GA application in Matlab is simple yet encompasses the concept of congestion factor on different nodes. Salman Yousof et.al in reference [14] paid attention to the problem of shortest path routing yet have not discussed about the congestion in the network. Apart from avoiding long distances, it very much important to minimize the congestion in the path once selected in the network, because congestion is a major factor which restricts the data flow drastically, and even much more effect than distances between the transmitting and receiving nodes.

REFERENCES


A Plus-Shaped Microstrip Patch Antenna for X-Band Microwave Applications

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University institute of Technology, Kurukshetra

Abstract: A plus-shaped microstrip patch antenna has been designed for X-band microwave applications. Four slots at opposite edges of antenna are incorporated to perturb the surface current path, introducing local inductive effect that is responsible for the excitation of the resonance. A substrate of low dielectric constant is selected to obtain a compact radiating structure that meets the demanding bandwidth specification. The reflection coefficient at the input of the proposed plus-shaped microstrip patch antenna is below $-12$ dB over (6.5-8.5) GHz of frequency range of analysis. Simulation of antenna is carried out on Ansoft simulator.

Keywords: PLUS-shaped, slots, reflection coefficient, Ansoft.

I. INTRODUCTION

Wireless local area networks (WLAN) are widely used worldwide. The IEEE 802.11b and 802.11g standards utilize the 2.4-GHz ISM band. The frequency band is license-free; hence the WLAN equipment will suffer interference from microwave ovens, cordless phone, Bluetooth devices and other appliances that use this same band. The 802.11a standard uses the 5-GHz band which is cleaner to support high-speed WLAN. However, the segment of frequency band used varies from one region of the world to another [1]. Autonomous distributed wireless sensor networks such as those being investigated by the Speckled Computing Consortium [6] are widely predicted to have major growth opportunities in the coming years in numerous imaging, safety, biomedical and environmental applications. In most of these areas, the design challenges are somewhat different from contemporary wireless communications systems in that data rates will be low, and power consumption and size of the sensor node are the key issues.

A microstrip or patch antenna shown in fig 1 is a low profile antenna that has a number of advantages over other antennas. It is lightweight, inexpensive, and easy to integrate with accompanying electronics. The antenna can be 3D in structure. Microstrip patch antennas radiate primarily because of the fringing fields between the patch edge and the ground plane. Since the propagating EM fields lay both in the substrate and in free space, a quasi-TEM mode is generated [7]. Microstrip antenna is the ideal choice for many application due to its low-profile, lightweight, low-cost and ease of integration with microwave circuits.

However, standard rectangular microstrip patch antenna has the drawback of narrow bandwidth. Enhancement of the performance to cover the demanding bandwidth is necessary. The bandwidth of microstrip antenna may be increased using air substrate [7]. However, dielectric substrate must be used if compact antenna size is required. A few approaches can be applied to improve the microstrip antenna bandwidth. These include increasing the substrate thickness, introducing parasitic element either in coplanar or stack configuration, and modifying the shape of a common radiator patch by incorporating slots. The last approach is particularly attractive because it can provide excellent bandwidth improvement and maintain a single-layer radiating structure to preserve the antenna’s thin profile characteristic. The successful examples include E-shaped patch antennas [1], U-slot patch antennas [8], and V-slot patch antennas [5].
II. ANTENNA DESIGN

First, a rectangular microstrip patch antenna is designed based on the standard design procedure to determine the length \( L \) and width \( W \) at resonant frequency 2.4GHz. Then, four square slots at corner are incorporated to perturb the surface current path, introducing local inductive effect that is responsible for resonance in antenna. The slot length \( L_s \), slot width \( W_s \) of the Plus-shaped patch controls the frequency of the fundamental resonant mode [6]. It has been excited at two positions. The dimension of slots i.e. width and length always affects the performance of antenna as discussed in [1, 7]. The slot dimensions for Plus-shaped antenna are \( L_s=5 \text{ mm} \) and \( W_s=5 \text{ mm} \). Effects of slots on performance of antenna can be measured by modeling the antenna in terms of its inductance, capacitance and load resistance.

III. RESULTS

The Plus-shaped microstrip Patch antenna has been simulated using HFSS at 10 GHz of frequency. The electric and magnetic field vector profiles are shown in fig. 4 & 5. These profiles show the resonance nature of antenna and the distribution of field at various positions of Plus-Shaped antenna. The radiation pattern of Plus-shaped microstrip antenna shown in fig.6 represents radiation intensity in all directions in spherical co-ordinates.
The dark red areas observed in pattern shows the maximum values of radiation intensity at those points. From the pattern it is clear that the antenna radiates well in broad dimensions along upward direction. So, it suits for directional X-band applications.

The VSWR of Plus-shaped antenna for both the feed ports has been shown in fig. 9. From the same it has been observed that the VSWR is very less i.e. nearly 2.5 dB in (6.5-8.5) GHz of frequency range.

From the return loss plot shown in fig.7 of the microstrip antenna it is observed that the reflection coefficient at the input of the proposed Plus-shaped microstrip patch antenna is below $-12$dB over (6.5 -8.5) GHz of frequency range of analysis at both the ports. At 8 GHz the return loss is -14.8dB which shows the resonance in antenna at this frequency.

A single back lobe has been observed in radiation pattern which proves minimum power loss in undesired directions makes antenna directional which makes it suitable X-band microwave discussed in [3].
The gain plot in dB scale of proposed plus-shaped patch antenna has been shown in fig. 10. From which it observed that the gain is equally well in longitudinal directions major lobe which proves its directional nature and makes it suitable for the X-band applications.

V CONCLUSION

A wideband Plus-shaped microstrip patch antenna for X-band applications and other wireless communication systems covering the (6.5-8.5) GHz frequency band has been designed. It shows good resonance at frequency 8 GHz and at the same frequency it has very low VSWR. It has also been observed that slot incorporation in a well defined manner change the performance of antenna remarkably. Proposed antenna can be used for X-band applications like navigation etc.

VI REFERENCES

A Comparative Corpus Approach to Speech Enhancement

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2Assistant Professor, E & C Deptt. MMU Mullana, Ambala, India.
1er.abhapatyal@gmail.com, 2agarg001@yahoo.com

ABSTRACT: A novel system based on minimal noise prior for non stationary noise is proposed. Existing speech algorithms consist of different dynamics and speaker characteristics, robustness to noise and requirement of the prior information of the noise. But they are not focussed on speech intelligence quotient. In this paper, a framework is made that can be used as analysing potential factor that can effect the processed speech intelligent quotient. To achieve a good intelligent quotient, distortion producing factors should be controlled. And for this, various observations are made through a controlled processed speech in order to maximally extract corpus speech from that of noisy speech. A comparative study to the speech enhancement for previously developed algorithms will lead to have good intelligence quotient and promising in improving performances.

KEYWORDS: Speech enhancement; noise removal; corpus speech; subjective framework; intelligent quotient; signal distortion; background intrusiveness.

I. INTRODUCTION
Speech enhancement technology has made it possible to extract a great deal of information about corpus part from that of noisy part. And various speech enhancement algorithms are developed to have more improvements in results. The motivation for the study of it exists in the application it consists of. Yet, this is even not clear that which algorithm is more effective and in which aspect. A subjective framework is developed here which will act as a platform for interpretation of all the algorithms in different types of noises. The purpose of this framework is to observe a few of most current speech enhancement techniques and secondly, to propose a very simpler alternative that can manage the restricted scenario where the speech processed is get mixed with various terminals. In a noisy atmosphere, it is difficult to check the noise priority of corpus sentence. And various approaches viz. Subspace algorithm, statistical model based algorithm, spectral subtractive and wiener filter algorithm have been considered for speech enhancement. These algorithms have been evaluated using a noisy speech corpus aurora database suitable for evaluation of speech enhancement algorithms.

Noisy Speech Corpus: Six persons (three male and three female) were taken as speakers taking IEEE sentences into consideration. And were made influenced by different noises at 5 dB.

Noise: Noise considerations taken for speech enhancement algorithms are babble (crowd of people), car, train. 30 different speech sentences are taken as base materials.

Speech part: Various speech sentences are taken into consideration in order to reduce noise from that of corpus sentences. These sentences are given as:

<table>
<thead>
<tr>
<th>Filename</th>
<th>Speaker</th>
<th>Gender</th>
<th>Sentence text</th>
</tr>
</thead>
<tbody>
<tr>
<td>sp01.wav</td>
<td>CH</td>
<td>M</td>
<td>The birch canoe slid on the smooth planks</td>
</tr>
<tr>
<td>sp02.wav</td>
<td>CH</td>
<td>M</td>
<td>He knew the skill of the great young actress</td>
</tr>
<tr>
<td>sp03.wav</td>
<td>CH</td>
<td>M</td>
<td>Her purse was full of useless trash</td>
</tr>
<tr>
<td>sp04.wav</td>
<td>CH</td>
<td>M</td>
<td>Read verse out loud for pleasure</td>
</tr>
<tr>
<td>sp05.wav</td>
<td>CH</td>
<td>M</td>
<td>Wipe the grease off his dirty face</td>
</tr>
<tr>
<td>sp06.wav</td>
<td>DE</td>
<td>M</td>
<td>Men strive but seldom get rich</td>
</tr>
<tr>
<td>sp07.wav</td>
<td>DE</td>
<td>M</td>
<td>We find joy in the simplest things</td>
</tr>
<tr>
<td>sp08.wav</td>
<td>DE</td>
<td>M</td>
<td>Hedge apples may stain your hands green pole</td>
</tr>
<tr>
<td>sp09.wav</td>
<td>DE</td>
<td>M</td>
<td>Hurdle the pit with the aid of a long bright blue pole</td>
</tr>
<tr>
<td>sp10.wav</td>
<td>DE</td>
<td>M</td>
<td>The sky that morning was clear and bright blue</td>
</tr>
<tr>
<td>sp11.wav</td>
<td>JE</td>
<td>F</td>
<td>He wrote down a long list of items sound</td>
</tr>
<tr>
<td>sp12.wav</td>
<td>JE</td>
<td>F</td>
<td>The drip of the rain made a pleasant sound</td>
</tr>
<tr>
<td>sp13.wav</td>
<td>JE</td>
<td>F</td>
<td>Smoke poured out of every crack sound</td>
</tr>
<tr>
<td>sp14.wav</td>
<td>JE</td>
<td>F</td>
<td>Hats are worn to tea and not to dinner sound</td>
</tr>
<tr>
<td>sp15.wav</td>
<td>JE</td>
<td>F</td>
<td>The clothes dried on a thin wooden rack sound</td>
</tr>
</tbody>
</table>
Table 2
List of sentences used

<table>
<thead>
<tr>
<th>Filename</th>
<th>Speaker</th>
<th>Gender</th>
<th>Sentence text</th>
</tr>
</thead>
<tbody>
<tr>
<td>sp16.wav</td>
<td>KI</td>
<td>F</td>
<td>The stray cat gave birth to kittens</td>
</tr>
<tr>
<td>sp17.wav</td>
<td>KI</td>
<td>F</td>
<td>The lazy cow lay in the cool grass</td>
</tr>
<tr>
<td>sp18.wav</td>
<td>KI</td>
<td>F</td>
<td>The friendly gang left the drug store</td>
</tr>
<tr>
<td>sp19.wav</td>
<td>KI</td>
<td>F</td>
<td>We talked of the sideshow in the circus</td>
</tr>
<tr>
<td>sp20.wav</td>
<td>KI</td>
<td>F</td>
<td>The set of china hit the floor with a crash</td>
</tr>
<tr>
<td>sp21.wav</td>
<td>SI</td>
<td>M</td>
<td>Clams are small, round, soft and tasty</td>
</tr>
<tr>
<td>sp22.wav</td>
<td>SI</td>
<td>M</td>
<td>The line where the edges join was clean</td>
</tr>
<tr>
<td>sp23.wav</td>
<td>SI</td>
<td>M</td>
<td>Stop whistling and watch the boys march</td>
</tr>
<tr>
<td>sp24.wav</td>
<td>SI</td>
<td>M</td>
<td>A cruise in warm waters in a sleek yacht is fun</td>
</tr>
<tr>
<td>sp25.wav</td>
<td>SI</td>
<td>M</td>
<td>A good book informs of what we ought to know</td>
</tr>
<tr>
<td>sp26.wav</td>
<td>TI</td>
<td>F</td>
<td>She has a smart way of wearing clothes</td>
</tr>
<tr>
<td>sp27.wav</td>
<td>TI</td>
<td>F</td>
<td>Bring your best compass to the third class</td>
</tr>
<tr>
<td>sp28.wav</td>
<td>TI</td>
<td>F</td>
<td>The club rented the rink for the fifth night</td>
</tr>
<tr>
<td>sp29.wav</td>
<td>TI</td>
<td>F</td>
<td>The flint sputtered and lit a pine torch</td>
</tr>
<tr>
<td>sp30.wav</td>
<td>TI</td>
<td>F</td>
<td>Let us all join as we sing the last chorus</td>
</tr>
</tbody>
</table>

**Voice Activity Detector:** A sum of 13 speech enhancement algorithms is defined for maximally extraction of noise part from that of clean speech. These algorithms are categorized in four categories. And are given as: subspace, spectral subtractive, wiener type and statistical model type.

A voice activity detector (VAD) was used in the speech enhancement methods to check the noise spectrum. More precisely, a statistical-model based voice activity detector (VAD) (Sohn et al., 1999) was used to check noise spectrum during speech-absent periods. In this methodology, these 13 speech enhancement algorithms used VAD equations (Gustafsson et al. (2001)).

II. METHODOLOGY

The subjective tests were designed according to the thirty statements taken. The methodology was designed to reduce and check the listener’s uncertainty in test as to which component(s) of a noisy speech signal, i.e., the speech signal, the background noise, or both, should form the basis of their ratings of overall quality i.e. OVRL. This instructs the listener to successively attend to and rate the enhanced speech signal on:

1. the speech signal alone using a five-point scale of signal distortion (SIG) (Table 3),
2. the background noise alone using a five-point scale of background intrusiveness (BAK) (Table 4),
3. the overall effect using the scale of the Mean Opinion Score (OVRL)

\[ 1 = \text{bad}, 2 = \text{poor}, 3 = \text{fair}, 4 = \text{good}, 5 = \text{excellent} \]

<table>
<thead>
<tr>
<th>Table 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale of signal distortion (SIG)</td>
</tr>
<tr>
<td>5 – Very natural, no degradation</td>
</tr>
<tr>
<td>4 – Fairly natural, little degradation</td>
</tr>
<tr>
<td>3 – Somewhat natural, somewhat degraded</td>
</tr>
<tr>
<td>2 – Fairly unnatural, fairly degraded</td>
</tr>
<tr>
<td>1 – Very unnatural, very degraded</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale of background intrusiveness (BAK)</td>
</tr>
<tr>
<td>5 – Not noticeable</td>
</tr>
<tr>
<td>4 – Somewhat noticeable</td>
</tr>
<tr>
<td>3 – Noticeable but not intrusive</td>
</tr>
<tr>
<td>2 – Fairly conspicuous, somewhat intrusive</td>
</tr>
<tr>
<td>1 – Very conspicuous, very intrusive</td>
</tr>
</tbody>
</table>

![Fig. 1. Babble (crowd of people) noise(5dB) Showing SIG, BAK, OVRL](image1)

![Fig. 2. Car noise(5dB) showing SIG, BAK, OVRL](image2)
IV. Conclusion

Following results are observed:

1. Noise estimation algorithms perform well in station background noise eg. Car environment but not in other environments eg. Babble or train.

2. Subjective evaluation of speech enhancement algorithms can be done for separating free-text mixed sentences spoken by different speakers by using speaker diarization to corpus sentences.

3. In terms of overall quality and distortion of speech, the algorithms performed the best are: MMSE-SPU, logMMSE, logMMSE-ne, pMMSE and MB. The subspace algorithms performed poorly.

4. Minimal noise prior or lack of accurate estimation of noise spectrum becomes a major factor for absence of speech intelligent quotient.

5. The statistical-model based algorithms (e.g., MMSE, Wiener filter) derive the magnitude spectra by minimizing the mean-squared error (MSE) between the clean and estimated (magnitude or power) spectra. The MSE metric, however, pays no attention to positive or negative differences between the clean and estimated spectra. A positive difference between the corpus clean and estimated spectra would signify attenuation distortion, while a negative spectral difference would signify amplification distortion. The perceptual effect of these two distortions on speech intelligibility cannot be assumed to be equivalent.

6. Comparisons of ratings of the overall quality of noisy (unprocessed) speech against that of enhanced (processed) speech revealed that only a subset of the algorithms tested provided significant benefit to overall quality and only in a few conditions (car, street and train). No algorithm produced significant quality improvement in multi-talker babble, i.e., in highly nonstationary environments.

V. REFERENCES


ECG Signal Analysis and Feature Extraction Using Wavelet Transform

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Abstract: This paper deals with the study of ECG signals using wavelet transform analysis. The purpose of this study is to apply and evaluate performance of wavelets and select an appropriate wavelet to detect the R waves from the waveform captured from lead II electrocardiograph (ECG) and perform heart rate variability in time, frequency and non-linear analysis. Heart Rate Variability has been recently established as the window to the autonomic nervous system of the brain. The techniques developed were executed on a set of 5 data samples from healthy subjects captured by the use of Biopac 150 (sampling frequency was 1000 samples per second). Daubechies wavelet was found to be suitable for ECG analysis. Overall efficiency of 99.30% for peak detection of ECG signal was achieved. The ECG signal was denoised by removing the corresponding wavelet coefficients. Then QRS complexes were detected and each complex was used to find the peaks of the individual waves like P and T, and also their deviations. The objective of our work includes preprocessing (filtering, denoising, baseline wander removal), parameter extractions (the most important processing phase) and soft computing methods for interpretation and more accurate results for performing Heart Rate Variability in Time, Frequency and Non-Linear analysis.

Keywords: ECG, QRS-complex, R-R interval, DWT, Baseline Drift, HRV.

I. INTRODUCTION

Wavelets are mathematical functions that cut up data into different frequency components, and then study each component with a resolution matched to its scale. An ECG is a graphical produced by an electrocardiograph, which records the electrical activity of the heart over time. It is nothing but the recording of the hearts electrical activity. The deviations in the normal electrical patterns indicate various cardiac disorders [2][3]. The ECG cannot reliably measure the pumping ability of the heart; for which ultrasound-based (echocardiography) or nuclear medicine tests are used. Heart rate can be measured by e.g. outputs easily by counting the no. of big blocks b/w two successive R-waves.

This paper used a discrete wavelet transform (DWT) to extract the relevant information from the ECG input data.

The obtained ECG features are then further processed. The features are: mean, median, maximum, minimum, range, standard deviation, variance, and others. Another key advantage of wavelet techniques is the variety of wavelet functions available, thus allowing the most appropriate to be chosen for the signal under investigation.

HRV is a measure of the variability in heart rate, i.e., variability in inter beat interval spectra of human HRV can be divided into three main frequency zones: below 0.04 Hz is very low frequency (VLF), between 0.04 and 0.15 Hz is low frequency (LF), and between 0.15 and 0.5 Hz is high frequency (HF). The ratio of the LF to HF power has been associated with the sympathovagal balance [8].
Normally, the frequency range of an ECG signal is of 0.05–100 Hz and its. The ECG signal is characterized by five peaks and valleys labelled by the letters P, Q, R, S, T. In some cases we also use another peak called U. The performance of ECG analyzing system depends mainly on the accurate and reliable detection of the QRS complex, as well as T- and P-waves. The P-wave represents the activation of the upper chambers of the heart, the atria, while the QRS complex and T-wave represent the excitation of the ventricles or the lower chamber of the heart. The detection of the QRS complex is the most important task in automatic ECG signal analysis. Once the QRS complex has been identified a more detailed examination of ECG signal including the heart rate, the ST segment etc. can be performed.

In the normal sinus rhythm (normal state of the heart) the P-R interval is in the range of 0.12 to 0.2 seconds. The QRS interval is from 0.04 to 0.12 seconds. The Q-T interval is less than 0.42 seconds and the normal rate of the heart is from 60 to 100 beats per minute. So, from the recorded shape of the ECG, we can say whether the heart activity is normal or abnormal.

Amplitude
- P-wave — 0.25 mV
- R-wave — 1.60 mV
- Q-wave — 25% R wave
- T-wave — 0.1 to 0.5 mV

Duration
- P-R interval : 0.12 to 0.20 s

The normal value of heart beat lies in the range of 60 to 100 beats/minute. A slower rate than this is called bradycardia (Slow heart) and a higher rate is called tachycardia (Fast heart). If the cycles are not evenly spaced, an arrhythmia may be indicated. If the P-R interval is greater than 0.2 seconds, it may suggest arrhythmias, conduction abnormalities, ventricular hypertrophy, myocardial infection and other disease states.

II. MATERIALS AND METHODS

2.1 ECG signal and choice of Wavelet function

The waveform of the db6 matches as that of the EC so it is used for performing signal processing of ECG signals. The most commonly used set of discrete wavelet transforms was formulated by the Belgian mathematician Ingrid Daubechies.

2.2 Wavelet Decomposition Using Discrete Wavelet Transform (DWT)

One of the most frequently and commonly used Wavelet Transformation is the Discrete Wavelet Transformation (DWT). The discrete wavelet transform has emerged as a particularly powerful tool for the encoding of data required for compression systems.

Mathematically a Discrete Wavelet Transform can represent as:

$$\psi[n] = \sum_{2^k} \psi[k] \cdot 2^n - k$$

(2.1)

Wavelet packet transforms (WPTs) are a generalization of the discrete wavelet transform which involve particular linear combinations of discrete wavelets and the decomposition of a signal is performed in a manner similar to the discrete wavelets and the decomposition of a signal is performed in a manner similar to the multiresolution subband coding algorithm.

III SYSTEM DESIGN AND IMPLEMENTATION

3.1 Data Acquisition and Sampling

The ECG Database mostly which are sampled at 1000 Hz is being used as a data of ECG input signal for features extraction part and processing.
3.2 Preprocessing of ECG Signals

Generally, the recorded ECG signal is often contaminated by noise and artifacts that can be within the frequency band of interest and manifest with similar characteristics as the ECG signal itself. Preprocessing ECG signals helps to remove the contaminants from the ECG signal [9]. Among the various noises, the power line interference and the baseline wandering are the most significant and can strongly affect ECG signal analysis. Except for these two noises, other noises may be wideband and usually are a complex stochastic process which also distorts the ECG signal.

3.3 Baseline wander Removal

Wavelet transformation helps us decompose the signal to any desired level, and smaller ranges of frequencies can be processed as per desire. In this study, the low frequency components of a decomposed signal are A10 and D10. Therefore, to remove the baseline Drift these components should be removed from the original ECG signal. i.e Detrended Signal (DS) = Original Signal - (A10+D10). Thus the problem of baseline shifting is solved. Here we have decomposed to the 10th level because (0-0.5)Hz purely causes baseline wandering and do not hold any part of the information signal.

3.4 Feature Extraction

In feature extraction initially R wave signal is obtained by marking the R peaks by unit impulses. R-R time series signal is evaluated from R wave signal.

3.4.1 Calculating the RR interval for HRV analysis

Measuring the R-R interval is of high importance and a critical factor in exploring HRV[8].

The R-R interval is obtained as, \( RR(t) = \hat{r}(t) - \hat{r}(t-1) \)

\( RR(t) = R - R \) interval at tth sample

\( R(t-1) = \) position of delta function at (t - 1)st R peak.

\( R(t) = \) position of delta function at tth R peak

3.5 HRV Analysis

3.5.1 In Frequency domain

3.5.2 In Time domain
3.5.3 Non linear Poincare curve

![Poincare Plot](image-url)

Fig 1.9 Poincare Plot

IV. RESULTS

The algorithm was developed and evaluated in MATLAB® 7. The results are depicted in the Table. Wavelets achieved an overall efficiency of 99.30% (when run against our test database comprising of 5 healthy subjects)

Table 5.1

Results of comparison between manual and automatic detection of R waves in ECG signals

<table>
<thead>
<tr>
<th>Record No/Subject</th>
<th>Manual Count</th>
<th>Algorithm Count</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>430</td>
<td>428</td>
<td>99.53%</td>
</tr>
<tr>
<td>30</td>
<td>390</td>
<td>384</td>
<td>98.46%</td>
</tr>
<tr>
<td>45</td>
<td>410</td>
<td>410</td>
<td>100%</td>
</tr>
<tr>
<td>78</td>
<td>400</td>
<td>396</td>
<td>99.00%</td>
</tr>
<tr>
<td>84</td>
<td>430</td>
<td>428</td>
<td>99.53%</td>
</tr>
</tbody>
</table>

Table 5.2

Calculated results for Heart rate variability for Normal, arrhythmias and signal extracted features

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal ECG signal HRV</td>
<td>88.9987 (H.R.)</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>132.9669 (H.R.)</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>36.982 (HR)</td>
</tr>
<tr>
<td>Mean HRV</td>
<td>97.2576</td>
</tr>
<tr>
<td>SDNN</td>
<td>0.037835</td>
</tr>
<tr>
<td>RMSSD</td>
<td>0.027122</td>
</tr>
<tr>
<td>LF/HF ratio</td>
<td>-0.3046-0.67305i</td>
</tr>
<tr>
<td>NN50</td>
<td>0</td>
</tr>
</tbody>
</table>

V. REFERENCES


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Dynamic Performance of AC Generators and DSTATCOM Devices Connected to Distribution Systems

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Abstract: This contribution starts from the dynamic study about the AC generators (Induction and synchronous machines) and distribution static synchronous compensator devices. Presently distribution generation and devices based on power electronics. AC generators draws very large reactive current under fault condition and gets down the mesh voltage and conduct voltage instability. For solution of this problem need a dynamic reactive power compensation. For this work the DSTATCOM is very much suitable for behavior of DSTATCOM to improve the voltage stability performance of distribution system with AC generator (induction generator). A DSTATCOM power factor controller may adversely affect the stability performance of synchronous generators. After analysis and computer simulation result it is proved a DSTATCOM voltage controller can improve the stability performance of AC generators.

Key Words: AC Generators, DSTATCOM, Voltage stability, Distributed generation, custom power devices.

I. INTRODUCTION
Distributed generation is a small scale electricity generation. It is fairly a new concept in electric energy market. Electric utilities are seeking new technologies to provide acceptable power quality and reliability. Current power distribution systems are receiving increased installation of distributed generation. For improving power quality and reliability custom power devices have been adopted. But more attention has been given to the equipment based on the voltage source converter technology. Distribution static synchronous compensator (DSTATCOM) is the best example of this type of devices. Distribution static synchronous compensator (DSTATCOM) improve the voltage stability performance of distribution system with induction generators is investigated. Such investigation based on three phase non-linear dynamics. Simulation utilizing the power system block set for use with matlab simulink. For analysis of a DSTATCOM two control strategy adopt –

1. Voltage control,
2. Power factor control.

For such studies a DSTATCOM is represented by a model based on controllable three-phase voltage sources and an algebraic model of DC link. The main impact on the stability performance of distribution network due to simultaneous usage of ac generators and DSTATCOM devices are determined.

II. DISTRIBUTION SYSTEM MODEL
For this analysis all circuit components were represented by presented by three-phase model, constant current model is active component of loads and constant impedance model is reactive components. The Distribution feeders were modeled as series RL Impedances. The loads are simulated using three parallels RL impedances wye-connected, with the neutral connected to the ground. The three phase transformers are simulated taking into account the core losses. Which is a 132 KV, 60 Hz, sub transmission system with a short circuit level of 1500 MVA, Represented by a thevenin’s equivalent (sub) which feeds a 33KV distribution system through two 132/33 KV ∆/Y g transformers. An AC generator with a capacity of 30 MW is connected to the network through a 33/0.69 KV transformer. This machine can represent one generator in a thermal generation plant as well as an equivalent of various generator in a small hydro generation and wind plant.
III. DSTATCOM DEVICES

A DSTATCOM consist of a three phase voltage source converter which is shunt connected to the distribution network. DSTATCOM is the most important network for distribution network. It has been widely used since the 1990’s to precisely regulate system voltage improve voltage profile, reduce voltage harmonics, reduce transmit voltage disturbances and load compensation. The DSTATCOM uses a power electronic converter to synthesize the reactive power output. A DSTATCOM converter is controlled using pulse width modulation PWM. In Distribution voltage level devices, the employed switching element is the IGBT (Integrated Gate Bipolar Transistor), due to its lower switching losses and reduced size. The PWM (Pulse width Modulation) control the output voltage and eliminate the harmonic component.

A directly controlled converter is more difficult and expensive to implement than an indirectly controlled converter, the former presents superior dynamic performance. DSTATCOM devices can be represented by a controllable three phase voltage source behind a transformer as shown in figure. Here Va, Vb, Vc represent the reference instantaneous voltage to the converter in pu, which is determined from the control signal Vabc. And the output voltage of the converter in volts and dependent of the dc link voltage i.e.

\[ V_a = V_{dc}V_a \]
\[ V_b = V_{dc}V_b \]
\[ V_c = V_{dc}V_c \]

Therefore it is important to represent the DC link dynamics. This can be built based on the energy conversion principle. The AC output terminal must always be equal as per energy conservation principle, can be expressed mathematically

\[ V_{dcI_{dc}} = V_{la} + V_{lb} + V_{lc} \]

Vdc and Idc are the voltage and current in the dc link, and Iabc are the currents injected into the network by the DSTATCOM.

A. DSTATCOM Voltage Controller

The Voltage controller analyzed in this section and its block diagram exhibited in figure -

Such controller consist of a phase locked loop (PLL) which synchronize the output three phase voltage of the converter.
with the zero crossing of the fundamental component of the phase –A voltage. Therefore the PLL provides the Φ angle to \( \text{abc} \rightarrow \text{dq0} \) (dq0-abc) transformation. There are four proportional integral PI regulations. One is responsible for controlling the terminal voltage through the reactive power exchange with the ac network. This proportional integral regulator provide the reactive current reference \( I_q^* \) with the limited between +1 p.u. inductive. This proportional integral regulator has one droop characteristic usually ±5%, which allows the terminal voltage varies a small amount to avoid oscillations. Second proportional regulator is responsible to keep constant the dc voltage through small active power exchange with ac network. This proportional integral regulator provide \( I_d \) reference value. The other two proportional integral regulator determine \( V_d \) and \( V_q \) reference voltage components which are sent to the PWM signal generator of the converter, after a drop- to- abc transformation. Finally \( V_{abc} \) are the three phase voltages desired at the converter output.

B. DSTATCOM Power Factor Controller

The power factor controller for this section is adopted here is shown figure –

![Fig. 5 DSTATCOM Power Factor Controller](image)

This DSTATCOM power factor is very similar to the DSTATCOM voltage controller presented by previous section. The main difference found from the reactive power exchange controller, which is generally adjusted to provide all reactive power consumption at the facility. (i.e. unitary power factor operation. Thus the reactive power reference \( Q^* \) is generally set equal to zero and \( Q \) is the reactive power demand of the customer installation. In this case, \( Q \) is reactive power flow bus 5 to bus 6. Thus the DSTATCOM is responsible to provide the reactive power demand to the transformer 5-6 and induction generator at bus 6.

In Denmark a practical example of a DSTATCOM power factor controller is established, which is an 8 MVA DSTATCOM that was installed on a 24 MW wind form. Whose control system is arranged so that the wind form generate at unity power factor.

IV. INDUCTION GENERATORS

An Induction generator is identical in electrical and mechanical construction to induction motor. A motor is normally wound for a voltage somewhat below the nominal system voltage drop caused by motors load current. An Induction generator is an Induction motor which is driven above the generators speed by a suitable prime mover and is provided a source of sufficient reactive power for excitation. The induction generator are very simple, reliable and low cost so it is well suited for many industrial applications. Here we discuss about the dynamic behavior of the induction generator and it is represented for a sixth order three phase model in the dq rotor reference frame. In first case the simulated without DSTATCOM, a three phase capacitor bank was connected to the terminal of the induction generator, which was fixed to keep the terminal voltage at 1p.u. during steady state. In this case the mechanical power was considered constant (i.e. the effect of prime mover and governor were neglected). The synchronous generator was represented by an eight order three-phase model in the d-q rotor reference frame such a generator was equipped with an AVR Automatic voltage regulator. The mechanical power was considered constant. And all electrical variable and parameters are referred to the stator.

V. RESULT

In this section, the simplified model is validated and the simulation results are presented. In the absence of the DSTATCOM terminal voltage varies. In the case simulated without a DSTATCOM all reactive power demand of the induction generator is provided from a three phase capacitor bank; the terminal voltage is equal to 1 P.U. during steady state. On the other hand, simulation with a DSTATCOM terminal voltage variation minimized and the dc capacitor

![Fig. 6. Test Model](image)
value is adopted equal to 0.01F and the reference dc voltage is 4000V. Moreover, in all cases the simulated faults are applied at bus 4 at t=0.5 second and eliminated after 9 cycles (150ms) through the tripping of the branch 2-4. Three cases are studies as follows.

**Case (a)**: In this first case the induction generator is injecting 25MW into the network when a three phase ground short circuit occurs. Figure shows the terminal voltage response for this case. It can be verified that all the three simulation i.e. without DSTATCOM, DSTATCOM controlled by voltage and power factor, are stable.

![Fig. 7 case (a) terminal voltage response - No DSTATCOM](image)

1. DSTATCOM controlled by voltage;
2. DSTATCOM controlled by power factor.

![Fig. 8 case (a) DC voltage response - DSTATCOM controlled by voltage](image)

**Case (b)**: This case also same to the previous case. The main difference in this case is that the induction generator is injecting 30 MW into the network at the fault movement in place of 25 MW. Figure-9 presented the terminal voltage responses. It is observed that this is the only case in which the DSTATCOM is controlled by voltage is stable.

![Fig. 9 Case (b) terminal voltage response - DSTATCOM controlled by voltage](image)

Due to Reactive power lack Without a DSTATCOM the system becomes unstable. In the other situations, the DSTATCOM act as a reactive power source. However, the reactive power injection of the DSTATCOM is completely different each other. The behavior of the reactive power injected by DSTATCOM into the network in each case is shown in fig 11 for the time interval up to 1.5 second. Such different behavior can explain distinct impacts on the system stability.

![Fig. 10 Case (b) Reactive power injected into network - DSTATCOM controlled by voltage](image)

**Case (c)**: The induction generator is injecting 30 MW into the network when a phase-A ground fault occur at the 4. The terminal voltage response are depicted in Fig.11.
In all cases, the system is stable, but with the DSTATCOM, the terminal voltage recovers faster to 1pu.

The different behavior of the reactive power injected by DSTATCOM for each kind of controller is shown in Fig. 12.

VI. SYSTEM DATA

Source (sub): 132 KV; Zeq=0.00667 pu

<table>
<thead>
<tr>
<th>TABLE I. LINE PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>2-4</td>
</tr>
<tr>
<td>2-3</td>
</tr>
<tr>
<td>3-4</td>
</tr>
<tr>
<td>4-5</td>
</tr>
</tbody>
</table>

VII. CONCLUSIONS

This analysis shows that the study about the behavior of a DSTATCOM to improve the voltage stability of distribution networks with induction generators. Simulation results show that such devices can increase the voltage stability limit, moreover, it can be verified that when the DSTATCOM is controlled by voltage its impact on stability is more effective than the control by power factor.

VIII. REFERENCES

Schemas Alternatives in Designing of Data Warehouses Along with MATLAB

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Abstract: - This paper is focused on the efficient schema alternatives for designing of a data warehouse. Data warehouses typically maintain historical information as well as recent information and therefore they tend to be very large and grow over time. There are number of schema alternatives are presents that are used to design the data warehouses. The purpose of this paper is to give the reader a better understanding of how a designing schema is used for any data warehouse and which one is the best schema with the high performance. The performances of these schemas are evaluated in the MATLAB. Firstly, the schemas are developed in the SQL by implementing multiple queries that are placed in the SQL. Secondly, the time elapsed in each queries can be measured and these queries are too complex. Finally, the time observations are finally collected and the performance is evaluated in MATLAB environment. After evaluating the performance we have to find out the most advantageous designing schemas with extreme high performance so that we can used this best schema for designing of a warehouse.

Keywords: Data warehouse; Designing schemas; SQL; MATLAB environment.

I. INTRODUCTION

Data Warehouse1 Intelligence is a term to describe a system used in an organization to collect data, most of which are transactional data, such as purchase records and etc., from one or more data sources, such as the database of a transactional system, into a central data location, the Data Warehouse, and later report those data, generally in an aggregated way, to business users in the organization.

A data warehouse (DW) is a database used for reporting. The data is offloaded from the operational systems for reporting. The data may pass through an operational data store for additional operations before it is used in the DW for reporting. A data warehouse maintains its functions in three layers: staging, integration, and access.

Staging is used to store raw data for use by developers (analysis and support).

Integration layer is used to integrate data and to have a level of abstraction from users.

Access layer is for getting data out for users. This definition of the data warehouse focuses on data storage.

The main source of the data is cleaned, transformed, catalogued and made available for use by managers and other business professionals for data mining online analytical processing, market research and decision support.

However, the means to retrieve and analyse data, to extract, transform and load data, and to manage the data dictionary are also considered essential components of a data warehousing system.

Thus, an expanded definition for data warehousing includes business intelligence tools, tools to extract, transform and load data into the repository, and tools to manage and retrieve metadata. A common data warehouse having characteristics that are: Subject Oriented Integrated, Non-volatile, Time Variant.

Subject Oriented Data warehouses are designed to help you analyse your data. For example, you might want to learn more about your company's sales data. To do this, you could build a warehouse concentrating on sales. In this warehouse, you could answer questions like "Who was our best customer for this item last year?" This kind of focus on a topic, sales in this case, is what is meant by subject oriented.

Integrated is closely related to subject orientation. Data warehouses need to have the data from disparate sources put into a consistent format. This means that naming conflicts have to be resolved and problems like data being in different units of measure must be resolved.

Non-volatile means that the data should not change once entered into the warehouse. This is logical because the purpose of a warehouse is to analyse what has occurred.
Most business analysis requires analysing trends. Because of this, analysts tend to need large amounts of data. This is very much in contrast to OLTP systems, where performance requirements demand that historical data be moved to an archive.

II. DIFFERENT DESIGNING SCHEMAS

A schema is a collection of database objects, including tables, views, indexes, and synonyms. Fact tables and dimension tables are the two types of objects commonly used in dimensional data warehouse schemas.

A fact tables that contain the primary information in the data warehouse, and a number of much smaller dimension tables (or lookup tables), each of which contains information about the entries for a particular attribute in the fact table. A dimensional model may produce: Star schema, Snowflake schema.

STAR SCHEMA The star schema is perhaps the simplest data warehouse schema. It is called a star schema because the entity-relationship diagram of this schema resembles a star, with points radiating from a central table. The centre of the star consists of a large fact table and the points of the star are the dimension table. A star schema is characterized by one or more very large fact tables that contain the primary information in the data warehouse, and a number of much smaller dimension tables (or lookup tables), each of which contains information about the entries for a particular attribute in the fact table. A star join is a primary key to foreign key join of the dimension tables to a fact table.

Advantages

The advantages of star schema are as follows: It is easy to understand as data is organized around subjects. Since data is in highly denormalized format, browsing through data is easy. Defining hierarchies is easy. Few joins are needed to get the information about all columns. Maintenance required for the data warehouse is low because of use of integers for compound key generation.

SNOWFLAKE SCHEMA The snowflake schema is a more complex data warehouse model than a star schema, and is a type of star schema. It is called a snowflake schema because the diagram of the schema resembles a snowflake. Snowflake schemas normalize dimensions to eliminate redundancy. That is, the dimension data has been grouped into multiple tables instead of one large table A schema is called a snowflake schema if one or more dimension tables do not join directly to the fact table but must join through other dimension tables.

The snowflake schema shown in figure2 is an extension of the star schema where each point of the star explodes into more points. In this schema, the dimension tables are more

Advantages

The snowflake schema in some cases may improve performance because smaller tables are joined, is easier to maintain and increases flexibility.

Disadvantages

The snowflake schema increases the number of tables an end-user must work with, makes the queries much more difficult to create because more tables need to be joined.

IV. PERFORMANCE EVALUATION

The performance evaluation of the star schema and snowflake schema is done in basically two steps:

1. Development of Schemas using SQL.
2. Timing measurements.
3. Performance evaluation in MATLAB.

In the first step the star schema and snowflake schemas are developed in SQL. In the second step the queries are performed with the time elapsed in that query. Finally, performance evaluation is performed in MATLAB with all the timing observations.
1. DEVELOPMENT OF SCHEMAS USING SQL

SQL offers a number of options and suggestions for optimizing logical and physical relational database design and query performance. Many of these techniques apply to data warehouse databases, as well as to transaction processing databases.

We are using some of the queries like: Create, Insert, Select, Commit and Rollback etc.

2. TIMING MEASUREMENTS

By using the settimingon; command in SQL we can find out the value of time elapsed in executing a query.

Consider a query that is given below:

```
select st_id,prd_id,per_id,distt_id ,reg_id,brand,year,month
from sales,store,product,time
where product.p_id=sales.prd_id
and time.pr_id=sales.per_id
and store.s_id=sales.st_id
and sales.rupees>='10000';
```

The time elapsed in both the schemas are shown in table when we increase the values of tuples.

The table showing the time observations for these schemas is shown below:

<table>
<thead>
<tr>
<th>S.No</th>
<th>No. of tuples</th>
<th>Star time</th>
<th>Snowflake time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>12</td>
<td>301</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>9</td>
<td>420</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>21</td>
<td>462</td>
</tr>
<tr>
<td>5</td>
<td>100</td>
<td>14</td>
<td>1109</td>
</tr>
<tr>
<td>6</td>
<td>125</td>
<td>14</td>
<td>1203</td>
</tr>
<tr>
<td>7</td>
<td>150</td>
<td>25</td>
<td>889</td>
</tr>
</tbody>
</table>

Table 1: Time measurements of designing schemas

3. MATLAB IMPLEMENTATION

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

Typical uses include Math and computation Algorithm development Data acquisition Modelling, simulation, and prototyping Data analysis, exploration, and visualization Scientific and engineering graphics Application development, including graphical user interface building.

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning.

MATLAB DESKTOP

The MATLAB desktop appears, containing tools (graphical user interfaces) for managing files, variables, and applications associated with MATLAB. The following illustration shows the default desktop.

To evaluate the performance of the designing schemas a small code is written in the command window of MATLAB environment i.e.

```
clc;
clear all;
close all;
t=[0 25 50 75 100 125 150]
u1=[0 12 9 21 14 14 25]
u2=[0 301 420 462 1109 1203 689]
plot(t,u1,t,u2)
legend('STAR TIME','SNOWFLAKE TIME')
xlabel 'No. of Tuples'
ylabel 'Time in milliseconds'
```

The figure showing the performance evaluation of the star and snowflake schemas:
V. CONCLUSION

We have also looked into the various schema alternatives for a data warehouse and showed that for most of the cases the performance of star schema is good.

Since all the data in star schema is organized in single dimension table, it is easy to browse through data which might be of interest to many business users.

Snowflake schema is highly normalized and can be used when attributes are very long and redundancy is very high but at the expenses of poor browsing performance as the data is distributed across many dimension tables.

As we seen the star schema performs far better than snowflake schema in most of the cases. In general, the snowflake schema takes more number of joins of dimension tables to get the same information.

With this performance evaluation comparison we have seen that the star schema is the reasonable choice for designing a data warehouse.

VI. FUTURE WORK

Today its individual choice to developing the schemas in SQL programming. But in future we can include some other programming environments. This will be beneficial for the students and faculty also. As well as the fuzzy data bases are also combined with the data warehouses.

VII REFERENCES

Service Specific Call Admission Control In WCDMA System

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ABSTRACT: To support multiple Service class of different data transmission rate for multimedia application in wireless systems. WCDMA involves orthogonal variable spreading factor (OVSF) code technique. When a new call arrives, the system has to determine whether to accept the call or not. These admission decisions are performed by call admission control (CAC). CAC belongs to the resource management category and is widely being investigated in many other researches as well. However, researches on CAC have mostly focused on channel allocation in the traditional FDMA and TDMA systems. We focus on WCDMA system, which has no fixed channel capacity. In this study, a new CAC scheme for WCDMA system is proposed. It contains CDMA capacity evaluation and code assignment problem. The proposed scheme consists of handoff and new call admission controls. For each service class, handoff and new call admission controls are considered with different priorities. The handoff call admission control process precedes that of the new call’s admission control process. Finally, we evaluate the performance of the proposed scheme by using the Markov analysis. The performance measures that we focus on are the blocking probabilities of handoff and new calls and the dropping probabilities of on-going calls.

Keywords-Call Admission Control (CAC); WCDMA; handoff; multimedia communications; OVSF codes

I. INTRODUCTION

In WCDMA system, there are many service classes and each class needs different quality of service (QoS) level and data transmission rate. Since the system has limited capacity, resource management is an important decision making problem. When a new call arrives, the system has to determine whether to accept the call or not. These admission decisions are performed by call admission control (CAC). CAC belongs to the resource management category and is widely being investigated in many other researches as well [1,4-6]. Traditionally, researches on CAC have mostly focused on channel allocation. We focus on WCDMA system, which has no fixed channel capacity. In this study, a new CAC scheme for WCDMA system is proposed. It contains CDMA capacity evaluation and resource reservation for hand-off calls. The proposed scheme considers the priority of each service class. To simplify the problem, we define three service classes with priorities given in the following order: real time high data rate is classified into either the handoff or new call. Therefore, there are six priority levels in total. In the proposed CAC scheme, the handoff call has higher priority than the new call. Due to the soft capacity of CDMA, CAC in CDMA system is different from those in FDMA and TDMA. In WCDMA, it is important to satisfy the required QoS of the calls, which is expressed in SIR [1,2,5-6]. When a new call enters the system, total noise of the system increases and the SIR of all other calls decreases. The system has to satisfy the required SIR of all the calls, including the newly entered calls. Moreover, the system should have codes available for new calls. The proposed CAC is performed separately at each service class to guarantee the QoS priority. For each service class, the handoff and new call admission controls are considered with different priorities. When a call satisfies the SIR requirement, an adequate code must be assigned. In WCDMA system, orthogonal variable spreading factor (OVSF) code is employed to serve various data rate services. Even though OVSF code assignment may encounter the code blocking problem, it can be eliminated by the process of reassigning the codes [3]. Compared to other CAC mechanisms, the proposed scheme considers the OVSF code assignment to the newly admitted calls and determines whether code reassignment is necessary.

Finally, we evaluate the performance of the proposed scheme by using the Markov analysis. For modeling multiclass service traffic, multi state Markov chain is employed. The performance measures that we focus on are the blocking probabilities of handoff and new calls.

II. SYSTEM MODELING

WCDMA systems, like the CDMA systems, are interference-limited systems. Thus, the capacity of a cell
varies with loading of the home and neighboring cells because the co-channel interference changes according to the loading. On the other hand, in order to guarantee a reasonable call quality, the SIR of a call should be maintained at a higher value than the predefined value. To accomplish this objective, a call request is admitted only when the SIR of an ongoing call is guaranteed not to be smaller than a threshold value. This type of CAC scheme is called the SIR-based scheme [1]. We propose a SIR-based CAC scheme for a WCDMA system, which has several service classes with different data rates.

A. Model of Service Classes: In WCDMA system, there can be a large number of calls with different service classes. Various data rate services are provided with OVSF codes. There are real time services and non-real time services in the system. We will mainly focus on real time services and consider non-real time services as best capacity, nonreal time services can be served but when a real time service enters the system, non-real time services may be dropped to create enough capacity for the real time services. Thus, nonreal time services are ignored in the proposed CAC scheme. We assume there are three real time service classes: high data rate, low data rate and voice service. Each service class needs data rate of 240kbps, 120kbps and 15kbps. Furthermore, there are two types of calls, hand-off and new calls, occurring in all the cells. If a hand-off call is blocked in an attempt to enter a cell, it means that a call dropping has occurred. Since handoff call dropping is more critical than a new call blocking, hand-off calls have higher priority than the new calls. Moreover, hand-off calls are divided into three service classes: high data rate, low data rate and voice. All of the hand-off call service classes have higher priority than the classes of new calls.

B. System Capacity: In CDMA, SIR value can be expressed in bit-energy to-noise density ratio, which is denoted as \( E_b / N_0 \). The call can be served, if the measured \( E_b / N_0 \) of a call is lower than the required value. The required \( E_b / N_0 \) value is different for each service class and channel state. Capacity properties of uplink and downlink are quite different in CDMA system. Since multimedia traffic has the asymmetric property of downlink traffic being much larger than the uplink traffic, we only consider downlink capacity for hand-off calls. Many other schemes focus on just one type of resource, like power, codes or channel frequency. However, we use different resource reservation methods for each service classes. This is important for various traffic and capacity properties of WCDMA systems.

\[
\frac{E_b}{N_0} = \frac{W}{R_k (1+f) \left( \frac{n_i}{R_i} - 1 \right) + \sum_{k \neq i} \frac{R_k}{R_i}}
\]

Where \( W \) is the bandwidth of downlink, \( R_i \) is the data rate of class \( i \) service and \( n_i \), the number of class \( i \) users. Other cell interference factor \( f \) is 0.55

III. CALL ADMISSION CONTROL

Generally, dropping of on-going calls is more critical than the blocking of new calls, so many CAC schemes employ channel reservation method to reduce the blocking probability of hand-off calls. We also employ reservation of capacity for hand-off calls. Many other schemes focus on just one type of resource, like power, codes or channel frequency. However, we use different resource reservation methods for each service classes. This is important for various traffic and capacity properties of WCDMA systems.

A. Resource Reservation: From (1), we can calculate \( E_b / N_0 \) of each service channel with the given data rate. Based on this calculation, we will demonstrate the need for code and power reservations in the following examples. When the system carries 240kbps channel users, the required \( E_b / N_0 \) is 1.0dB. In this case, up to 11 users satisfy the required value of \( E_b / N_0 \) [2]. However, only 4 OVSF codes are available in the 240kbps channel since its spreading factor is 4. Thus, we
have encountered the problem of code limitation in the 240kbps channels. On the other hand, 120kbps channels system can serve only 14 users due to the $Eb / N0$ requirement, even though 16 codes are available. For this reason, capacity (number of users that the system can serve) of high data rate services is code limited and capacity of low data rate services is power limited.

We employ two types of reservation methods: code reservation and power reservation. For high data rate services (i.e. SF=4, 8, etc), code reservation is employed because the required $Eb / N0$ value is quite low. Thus, before the occurrence of the outage, code shortage will occur. On the other hand, for low data rate services (i.e. SF=32, 64, etc), even though there may be enough codes available for assignment, there will not be enough power available.

Therefore, power reservation is employed for low data rate services.

Considering the code reservation for hand-off calls, $RC(i)$ , the number of reserved codes for class- $i$ service, can be stated as

$$RC(i) = \frac{\lambda_{HO}}{\lambda_{HO} + \lambda_{New}} \cdot SF(i)$$

(2)

Where $\lambda_{HO}$ and $\lambda_{new}$ are call arrival rates for hand-off call and new call, respectively. $SF(i)$ is the spreading factor of class- $i$ call.

Considering the power reservation for hand-off calls, $RP(i)$ , the reserved power for class- $i$ service can be stated as

$$RP(i) = \frac{\lambda_{HO}}{\lambda_{HO} + \lambda_{New}} \cdot P_{\text{max}}$$

(3)

where $P_{\text{max}}$ is the maximum power of base station.

B. Hand-off Call Admission Control Scheme: Hand-off CAC is performed separately for each service class. Since on-going calls are considered more important than the new calls, we state that the hand-off calls may use all of the system capacity. When a new call arrives, as shown in the block diagram of hand-off CAC in Fig.1 below, CAC needs to determine whether the required value of $Eb / N0$ is satisfied and also, check the existence of available codes. Code reassignment is performed by dynamic OVSF assignment scheme from [3].

C. New Call Admission Control Scheme: New CAC is quite different from the hand-off CAC due to resource reservation. For each service class, if power reservation is performed, new CAC considers the amount of reserved power that is already in usage before checking whether the $Eb / N0$ requirement is satisfied. If code reservation is performed to a service class, new CAC considers the number of reserved code is in usage before deciding the existence of available codes for the new calls. Furthermore, the accept probability $ai$ is employed to each service class $i$ to give priority to each service class. In short, even after satisfying all the other requirements stated in CAC, a new call would only be accepted with probability $ai$ , which may have a degrading effect to the system in terms of utilization. Therefore, we use some thresholds to employ the accept probability. When the remaining power is lower than the threshold, new calls are accepted with probability $ai$ However, if the system has enough remaining power over the threshold, it would not be necessary to block new calls. In this case would accept all of the new calls. The block diagram of new CAC is shown in Fig. 2.

IV. PERFORMANCE ANALYSIS

In this section, we present the performance measures and the Markov model in order to validate the system performance.

A. Performance Measure: We focus on blocking probability of the calls and derive the cost function by using the hand-off and new call blocking probabilities. The cost function can be stated as

$$C_{\text{Total}} = w_{HO} \cdot P_{BH0} + P_{Bnew}$$

(4)

Where $C_{\text{Total}}$ is the total cost and $w_{HO}$ is the weight of hand-off call to new call. When the weight is larger than 1, hand-off calls are considered more important than the new calls. We assign 10 as the value for $w_{HO}$ . $P_{BH0}$ and $P_{Bnew}$ are blocking probabilities of hand-off calls and new calls. The
objective of CAC scheme is to minimize the total cost of the system. We can derive the hand-off call blocking probability of class- $i$ calls as

$$P_{BHO}(i) = \sum_{s \in S_{\text{max}}(i)} P_s \left( \frac{\lambda_i}{\lambda_i + \lambda_i} \right)$$

(5)

And the new call blocking probability of class- $i$ calls as

$$P_{\text{BNe}}(i) = \sum_{s \in S_{\text{max}}(i)} P_s \left( \frac{\lambda_i}{\lambda_i + \lambda_i} \right) + \sum_{s \in S_{\text{max}}(i)} P_s (1 - a_i) \left( \frac{\lambda_i}{\lambda_i + \lambda_i} \right)$$

(6)

Where $S_{\text{max}}(i)$ is the set of states with maximum number of available class- $i$ on-going calls in the system.

V. NUMERICAL RESULTS

In this section we will examine the effect of proposed reservation CAC scheme. System performance is measured by the call blocking probabilities (5), (6) and the cost function (4). The new call accept probability $a_i$ is 1 for all classes in this example.

VI. CONCLUSION

We have proposed a new reservation CAC scheme and demonstrated its performance. The numerical results obtained by the Markov analysis show that the performance of the proposed scheme well meets our design objectives.

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Different Attacks on Mobile Ad hoc Network

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ABSTRACT: Wireless ad hoc network is a temporary network set up by wireless nodes usually moving randomly and communicating without a network infrastructure. MANET(Mobile ad hoc network) is suitable for use in situations where any wired or wireless infrastructure is inaccessible but the Wireless Ad-hoc networks is particularly vulnerable due to its features of dynamic changing topology, distributed nature, Bandwidth Constraint, No wires, Limited battery life, Limited memory and processing capability, Multi-hop Routing etc. In hostile environment Intrusion Prevention secure key distribution Management schemes -doesn’t work once the node is compromised and the secrets leak. So, Security in MANET is a challenging task for research problem. In this paper the current security issues in MANET investigated and we also have examined different attacks on MANET.

Keywords: Sinkhole attack, AODV, MANET, RREQ, RREP

I. INTRODUCTION

In the ubiquitous computing environment, individual users utilize, at the same time, several electronic Platforms through which they can access all the required information whenever and wherever they may be[1]. The nature of ad hoc networks poses a great challenge to system security designers due to the following reasons: firstly, the wireless network is more susceptible to attacks ranging from passive eavesdropping to active interfering; secondly, the lack of an online CA or Trusted Third Party adds the difficulty to deploy security mechanisms; thirdly, mobile devices tend to have limited power consumption and computation capabilities which makes it more vulnerable to Denial of Service attacks and incapable to execute computation-heavy algorithms like public key algorithms[2]. Internet Engineering Task Force (IETF) has MANET working group (WG) that is devoted for developing IP routing protocols. MANET, a collection of mobile hosts with wireless network interfaces form a temporary network without the aid of any fixed infrastructure or centralized administration. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet.

A. Types of Mobile Ad Hoc Network:

1) Vehicular Ad Hoc Networks (VANET’s)
2) Intelligent Vehicular Ad Hoc Networks (InVANET’s)
3) Internet Based Mobile Ad Hoc Networks (iMANET’s)

- **Vehicular Ad Hoc Networks (VANET’s)**: VANET is a type of Mobile ad hoc network where vehicles are equipped with wireless and form a network without help of any infrastructure. The equipment is placed inside vehicles as well as on the road for providing access to other vehicles in order to form a network and communicate.

- **Intelligent Vehicular Ad Hoc Networks (InVANET’s)**: Vehicles that form Mobile Ad Hoc Network for communication using WiMax IEEE 802.16 and WiFi 802.11. The main aim of designing InVANET’s is to avoid vehicle collision so as to keep passengers as safe as possible. This also help drivers to keep secure distance between the vehicles as well as assist them at how much speed other vehicles are approaching. InVANET’s applications are also employed for military purposes to communicate with each other.

- **Internet Based Mobile Ad Hoc Networks (iMANET’s)**: these are used for linking up the mobile nodes and fixed internet gateways. In these networks the normal routing algorithms does not apply.

The properties of MANET make it so much favorable that would bring so many benefits. Security Challenges in MANET.

Primary challenges in securing MANET routing:

- Multi-hop routing between distant source and Destination nodes
- Relay nodes are not trustworthy
- Nodes may be resource- and capability-limited
- No centralized authority or monitor
Secure routing likely relies on existing key mgmt. The salient features of ad hoc networks pose both challenges and opportunities in achieving these security goals[3].

Unreliability of wireless links between nodes.

Constantly changing topology

The rest of this paper is organized as follows. In section II, we discuss the Application areas in MANET. Section III describes the different attacks on MANET. Finally we conclude in section IV.

IV. APPLICATION AREAS OF MANETS

A Mobile Ad Hoc Network (MANETs) is a collection of wireless hosts that can be rapidly deployed as a multi hop packet radio network without the aid of any established infrastructure or centralized administration. So, there are many fields in which MANETs has a lot of advantages in day to day life.

Following are some areas in which MANETs are very useful.

- Battlefield application: Ad hoc networks can be used to enable next generation of battlefield applications envisioned by the military, including situation awareness systems for manoeuvring war fighters, and remotely deployed unmanned micro-sensor networks [5].
- Civilian application: Ad Hoc networks can also provide solutions for civilian applications such as disaster recovery and message exchanges among safety and security personnel involved in rescue missions.
- Military tactical operations: Military tactical operations are still the main application of ad hoc networks today. For example, military units (e.g., soldiers, tanks, or planes), equipped with wireless communication devices, could form an ad-hoc network when they roam in a battlefield.[6]
- Used For emergency: Ad hoc networks can also be used for emergency, law enforcement, and rescue missions.
- Virtual classrooms: Since an ad hoc network can be deployed rapidly with relatively low cost, it becomes an attractive option for commercial uses such as sensor networks or virtual classrooms.
- Ad hoc networks are planed to work in situations like home automation, disasters (earthquake, war, etc.), mobile or nomad computing (Conferences, interactive shows, etc.)

V. DIFFERENT ATTACKS ON MANET

Categorization of attacks in MANET: This attacks can be categorized on the basis of the source of the attacks i.e. Internal or External, and on the behavior of the attack i.e. Passive or Active attack. This classification is important because the attacker can exploit the network either as internal, external or/ as well as active or passive attack against the network.

1) External and Internal Attack :

External attackers are mainly outside the networks who want to get access to the network and once they get access to the network they start sending bogus packets, denial of service in order to disrupt the performance of the whole network. This attack is same, like the attacks that are made against wired network. These attacks can be prevented by implementing security measures such as firewall, where the access of unauthorized person to the network can be mitigated. While in internal attack the attacker wants to have normal access to the network as well as participate in the normal activities of the network. The attacker gain access in the network as new node either by compromising a current node in the network or by malicious impersonation and start its malicious behavior. Internal attack is more severe attacks then external attacks.

2) Active and Passive Attack :

When the attacker disrupts the performance of the network, steal important information and try to destroy the data during the exchange in the network . Active attacks can an internal or an external attack. The active attacks are meant to destroy the performance of network in such case the active attack act as internal node in the network. Being an active part of the network it is easy for the node to exploit and hijack any internal node to use it to introduce bogus packets injection or denial of service. This attack brings the attacker in strong position

Where attacker can modify, fabricate and replays the massages. Attackers in passive attacks do not disrupt the normal operations of the network. In Passive attack, the attacker listen to network in order to get information, what is going on in the network. It listens to the network in order to know and understand how the nodes are communicating with each other, how they are located in the network. Before the attacker launch an attack against the network, the attacker has enough information about the network that it can easily hijack.

Table 1: SECURITY ATTACKS CLASSIFICATION

<table>
<thead>
<tr>
<th>Passive Attacks</th>
<th>Passive eavesdropping, traffic analysis, monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Attacks</td>
<td>Wormhole, black hole, gray hole, location disclosure, resource consumption, routing attacks</td>
</tr>
</tbody>
</table>

2) Active Attacks against MANET’s can be divided into two groups.
Different Attacks on Mobile Ad hoc Network

**Attack the route discovery process by:**
- Modifying the route reply message
- Refusing to participate in the route discovery process.
- Changing the contents of a discovered route.

**Attack the Routing mechanism by:**
- Modifying the content of data packet or the route via which that packet is supposed to travel.

**Definitions of different attacks in MANET:**

- **Passive Eavesdropping**
  An attacker secretly eavesdrop on going communication between targeted nodes to collect information what is going on in the network (e.g., medium access control [MAC] address) and cryptography (e.g., session key materials). Eavesdropping is also a threat to location privacy. An unauthorized node can notice a wireless network that exists within a geographical area, just by detecting radio signals [3].

- **Selective Existence (Selfish Nodes)**
  A node will not serve as a router for other nodes. This malicious node which is also known as selfish node and which is not participating in the network operations, use the network for its advantage to enhance performance and save its own resources such as power. Selfish nodes do not even send any HELLO messages and drop all packets even if they are sent to itself, as long as it does not start the transmission. When a selfish node wants to start a connection with another node, it performs a route discovery protocol and then sends the necessary packets. Selective existence is kind of a passive attack, nodes just do not participate in the network operations and they do not change the content of packets.

- **Gray Hole Attack (Routing Misbehavior)**
  Gray hole attacks is an active attack type, which lead to dropping of messages. Attacking node first agrees to forward packets and then fails to do so. Initially the node behaves correctly and replays true RREP messages to nodes that initiate RREQ message. This way, it takes over the sending packets. Afterwards, the node just drops the packets to launch a (DoS) denial of service attack. This attack is known as routing misbehaviour [2]. Dropping packets is also one of the behaviors of failed or overloading nodes. Actually most routing protocols have no mechanism to detect whether data packets have been forwarded, DSR being the only exception. Moreover, the malicious node that attempts gray hole attacks cannot be perceived easily since it does not send false messages. Behavior of failed or overloaded nodes may seem like selfish nodes attacks [1, 6].

- **Sink-hole or Black Hole Attack**
  In a Black hole attack, a malicious node sends routing information; claiming that is has an optimum route and causes other good nodes to route data packets through the malicious one. The difference of Black Hole Attacks compared to Gray Hole Attacks is that malicious nodes never send true control messages initially. To carry out a black hole attack, malicious node waits for neighboring nodes to send RREQ messages. When the malicious node receives an RREQ message, without checking its routing table, immediately sends a false RREP message giving a route to destination over itself, assigning a high sequence number to settle in the routing table of the victim node, before other nodes send a true one. Therefore requesting nodes assume that route discovery process is completed and ignore other RREP messages and begin to send packets over malicious node. To succeed a black hole attack, malicious node should be positioned at the center of the wireless network. Gray hole attacks against one or two nodes in the network to isolate them, while as black hole attack affects the whole network [1].

- **Impersonation**
  An attacker impersonate another node’s identity to establish a connection with or launch other attacks on a victim. Due to lack of authentication in ad-hoc networks, only MAC or IP addresses uniquely identify hosts. These addresses are not adequate to authenticate the sender node. Therefore non-repudiation is not provided for ad-hoc network protocols. MAC and IP spoofing are the simplest methods to pretend as another node or hide in the network.

- **Wormhole Attack:**
  A path is created between two nodes that can be used to transmit packet secretly. In this attack, a pair of colluding attackers record packets at one location and replay them at another location using a private high speed network. The seriousness of this attack is that it can be launched against all communications that provide authentication and confidentiality.

- **Flooding attacks:**
  The aim of flooding attack is to exhaust the network resources, such as bandwidth and to consume a node’s resources, such as battery power. For example, in AODV protocol, a malicious node can send a large number of RREQs in a short period to a destination node that does not exist in the network because no one will reply to the RREQs. So, this attack will flood the whole network. As a result, all of the node battery power, as well as network bandwidth will be consumed and could lead to denial-of-service attack [1].
Replay attack
In a replay attack, a node records another node’s valid control messages and resends them later. This causes other nodes to record their routing table with stale routes. In MANET, topology frequently changes due to node mobility. This means that current network topology might not exist in the future [3,6].

V. CONCLUSION AND FUTURE WORK

The research on MANET security is still in its early stage due to absence of a clear line of defence. Normally, attacks by an intruder cause unauthorized use of the wireless network. In this paper, we try to inspect the security issues in the mobile ad hoc networks, which may be a main disturbance to the operation of it. Due to the mobility and open media nature, the mobile ad hoc networks are much more prone to all kind of security risks.

VI. REFERENCES


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Recent Trends in Development of Machine Tools

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Abstract: The enormous changes taking place in the realm of metal working can be attributed to the fast tempo of developments in machine tool technology, control engineering and manufacturing concepts. The technology of machining is developing fast to answer the incessant demands from the manufacturing sector. Developments pertaining to new cutting materials, cutting tools and new generation of drives are not only influencing the very concept of machining, but they are adding a new dimension to the very methodology of machine tool design. The design of a machine tool should reflect the confluence of several engineering disciplines. The latest trends bear testimony to an integrated approach to the design of every major element of a machine tool.

Key words: machine tools; metal working; developments; control engineering; manufacturing; design; control engineering

I. INTRODUCTION

At present, the machine tool industry worldwide is enjoying unprecedented demand, and the industry’s output is apparently even failing to satisfy current demand. Machine tool industry, in particular, has boasted the greatest share in the world since 1982, and its share has been exceptionally high in the last two years. In order that the enterprises involved in it must remain committed not only to expansion and advancement of their product facilities, but also to steady research and development efforts. They must continue to add more value to their products in order to cope with future needs and maintain competitiveness compared to machine tool manufacturers in other nations. In this paper, current topics about recent machine tools and trends in the research and development commitments of machine tool industry has been discussed.

II. MACHINE TOOLS

NC/CNC in machine tools [1] has made the revolutionary transformation in manufacturing. Individual machines changed from single purpose to multiple function equipment with capability to do a wide range of tasks such as milling, drilling, reaming, boring, turning etc. Turning centers and machining centers can cover major machining tasks for any part. Parts requiring machining are generally rotationally symmetrical- disc type or shaft type, prismatic ones, or combination of the two mentioned earlier. While turning centers are the choice for rotationally symmetrical parts, machining centers are universal preference for flexible machining of prismatic parts. In one engineering company manufacturing machine tools, earlier it took five machining processes on five separate machine tools to produce one part. Now it takes about three processes, and in many cases, all three can be done on a single machine tool. The plant was producing 800 different kind of parts per month on 81 machine tools and equipment. Now it is producing 1400 different kind of parts on 61 machines. The throughput time has been reduced by 50%.

III. FEATURES OF ADVANCED MACHINE TOOLS

Manufacturers have improved all the mechanical and electrical components of the-state-of-the-art machine tools. The most daunting challenge is how to make a machine with both low inertia in its moving members and the structural stiffness to resist falling prey to the increased propensity for vibration that comes along with ever increasing high speed. Various design features relate to improving upon the basic problems such as friction and vibration. Some address them through compensation, but they are also some who have addressed very rightly the causes as close to the sources of the problems as possible. It is all these advances together that have led to a tenfold increase in rotational speeds and chip removal rates compared with conventional spindles.
IV. MODULAR DESIGN CONCEPT OF MACHINE TOOLS

All major manufacturers are tending to incorporate modular design concept in their machine tools, based on the combinability of the individual modules. These modules can be produced, assembled, and checked independently and without relation to specific requirements. The final assembly of the customer specific machine tool from selected modules does not take much time and can be performed at short notice. At any later time based on customer requirements, a contemporary module may replace any of the modules. The modular design concept further makes the machine tool easily adaptable to model change of the product of the end users.

V. INTELLIGENT MACHINE TOOLS

A new concept of intelligent machine tool is already under development with the following specific features as goal: 

*Intelligence*: to acquire, systematize, and utilize the manufacturing knowledge.

*Autonomy*: to make decisions based on its own criteria, and physically support and maintain itself if possible.

*Flexibility*: to cope with various changes in requirements, available resources, constraints, etc.

*Cooperation*: to find mutually agreeable solutions with other machines or agents through communication, exchange information and negotiation.

Some of the important functions of the intelligent machine tools are as follows:

1. Communication and coordination with other machines and equipment Communication with the higher-level control computer, CAD system and the other equipment on the shop floor. The coordination with other machines and equipment is essential to optimize the total system performance and also to cope with changes and unforeseen events. Emphasis today is more on man-machine interface and the user friendliness.

2. Machining preparation covers the process planning, the operation planning, NC programming, etc. The machine must generate the optimum NC commands for the specific task, cope with changes in machining requirements and available resources, prepare the reference information required for the decision making in the later process, etc.

Just as a skilled operator does, the intelligent controller conceives the machining scenario once the CAD data and the requirements are given, simulates the whole process and generates the machining information. If it is judged that the machining data generated are not optimum for the given task, the whole process is repeated until the optimum solution is obtained.

VI. ACCURACY OF MACHINE TOOLS

Five sources for inaccuracies in a part are normally—machine geometry, machine thermals, process thermals, process parameters, and measurement error. Precision is attained through effective balancing of all the elements. However, the precision of a machine tool is one major factor deciding part accuracy. Trend is toward tighter part specification for all machining processes. For a consistent production of quality parts over the effective life of the machine tool, emphasis today is on a regular monitoring and maintenance of the accuracy of machine tool. Quality of performance capabilities of machine tools are defined by:

» Accuracy

» Repeatability

*Accuracy* is how precisely a machine can position the cutting tool at a given location once, while *repeatability* is the precision with which the tool can be consistently moved to a given position.

Present trend for improved quality is to go for machines with known performance based on standards. Gradually, the machine tool builders are accepting standards such as ANSI/ASME B5.54 introduced in 1994 to express accuracy and repeatability. The standards describe tests and performance parameters. To find the right machine for the task, techniques are needed to translate these performance parameters into part tolerances. Further, a machine’s performance characteristics are required to be stored for reference.

“Foot printing” is developing as an alternative to the standardized tests when making a limited number of parts in large volume. A probe regularly measures a reference part. The values obtained are the footprint or signature of the machine. The changes in the measured dimensions over time provide the information about the machine’s health. Two versions of tests normally in use for regular monitoring are:
I. The more complete check, which requires to measure 18 displacement error parameters that include six possible errors per axis: As the spindle moves along a single axis of travel, possible errors include linear displacement inaccuracies, horizontal and vertical straightness deviation, and three rotational errors—yaw, pitch, and roll. Additionally, the perpendicularity of the axes relative to one another must be measured. A complete geometric characterization of a machine tool requires a total of 21 measurements for a three-axis machine (‘more’ for more number of axes).

II. The ‘one-day, five-test’ -version that verifies basic positioning. Trend in world class manufacturing plants today is to use this Rapid Machine Tool Error Assessment (RMTEA). The key element is a laser sensor. Prediction of performance deterioration and planning for corrective steps for a machine is done through trends of the error measurement data.

VII. HIGH-SPEED, HIGH-EFFICIENCY MACHINE TOOLS

It is well known that demands are mounting for greater maximum main spindle speeds and feed speeds—in other words, that machine tools of higher speed and higher efficiency are much needed. Background information about high-speed machine tools and supporting technologies. In this section, focus will be on the avoidance of chatter vibration, which is one outstanding advantage of high-speed, high-efficiency machine tools. In the period of the 1960’s and 1970’s, there were research efforts worldwide on the chatter vibration of machine tools. As a result, the underlying principles behind so-called regenerative chatter vibration and forced chatter vibration were clarified, and basic solutions were proposed. Unfortunately, however, examples of further systematic research efforts have been rare. Recent trends in the machine tool technologies are surveyed from the view points of high speed and high performance machine tools [4], combined multifunctional machine tools, ultra precision machine tools and advanced and intelligent control technologies. The machine tools are bases of manufacturing industries.

VIII. TRENDS IN RECENT MACHINE TOOL TECHNOLOGIES

Generally, chatter vibration is avoided by reducing the depths of cuts and cutting speeds (low-speed stability), but it is possible to avoid chatter vibration by increasing spindle speed. This fact was already known from research done in the 1960’s. Since high-speed spindles boasting this ability were not available in those days, however, this fact was regarded simply as a theoretical possibility. In the mathematical field, it was also difficult theoretically to handle chatter vibration in milling processes, including end milling. Notwithstanding, Prof. Y. Altintas et. al. [2] obtained results for stability graphs. This graph shows that chatter vibration does not occur in the region of depths cut below the stability lobes relative to spindle speeds on the horizontal axis. Though detailed discussion of this finding 2) is omitted in this paper. Variations in chip thickness are caused by differences between the roughness of the finished surface generated by the immediately previous revolution of the main spindle or by an immediately previous cutting edge and the roughness of the finished surface currently generated by the current cutting edge. This variation in chip thickness contributes to variation in the cutting force and contributes to continuing vibration. If we can run the main spindle at a higher speed that is equivalent to the vibration frequency, then the difference between the phase of vibration resulting from the immediately previous revolution and the phase of vibration deriving from the current revolution can be effectively controlled, thereby eliminating variations caused by chip thickness. If such a condition is realized, chatter vibration will not occur even with greater cut depths. Utilizing this principle, high-speed, high-efficiency cutting has been implemented for aircraft components made of aluminum and other materials. Given this, there has been mounting interest in the dynamic characteristics of a main spindle system that includes a main spindle, chuck and tools. As a result, the interrelation of bearings and other design factors with the dynamic characteristics of the main spindle and main spindle system has been clarified both theoretically and experimentally, and this achievement has been applied to the design of main spindles. Recently, various software packages are also being used frequently for analysis and design. The theoretical study of main spindle designs will become increasingly important.

IX. COMBINED MULTIFUNCTIONAL MACHINE TOOLS

In addition to high-speed, high-efficiency, cutting capable machine tools, research on machine tools is currently focused on combined multifunctional machine tools, including 5-axis machining centers and combined multifunctional turning centers. Combined multifunctional machine tools can be roughly categorized into turning centers (TC) that have been developed from lathes and machining centers (MC) that started as milling machines. In addition to machining of bores, outer circumferences and end faces, certain applications are executed for slope machining and hobbing. Recently, a main spindle mounted to an area equivalent to a turret is capable of not only auxiliary cutting processes, such as end milling, but also to
more demanding milling processes. In addition, lathe based machine tools that resemble milling machines have been developed. Many different 5-axis machining centers have been developed. In particular, in addition to orthogonal 3-axis vertical and horizontal machining centers, many simultaneous 5-axis control machining center products that have work tables with two additional axes for rotation and oscillation are used widely. Most recently, some machining centers have a work table driven by a DD motor and a high-speed, high-power rotary table capable of high-speed indexing, and they feature the functions of vertical turning centers. As mentioned above, deriving from either lathes or milling machines, combined multifunctional machining tools may evolve into novel machine tools that incorporate features of both turning centers and milling machines. Combined multifunctional machine tools have advantages that include the following. They are capable of machining complex forms that require simultaneous control of five axes. Loss in machining accuracy from dismounting and remounting the work piece is prevented because once a work piece has been mounted to the chuck, all machining processes are executed without need for rechecking the work piece. As the needs for function-intensive parts and components increase, advanced multifunctional machining tools are capable of machining these work pieces at higher precision and higher efficiency. As superior machine tools, the demand for combined multifunctional machine tools will increase further in the future. To meet this demand, the researchers and engineers in this field must develop the hardware that helps realize sophisticated functions as well as the supporting software (CAM) to enable advanced control techniques and application technology.

Incidentally, within the next 2 years, the STC-M (Scientific Technical Committee: Machines) of CIRP (The International Academy for Production Engineering) will issue a keynote paper that covers current and future trends in combined multifunctional machine tool technology.

X. ULTRA PRECISION MACHINE TOOLS

Other than high speed and high efficiency, the most critical requirement for machine tools is high precision. Recently, various ultra precision machine tools have been developed that are significantly more evolved than earlier high-precision machine tools. Previously, the industrial fields that required ultra precision machine tools were limited and the market scale for ultra precision machine tools was relatively small. In contrast, needs have been increasingly mounting for ultra precision and micro-machined parts and components, such as dies for optical parts and components. In response to this trend, development is in progress for various ultra precision machine tools. Progress in the component technologies for ultra precision machinery, such as air hydrostatic bearings and guides, is remarkable. I believe that advances in hardware technologies for these mechanical elements are contributing to the higher value of Japanese machine tools. In the field of ultra precision machining and micromachining, typically for the machining of optical parts and components, the requirements for form accuracy and finished surface roughness have always been demanding, and the forms of machined parts and components have become increasingly complicated. Also, the process for preparing optical lenses has changed from injection molding with plastic materials to a hot-pressing process with glass. To cope with this trend, an increasingly larger number of dies are being made of materials that are extremely difficult to machine, such as tungsten carbide and ceramics, and these dies must undergo many machining processes including grinding and polishing. These techniques in die machining processes and glass press-forming processes are contributing positively to the manufacture of the lenses on camera cell phones and digital cameras, which are both increasingly common. Looking more closely at the lenses used in these types of digital equipment, machining processes that are more demanding are necessary to realize their unique optical arrangements. For example, this is needed to create a combination of a Fresnel lens and an aspherical lens, which enhances the optical characteristics of the related optical systems. At the same time, laser printers and other optical equipment that utilize lasers need more sophisticated optical elements that involve non ax symmetric or free-curved surfaces. Therefore, needs are growing increasingly for more advanced ultra precision machining techniques. To this end, I believe that the importance of ultra precision machine tools needed for ultra precision-machining and micro-machining will be further highlighted because they are indispensable in machining highly sophisticated parts and components with high added value.

XI. ADVANCED AND INTELLIGENT CONTROL

The increasing sophistication of machine tools is supported by progress in not only hardware but also in software. Recently, many advanced (intelligent) control techniques are available that reflect an understanding of machine tool characteristics and machining processes. For example, let us think of a control technique for controlling thermal deformation, which is the most critical factor adversely affecting the machining accuracy of machine tools. A much advanced control technique is now commercially used in which the magnitude of the current thermal deformation is estimated in real-time based on information about the machine tool and temperatures at various spots on the tool.
Using this information, the motion of the machine tool is controlled so that higher machining accuracy is ensured under any operating condition. It is also possible to simulate the motion of the machine tool in real-time based on information about the motion control applied to the machine tool.

XII. TRENDS IN RECENT MACHINE TOOL TECHNOLOGIES

In an effort to further advance this idea, under the title of Virtual Machine Tools, the previously mentioned STC-M in CIRP is currently attempting to perform complete simulations that cover machining processes, dynamic characteristics and control characteristics for machine tools. This simulation scheme is, for example, capable of complete computer simulation of a machine and its processes, allowing it to determine how various components of a machine tool will react when a motion command is given to the machine. It can also determine how the tool and work piece will interact with each other to machine the work piece and how the resultant cutting force will affect the machine and tool. In order to make virtual machine tools become a reality, further research and study efforts need to be made on many issues, including machining processes, and the dynamics and motion characteristics of machine tools. I want to point out that such research and studies are steadily making progress to this end.

XIII. CONCLUSION

Based on my own experience, I have described several examples of recent trends in machine tool technologies. The machine tool industry constitutes the backbone of machinery industry, and for this reason, endeavors to achieve higher speed, higher efficiency and ultra precision will continue with increasing commitment. In concluding this paper, I want to express my wish that recent technologies and products lead their counterparts in the global machine tool industry in the ever-demanding challenge to achieve the ultra-high-speed and ultrahigh-precision [3] required of the main spindle bearings that are critical components of many machine tools.

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Dhauj, Faridabad
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ABSTRACT: A high performance resonator and the DGS (Defected ground structure) are the important elements in many microwave circuits such as filters, amplifiers, couplers and antennas for electronic and microwave communication systems. This paper presents a novel design of a bandpass filter using combination of a simple transmission line and cylindrical dielectric resonator and defected ground structure. Three dielectric resonators with same permittivity (FR4 epoxy or duroid) having high permittivity and diameter of 0.72 mm are identified to be contributed to an ultra-wideband bandwidth of the filter. These band limited bandpass filters can also be used in T.D.M.A technique in wireless communication. This new approach increases the coupling effect as well as minimizing the insertion loss in the passband. In order to prove that the new approach contributes more advantages and is viable at the desired application band, the return and insertion losses of the filter are analyzed. The availability of high-Q tunable filters may also have a significant impact on production cost and delivery schedule in some communication systems. Such systems use multiple filters that are usually identical with the exception of center frequency and bandwidth. The production cost can be significantly reduced by building standard filter units that can be easily reconfigured during production phase to fit the required frequency plan.

KEYWORDS: Microwave strip lines; DGS; Band pass filter; Dielectric resonator

I. INTRODUCTION

Defected ground structure on the back of the filter improves the harmonic suppression characteristics of band pass filter[6]. This extraction method shows how to design a micro strip high-low pass filter by combining an arrow head shaped defected ground structure with multilayer circuit fabrication techniques[2]. DGS elements have been shown to provide a mean of shrinking the size of passive cktS such as low pass filter. The key is determining the size area of a selected DGS shape by correlating its area to the equivalent circuit. Inductance and capacitance required for a particular filter design as might otherwise be realised by conventional microstrip in addition to the smaller size, they deliver even sharper filter cutoff than conventional microstrip it has a conventional microstrip and stripline technology and can be used creatively in multilayer filter architecture for further saving in circuit realstate geometrical resonators. Dielectric resonator (DR) offers a lot advantages in increasing the performance of RF and microwave devices which make it as an ideal Ultra-Wideband Dielectric Resonator Bandpass Filter. It is wireless application; low design profile and wide bandwidth Dielectric resonators are mainly designed to replace resonant cavities in microwave circuits such as filters and oscillators. Like resonant cavities, they present the resonant modes of frequency determined by the dimensions and high Q-factors. The advantages of dielectric resonators are more compact, higher temperature stability and easy to use. Moreover, the ability of amenable in multitechnology such as Printed circuit and surface mounts technology. The dielectric resonators are also usually shielded to prevent radiation as well as maintain a high-Q that required by filters and oscillators circuits.

The DR filters are good for mobile and satellite communications. A typical DR filter consists of a number of dielectric resonators that are mounted in a planar configuration to obtain a good resonant frequency [5]. The relative dielectric constant of the materials for constructing DR in microwave filters generally was chosen from a higher value compared to the base substrate. The primary advantage in using a high dielectric constant is to miniaturize the filter size. The size of DR filter is smaller than the dimension of waveguide filters operating at the same frequency[6]. Furthermore, these DR filters are employed to replace waveguide filters in applications such as satellite communication systems where the planar filters cannot be used because of their inherently high loss. In this paper, a novel bandpass filter that consists of three dielectric resonators were excited with microstrip line that were used to increase the bandwidth of a bandpass filter[3&4]. The idea of using the three dielectric resonators is to generate
additional frequency which can merge together to produce wideband devices, increase the transmitting power and reduce the insertion loss. The optimum coupling effect in the filter was obtained from the matching position of the resonators on the microstrip line. The estimated range of unloaded Q values for each resonator category at 5 GHz is also shown in the same figure. There is a wide range of resonator configurations under each resonator category. The Q value can therefore vary widely for each resonator category. For example, a patch microstrip resonator would have a higher Q value than a standard 1/2 resonator, and a full height TE 101 waveguide cavity would have a higher Q than a reduced height TE 101 waveguide cavity resonating at the same frequency. Regardless of the tuning element used, tunable filters that employ planar or lumped-element resonator configurations exhibit a very low Q value. Once loaded with the tuning elements, the overall loaded Q will be further reduced. The resonator structures that can provide Q-values in the range of 4,000–10,000 at 5 GHz are 3-D cavities or dielectric resonators.

II. DESIGN METHODOLOGY

The dielectric resonator can increase Q-factor in a circuit. The size, location and shape of the dielectric were influencing the matching of the circuit. In this project, three dielectric resonators were excited with a microstrip line in order to obtain the optimum coupling effect. The dielectric resonators offer advantages in increasing the signal transmission performance of RF and microwave devices. The match combination of dielectric resonators and microwave circuit capable to generate additional coupling effect that can be merged together to produce a wideband device as well as increasing the transmitting power and reduce the insertion loss. This combination proficiently produces a low design profile. The dielectric constant is a parameter that reflects the capability of a material to confine a microwave. The higher this parameter means better in term of microwave confinement in the substrate. There is an inversely proportional relation between size and dielectric constant. A high dielectric constant is required to reduce circuit size of a device. A significant miniaturization can be achieved, thus high quality filters can be realized. The main difference lies in the fact that the wavelength in dielectric materials is divided by the square root of the dielectric constant, \( \lambda_g \), in a function of guided wavelength, \( \lambda_0 \), free space wavelength /sqrt of relative permittivity

\[
\lambda_g = \frac{\lambda_0}{\sqrt{\varepsilon_r}} \quad \text{Eq. 1}
\]

where \( \lambda_0 \) is the free space wavelength at the resonant frequency. Moreover, unlike resonant cavities, the reactive power stored during resonance is not strictly confined inside the resonator. The leakage fields from the resonator can be used for coupling or adjusting the frequency. The wavelength inside the DR, \( \lambda_g \), is also inversely proportional to the square root of the dielectric permittivity. The resonant frequency and radiation Q-factor can be varied even dielectric constant of the materials are fixed due to the dielectric resonators able to offer flexibility in dimensions. It is amenable in integrating to existing technologies by exciting using probes, slots, microstrip lines, dielectric image guides or co-planar waveguide and DGS.
Design of High -Q dielectric Resonance Bandpass Filter by Using DGS and Microstrip Lines

III. CONCLUSION

A bandpass filter was designed to operate at starting frequency of 3 GHz, without tuning the dielectric resonator. If dielectric resonator tuned than it will give more accurate pass band response by utilizing DGS Structure along with it, very small ripple at the passband insertion loss and able to operate with a wide bandwidth upto 11GHz or more. The structure of the filter is simple for ease fabrication process. The measurement values are closely agreed to the simulation results by HFSS.

IV. REFERENCES


Quantitative Estimation of Depth of Anaesthesia Using ANFIS

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ABSTRACT: The main objective of anaesthesia is to certify complete unconsciousness for preventing the patient from any kind of pain, shock, discomfort and to avoid intra-operative awareness which may further lead to post-operative reminiscences. Depth of Anaesthesia (DoA) gives the level of unconsciousness. The electroencephalogram (EEG) is the representation of electrical activity of brain. EEG data of 30 patients has been recorded. EEG signal has been analysed and 21 parameters from time and frequency domain have been calculated. Discriminant analysis and Variance analysis have been applied to avoid structural and calculation complexity due to simultaneous processing. Normalization of parameters has been done to bring all the parameters into one range. Analysis of EEG signal has been done through Fuzzy Inference System. Values of graded index have been calculated for all the patients that signifies the EEG Index. Adaptive Network Based Fuzzy Inference System (ANFIS) has been used along with EEG which distinguishes between Awake and Anaesthetic Sleep states. EEG Index obtained from ANFIS can be used by the doctors and physicians for automatic drug delivery control to the patient.

Index term: Electroencephalogram(EEG), Depth of Anaesthesia (DoA), Approximate entropy(ApEn), Average frequency(Avgf), Delta power(δ Power), Beta power(β Power), Step Discriminant Analysis (SDA), Adaptive Network Based Fuzzy Inference System (ANFIS)

I. INTRODUCTION

Anaesthesia is a state of total or partial loss of sensation to touch or pain, caused by nerve injury or disease, or induced intentionally, especially by the administration of anesthetic drugs, to provide medical treatment [1]. Electroencephalogram (EEG) is depiction of electrical activity of brain [2].

Vahid Esmaeili et al, 2007, in his paper found out that derived DoA lies between 100 to 0 where 0 signifies the fully awake state and 0 signifies the isoelectric state. These results when compared with results of CSM Monitor, revealed satisfactory correlation with clinical assessments [6].

Noor Mohammad Arefian et al, 2009, in his paper found out that time parameters have low accuracy in prediction of depth of anaesthesia while it is higher for frequency based parameters [3].

Amod Kumar et al, 2007, in his paper found out that Approximate Entropy, Average Frequency, LZ Complexity, Delta Power, Beta Power form a set of EEG Parameters which characterize the patient’s state under halothane anaesthesia more consistently and Variance analysis is comparatively better than Stepwise Discriminant analysis for reducing the EEG descriptors set required to predict awake or clinically anaesthetized state of patients [4].

Amod Kumar et al, found out that frequency parameters are more reliable than amplitude parameters and normalization of parameters is necessary to avoid the interpatient recognition problems [5].

Vahid Esmaeili et al, 2007, in his paper found out that ANFIS demonstrated good performance in discriminating awake and asleep states. The model also possessed good real time feasibility and generalization ability with an overall accuracy of 85.9% for three regimens namely propofol, isoflurane and halothane [8].

II METHODOLOGY

EEG Signal Acquisition: EEG signals of 30 patients undergoing abdominal surgeries have been recorded. 2 Channel EEG Data from the frontal keeping Fp1 and Fp2 as Active Electrode, Cz as reference and Nasion as Ground were recorded. EEG data has been recorded into two steps:
1.) when the patient is in awake state taken as BASE line EEG data. 2.) When the patient is in anaesthetized state.

**EEG Signal Processing:** EEG data is then passed through low pass filter to remove artifacts. EEG signal is then broken down into epochs of length 4 seconds. These epochs are then processed using MatLab Programmes and 21 parameters from time and frequency domain are calculated. A raw EEG parameters data base is prepared indicating the values of all the 21 parameters for all the patients. The average value and standard deviation of all the epochs for all the patients is also calculated.

However, the simultaneous processing of 21 parameters for calculating the EEG Index can lead to structural and calculation complexity. Hence reduction of 21 parameters into a meaningful set of 5 parameters is done. For this purpose, 2 approaches are applied:

1. **Step Discriminant Analysis:** For Step Discriminant Analysis, average values of all the parameters in both sleep and awake states are calculated. This method divides the data set into 2 groups: sleep and awake. Then a parameter having minimum value of Wilk’s $\lambda$ is selected. This parameter is then tested with the other parameters to find a set of parameters until the value of Wilk’s $\lambda$ remained less than 0.002. As a result a combination of 6 parameters having minimum value of Wilk’s $\lambda$ is found out. These parameters include: LZ complexity, Total Power, Bratio, Average Freq, Theta Power and Delta Ratio.

2. **Score Graph Analysis:** For more accurate results, Score Graph Analysis method is applied on the 21 identified EEG parameters. In this method, score value of 21 parameters is found out. Score Graph Analysis method uses the following rule base to find out a combination of parameters having maximum Score Value. Maximum score is achieved in case of 5 variables - Approximate Entropy, Average Frequency, LZ Complexity, Delta Band Power and Beta Band Power. These descriptors have best discriminative capability between Sleep and Awake states and are used for further analysis [2].

<table>
<thead>
<tr>
<th>Patient id</th>
<th>Score Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>↑</td>
</tr>
<tr>
<td>2</td>
<td>↑</td>
</tr>
<tr>
<td>3</td>
<td>↓</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Fig: Score Graph Analysis Method

‘↑’ indicates that Sleep Average is more than Awake Average. ‘↓’ indicates that Sleep Average is less than Awake Average.

The value of all 5 parameters does not lie in one range. In order to bring all parameters into one range, normalization of parameters with respect to some normalization parameter is done. Average values of epochs in sleep and awake states for a particular patient are calculated. Awake average is selected as the normalization parameter. If sleep average exceeds to awake average, then normalized sleep value = sleep value/average awake value and normalized awake value = average awake value/awake value. But if awake...
average exceeds to sleep average, then normalized sleep value=awake average/sleep value and normalized awake value=awake average/awake value. Maximum and minimum value of each normalized parameter in sleep and awake states are found out.

**EEG Index (DoA) by Fuzzy Inference System:**

Fuzzy Inference System is used for calculating the value of EEG Index. Mamdani type Fuzzy Inference System is used for this purpose. Trapezoidal membership functions are used for Mamdani type Fuzzy Inference System. Rule Base consists of 32 rules. A data set is prepared having normalized value of 5 parameters upto Nth column and value of EEG Index in N+1th column. This data set is divided into training and testing data set for ANFIS. The ratio of training to testing data set is kept to be 2:1.

**EEG Index (DoA) by ANFIS:** Takagi-Sugeno type Fuzzy Inference Systems are used in ANFIS. Hybrid Learning Algorithm is used in ANFIS for training. Trapezoidal membership functions are used for the input variables and linear membership function is used for the output variable. Two membership functions are defined for each input variable: Sleep and Awake.32 rules are derived from the stipulated input-output data pairs for ANFIS. The error tolerance is set to be 0.01.

The training of network is done with a minimum training error of 0.00569. This results in a derived Fuzzy Inference System which is used for the calculation of EEG Index. When this trained network is tested against the Testing Data Set, an accuracy of 100% is achieved.

**III. CONCLUSION**

EEG is the only means that allows a quantitative assessment of anaesthetics on the brain as the primary target organ during General Anaesthesia. Approximate Entropy, Average Frequency, LZ Complexity, Delta Band Power and Beta Band Power are the optimum parameters for best discrimination among sleep and awake states. So, Analysis of the EEG is done by calculating these parameters in both Awake and Sleep States from frontal FP1, FP2 region. EEG Index lies in the range of 0-100 where ‘0’ signifies the deep anaesthetized state and ‘100’ signifies the fully awake state. ANFIS is a soft computational technology for more reliable and precise calculation of DoA. EEG Index obtained from ANFIS can be used by the doctors and physicians for automatic drug delivery control to the patient.

**REFERENCES**


Reactive Power Output Optimisation in Wind Farm for Distribution Losses Reduction

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Abstract—In recent years, the number of small size wind farms used as DG sources located within the distribution system are rapidly increasing. In this paper, wind farm made up with doubly fed induction generators (DFIG) is proposed as the continuous reactive power source to support system voltage control due to the reactive power control capability of DFIG. The (GA) Genetic Algorithm is utilized to find wind farm optimal reactive power output for distribution system losses reduction and voltage profiles improvement. Finally, the three feeder distribution system is used as a test case to evaluate the algorithm.

Keyword- Doubly fed Induction Generator, Grid connected wind farm, Genetic Algorithm

I. INTRODUCTION

CURRENTLY, there is an increasing concern over the environmental impact and sustainability of traditional fossil-fueled power plants. Because wind energy is one of the most important and promising renewable energy resources in the world, leading to a growing penetration of the wind energy in electrical system, in [1] proposed a wind farm made up with DFIG as a continuous reactive power source to support system voltage control due to the reactive power control capability of DFIG. The particle swarm optimization algorithm (PSO) is utilized to find the optimal reactive power output of wind farm. The main objective of the optimization is to minimize the real power losses of the system and the deviation of the bus voltage in the proposed optimization algorithm, reactive power output of wind farm is utilized as the control variable for loss minimization and voltage profile improvement, in [2] studies the reactive power output optimization of wind farm, and the variability and intermittency of wind speed is considered. The multi-objective reactive power optimization model including network loss, average deviation of voltage. The effectiveness of the proposed method is demonstrated on IEEE-57 bus system with wind, in [3] the use of genetic algorithms for the resolution of the optimization problem of the voltages plan and the active losses in a power system including a wind power station by acting on the reactive productions of inductances and capacitors benches connected to the consuming nodes, in [4] an improved Genetic algorithm (GA) for reactive power optimization in wind farm. Traditional GA has some drawbacks, such as slow convergence. The coding method, genetic operators, crossover and mutation probability, stopping criterion in iteration has been improved. The reactive power optimization method with improved GA is tested in a MATLAB based simulation model, in [5] developed a wind farm model and concluded that wind farms made up of double fed induction generators constitute an important tool from the voltage regulation point of view. Furthermore, the designed proportional distribution algorithm makes all the generators work under similar conditions and quite far from saturation, which means far from the reactive power generation limits in [6] the power capability limits of doubly fed asynchronous generators. These limits have been obtained by taking into account the maximum stator and rotor currents and the steady state stability limit of the generator, in [7] describe the development of a new algorithm for the solution of a multi-objective problem in power systems with wind farm using Particle Swarm Optimization. Basically, the purpose is to search an optimal operation point of system which allows simultaneous power factor remote control and loss minimization. In [8] described the reactive power capabilities of wind power generator and then discuss reactive power ancillary services issues related to the wind farms in the electricity.

II SYSTEM MODEL AND CONTROL

The model of DFIG consisting of a pitch controlled wind turbine and an induction generator[1]. The stator of the DFIG is directly connected to the grid, while the rotor is
connected to a converter consisting of two back-to-back PWM inverters, which allows direct control of the rotor currents. Direct control of the rotor currents allows for variable speed operation and reactive power control thus DFIG can operate at a higher efficiency over a wide range of wind speeds and help provide voltage support for the grid. These characteristics make the DFIG ideal for use as a wind generator.

A. DFIG Capability Limits Curve

The stator active and reactive power can be expressed as a function of stator current and rotor current[1]

\[ P_s^2 + Q_s^2 = (3U_s I_s)^2 \]  
\[ P_s^2 + (Q_s + 3U_s^2 / X_s)^2 = (3X_m / X_s U_s I_R)^2 \]  

In the PQ plane, (1) represents a circumference centered at the origin with radius equal to the stator rated apparent power. Equation (2) represents a circumference centered at \(-3U_s^2 / X_s, 0\) and radius equal to \(3X_m U_s I_R / X_s\).

Therefore, given the stator and rotor maximum allowable currents \(I_{S\text{max}}\) and \(I_{R\text{max}}\), the DFIG capability limits are obtained.

Fig.1 shows the composed curve for the DFIG capability limits. Additionally, the steady state stability limit of the DFIG is taken into account, which represented as vertical line at \(-3U_s^2 / X_s, 0\), coordinate. It’s obvious that the DFIG reactive power capability mainly depend on the rotor maximum allowable current \(I_{R\text{max}}\).

B. Wind Farm Model

In this paper, a wind farm model is developed with \(n\) DFIG wind turbines connected in parallel. As a result, the total active and reactive power output of the wind farm equal to the sum of the active and reactive power generated by each of the DFIG wind turbine in the wind farm:

\[ P_{WF} = \sum_{i=1}^{n} P_{gi} \]  
\[ Q_{WF} = \sum_{i=1}^{n} Q_{gi} \]  

III PROBLEM FORMULATION

In this section, wind farm reactive power output optimization has been modeled as a multi objective, non differentiable optimization problem. In the proposed optimization algorithm, the objective function consists of two terms: 1) the real power losses of the system, 2) the deviation of the bus voltage.

\[ \min f_i(\bar{X}) = \lambda_1 \sum_{i=1}^{n} R_i \left( \frac{P_i^2 + Q_i^2}{|V_i|^2} \right)^2 + \lambda_2 \max |V_i - V_{rail}| \]  

Owing to the DFIG operational requirements, the minimization of the objective function is subjected to the following constraints:

1) Distribution power flow equations:

\[ P_i + P_{WF} = P_{Di} + \sum_{j=1}^{N_b} V_j (G_{ij} \cos \delta_j + B_{ij} \sin \delta_j) \]  
\[ Q_i + Q_{WF} = Q_{Di} + \sum_{j=1}^{N_b} V_j (G_{ij} \sin \delta_j - B_{ij} \cos \delta_j) \]

2) DFIG active capability limits:
3) DFIG reactive capability limits:

\[ Q_{gl} \leq \sqrt{\left(\frac{\lambda}{X_S} - \frac{U_s I_R}{X_S}\right)^2 - \left(\frac{U_s}{X_S}\right)^2} - \frac{U_s^2}{X_S} \]  

\[ Q_{gl} \geq -\sqrt{\left(\frac{\lambda}{X_S} - \frac{U_s I_R}{X_S}\right)^2 - \left(\frac{U_s}{X_S}\right)^2} + \frac{U_s^2}{X_S} \]

4) Node voltage magnitude limits:

\[ V_{\text{min}} \leq V_i \leq V_{\text{max}} \]  

5) Distribution line limits:

\[ P_{ij}^{\text{line}} \leq P_{ij,\text{max}} \]

6) Radial structure of the network.

**IV SIMULATION RESULTS**

For modeling of a dynamic system, the system should be fully defined. After building each component, integrate them into a complete model of the system. A three feeder distribution system is used as shown in the Fig. 2 with a base voltage of 0.69 KV. Total system load is 28.7MW and 17.3MVAR. A small wind farm comprising 10 DFIG wind turbines of 900kW, with a power installed of 9MW is connected at node 12 through a rated 23/0.69 kV transformer.

The performance parameters of the studied DFIG wind turbine are given in Table 1

**Table 1: DFIG performance parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated capacity</td>
<td>900KW</td>
</tr>
<tr>
<td>Cut in wind speed</td>
<td>4m/s</td>
</tr>
<tr>
<td>Cut out wind speed</td>
<td>25m/s</td>
</tr>
</tbody>
</table>

**Table 2: DFIG Electric Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stator resistance per phase</td>
<td>.0067Ω</td>
</tr>
<tr>
<td>Stator leakage reactance per phase</td>
<td>.0300Ω</td>
</tr>
<tr>
<td>General turns ratio</td>
<td>.3806</td>
</tr>
<tr>
<td>Mutual reactance</td>
<td>2.3161Ω</td>
</tr>
<tr>
<td>Rotor resistance per phase</td>
<td>.0399Ω</td>
</tr>
<tr>
<td>Rotor leakage reactance per phase</td>
<td>.3490Ω</td>
</tr>
</tbody>
</table>

The electric parameters of the studied DFIG wind turbine are given in Table 2

![Fig.2 Single line diagram of three feeder system](image)

A. Available Active and Reactive Power in Wind Farm

Fig.3 shows the wind speeds on the wind turbines considered in the simulation. Then the active power output of DFIG is obtained by means of the power curve. Considering the DFIG capability limits curve described in Fig.1, the maximum limits of available reactive power for
each generated active power of DFIG wind turbine can be calculated.

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VI CONCLUSIONS

In this paper, an optimization algorithm of reactive power control of wind farm is proposed. In the proposed optimization algorithm, reactive power output of wind farm is utilized as the control variable for losses minimization and voltage profile improvement. The optimal reactive power output of wind farm is efficiently obtained by taken in account DFIG reactive capability limits in the simulation. From the results obtained in the simulations, it can be concluded that wind farm made up of DFIG can constitute an important continuous reactive power source to support system voltage control.

REFERENCES


Green Computing: Role of IT in Eco-Environment

Ramesh Chandra Bharti, Pooja Vashishta

Abstract-As Information technology has revolutionized almost every aspect of life. With the rapid pace of life, technologies were changed every moment and there are number of pros and cons with this rapid change. And usually every one ignores the negative circumstances of the technological changes. Today’s at most of the work places the misuses of Electricity in electronic gadgets like computers are accounted as the wastage of resources. This increase in power utilization affects greenhouse gas emissions resulting in Global Warming. There is also a huge increase in electronic waste (e-waste) that needs to be managed in order to keep the environment clean and safe. And the remedy to all this is Green Computing. Opportunities lie in green technology like never before in history and organizations are taking it as a way to create new profit centers while trying to help the environmental cause. The objective of this issue is to present the latest research advances in the area of green information and communications technologies, which mainly includes the development of truly sustainable (eco-effective) information technologies and related solutions.

Keywords: Eco-Environment; E-Waste; Global Warming

I. INTRODUCTION

“Global Warming” is a cause of concern for all of us living in this planet. Global warming is the continuing rise in the average temperature of Earth’s atmosphere and oceans caused by increased concentrations of greenhouse gases in the atmosphere, resulting from various human activities. One such cause is technology consumption in wrong manner. We work over machines for an unaccountable time without concerning about the heat production. To overcome this rising temperature, air-conditioning is utilized which again adds to the global warming.

“E-waste” is a general term, considered to cover TVs, computers, mobile phones, white goods (e.g. fridges, washing machines, dryers etc), home entertainment and stereo systems—almost any household or business item with circuitry or electrical components with power or battery supply. Electronic wastes can cause widespread environmental damage due to the use of toxic materials in the manufacture of electronic goods. Land filling of e wastes can lead to the leaching of lead into the ground water and if they are crushed and burned, it emits toxic fumes into the air. Designers should ensure that the product is built for re-use, repair and/or upgradeability. Stress should be laid on use of less toxic, easily recoverable and problems, other protective erosion problems, climate change and acting as carbon reservoirs and skins. Eco-environment goes hand in hand with innovation. Projects must be environmentally beneficial, innovative and economically viable in the medium to long-term.

Energy Usage Profile (EUP)

<table>
<thead>
<tr>
<th>Component</th>
<th>Idle Power Usage</th>
<th>Average Power Usage</th>
<th>Maximum Power Usage</th>
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<tbody>
<tr>
<td>Server 1</td>
<td>383.75</td>
<td>454.19</td>
<td>600 (Estimated)</td>
</tr>
<tr>
<td>CPU</td>
<td>40.8</td>
<td></td>
<td>130</td>
</tr>
<tr>
<td>HDD</td>
<td>14.85</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>DIMM1</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>DIMM2</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Video</td>
<td>18.3</td>
<td></td>
<td>25.6</td>
</tr>
<tr>
<td>Network Card</td>
<td>4.95</td>
<td></td>
<td>4.95</td>
</tr>
<tr>
<td>CD/DVD</td>
<td>2</td>
<td></td>
<td>18</td>
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</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Idle Annual Cost</th>
<th>Average Annual Cost</th>
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<tr>
<td>CPU</td>
<td>822.04</td>
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<tr>
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<tr>
<td>DIMM1</td>
<td>60.44</td>
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<td>60.44</td>
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<tr>
<td>DIMM2</td>
<td>60.44</td>
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<td>60.44</td>
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<td>Video</td>
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<tr>
<td>Network Card</td>
<td>99.73</td>
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<td>99.73</td>
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<tr>
<td>CD/DVD</td>
<td>40.30</td>
<td></td>
<td>362.66</td>
</tr>
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</table>
II. WHY TO GREEN?

IT energy demand accounts for approximately 2% of global energy demand. “IT can account for 25% .

Manufacturing computers includes the use of lead, cadmium, mercury, and other toxics in general. Usually, computers can contain 4 to 8 pounds of lead alone, according to green experts. It’s no wonder that computers and other electronics make up two-fifths of all lead in landfills. To counter this growing pollution threat all over the world due to the growing use of electronic device in general and computers in particular there is a need to look for an eco-environment friendly computer which helps reducing global warming.

III. BENEFITS OF GOING GREEN

Save the Earth: Saving the Earth is the biggest benefit of going green. At the rate that we are consuming the world’s resources, polluting the earth and fueling global warming, and destroying the earth’s ecosystem, in no time, we would be left with nothing (no clean air, water, land and food) but an un-livable world beyond repair. We need to do something, starting today, if we do not wish to end up in that horrible state.

Live Healthy: Climate change has caused death and diseases all over the world, through natural disasters such as heat-waves, floods and droughts. So as we start to go green and fight climate change, we are helping to save lives, including our own. The quality of our air definitely has an impact on our health. In addition, the health of our environment also has an impact on the quality of our food and ultimately our health.

Cost Cutting: One of the most evident benefits of going green is that it can help us cut cost, whether as an individual, a household, a community or a nation. When we conserve energy and resources, by electricity, by sending our unwanted items for recycling, and supporting the recycling industry by purchasing recycled products, in the long run as a community, we are reducing the cost of production.

IV. WAYS TO GO GREEN

The work habits of computer users and businesses can be modified to minimize adverse impact on the global environment. Here are some steps that can be taken:

Virtualization of Resources: Computer virtualization refers to the abstraction of computer resources, such as the process of running two or more logical computer systems on one set of physical hardware reducing power and cooling consumption. The concept originated with the IBM mainframe operating systems of the 1960s. Virtualization can assist in distributing work so that servers are either busy, or put in a low power sleep state.

Adapting Terminal Servers: When using the system, users at a terminal connect to a central server; all of the actual computing is done on the server, but the end user experiences the operating system on the terminal. These can be combined with thin clients, who use up to 1/8 the amount of energy of a normal workstation, resulting in a decrease of energy costs and consumption. Examples of terminal server software include Terminal Services for Windows and the Linux Terminal Server Project (LTSP) for the Linux operating system.

Operating System Support: Windows 2000 was the first NT based operating system to include power management. This required major changes to the underlying operating system architecture and a new hardware driver model. Microsoft significantly improved this in Windows Vista by redesigning the power management system to allow basic configuration by Group Policy. The most recent release, Windows 7 retains these limitations but does include refinements for more efficient use of operating system timers, processor power management, and display panel brightness. The most significant change in Windows 7 is in the user experience. The prominence of the default High Performance power plan has been reduced with the aim of encouraging users to save power.

Power Supply: Desktop computer power supplies (PSUs) are generally 70–75% efficient, dissipating the remaining energy as heat. An industry initiative called 80 PLUS certifies PSUs that are at least 80% efficient; typically these models are drop-in replacements for older, less efficient PSUs of the same form factor. As of July 20, 2007, all new Energy Star 4.0-certified desktop PSUs must be at least 80% efficient.

Green Display: CRT monitors typically use more power than LCD monitors. They also contain significant amounts of lead. LCD monitors typically use a cold-cathode fluorescent bulb to provide light for the display. Some newer displays use an array of light-emitting diodes (LEDs) in place of the fluorescent bulb, which reduces the amount of electricity used by the display. Fluorescent back-lights also contain mercury, whereas LED back-lights do not.
**Materials Recycling:** Parts from outdated systems may be salvaged and recycled through certain retail outlets and municipal or private recycling centers. Unfortunately, in 2011, the collection rate of e-waste is still very low, even in the most ecologically advanced countries like France. In this country, e-waste collection is still at a 14 % annual rate between electronic equipments sold and e-waste collected for 2006 to 2009.

**Telecommuting:** Teleconferencing and telepresence technologies are often implemented in green computing initiatives. The advantages are many; increased worker satisfaction, reduction of greenhouse gas emissions related to travel, and increased profit margins as a result of lower overhead costs for office space, heat, lighting, etc.

V. FURTHER STEPS IN THIS FIELD
The average person might believe that the worldwide push to “go green” is coming solely from politicians and concerned citizens. In fact, this is not the case! In recent years, many big-name companies have realized their way towards more sustainable and eco-friendly business practices.

“IBM is significantly expanding the scope of Project Big Green to allow clients to address a much broader portion of the IT infrastructure, not only in the data center but beyond its walls.” Project Big Green is “IBM’s effort to improve the energy efficiency of its IT infrastructure. A keystone to IBM’s commitment to energy efficiency is its own program to boost compute capacity with no increase in energy consumption. The company expects to see an annual savings of 5 billion kilowatt hours through its efforts. In addition, IBM’s actions will result in the avoidance of 2.5 million tons of carbon dioxide emissions annually. That’s the equivalent of taking 1 million automobiles off the road.

“The U.S. government will dispose of some 750,000 computers and monitors this year and spend $79 billion on IT”[^1]. That budget will include the purchase of roughly one million computers and monitors. This vast IT footprint will become more environmentally friendly under two executive orders issued in 2007 and 2009. The orders direct government agencies to adopt a range of sustainability measures, including several green IT requirements, such as reducing paper use and buying more efficient equipment.

VI. EDUCATION FOR GREENING
Now day’s educational communities are taking several steps to showcase their thought, leadership and initiatives related to the green technology space as well as their technology transfer and commercialization programs.

Several degree programs are initiated that provide training in a range of information technology concentrations along with sustainable strategies in an effort to educate students how to build and maintain systems while reducing its negative impact on the environment.

VII. CONCLUSION
In summary we can clearly grasp and understand that problem of e-waste and global warming is of global concern because of the nature of production and disposal of waste in a globalized world. By engaging with various stakeholders and relevant scientific wisdom within this chain of events, we are on the way to solve this problem. Electronics giants are about to roll out eco-friendly range of computers (like desktops and laptops) that aim at reducing the e-waste in the environment. They are likely to be free of hazardous materials such as brominated flame-retardants, PVCs and heavy metals such as lead, cadmium and mercury, which are commonly used in computer manufacturing.

The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings. Solution may also need to address end user satisfaction, management restructuring, regulatory compliance, and return on investment (ROI). The greenest computer will not miraculously fall from the sky one day; it’ll be the product of years of improvements.

VIII. REFERENCES
[9]  http://focus.ti.com/analog/docs/powerhome.tsp?familyId=64&contentType=4&DCMP=TIHomeTracking&HQS=Other+OT+home+p_power
Green Computing: Role of IT in Eco-Environment

Electromagnetic Interference Study of Implantable Cardiac Pacemaker Using Perfectly Matched Layer and Finite Difference Time Domain Method

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ABSTRACT: In this paper we have developed a matlab code for studying the effect of electromagnetic interference (EMI) on cardiac implantable pacemaker using perfectly matched layer; a technique of free space simulation and finite difference time domain method. With increase of cardiac diseases, the uses of implantable pacemaker has been increased which is an artificial source to provide the pacing pulse to heart.


I. INTRODUCTION

Modern life exposes us all to an ever-increasing number of potential sources of electromagnetic interference (EMI). Patients with Implantable rhythm devices (IRD) like pacemakers, implantable cardioverter defibrillators or implantable loop recorders often ask about the electromagnetic interference caused due to use of microwave ovens, walking through airport metal detectors and use of cellular phones. Electromagnetic interference occurs when electromagnetic waves emitted by one device impede the normal function of another electronic device. The potential for interaction between implanted pacing systems and electromagnetic interference (EMI) has been recognized for years. It has been shown that EMI can produce clinically significant effects on patients with implanted pacemakers and ICDs.

a) Human Heart - Natural Pacemaker: The heart has its own built-in electrical system, called the conduction system (figure 1.1). The conduction system sends electrical signals throughout the heart that determine the timing of the heartbeat and cause the heart to beat in a coordinated, rhythmic pattern. The conduction system stimulates precise contractions of the heart's chambers to ensure that blood is pumped effectively. The electrical signals, or impulses, of the heart are generated by specialized tissue called the sinoatrial (SA) or sinus node (figure 1.1). The sinus node is sometimes called the heart’s "natural pacemaker." Each time the sinus node generates a new electrical impulse; that impulse spreads out through the heart's upper chambers, called the atria and the left atrium. This electrical impulse stimulates the atria to contract, pumping blood into the lower chambers of the heart (the right and left ventricles). The electrical impulse then spreads to another area of specialized tissue located between the atria and the ventricles, the atrioventricular (AV) node. The AV node momentarily slows down the spread of the electrical impulse, to allow the left and right atria to finish contracting. From the AV node, the impulse spreads into a system of specialized fibers called the bundle of His and the right and left bundle branches (figure 1.1). These fibers distribute the electrical impulse rapidly to all areas of the right and left ventricles, stimulating them to contract in a coordinated way. With this contraction, blood is pumped from the right ventricle to the lungs, and from the left ventricle throughout the body.

From the above it is clear that SA (sinoatrial) node a part of the heart plays an important role in the proper heart's functioning.

b) Artificial Pacemaker: A pacemaker (or artificial pacemaker, so as not to be confused with the heart's natural pacemaker) is a medical device which uses electrical impulses, delivered by electrodes contacting the heart muscles, to regulate the beating of the heart. The primary purpose of a pacemaker is to maintain an adequate heart rate, either because the heart's native pacemaker is not fast enough, or there is a block in the heart's electrical conduction system. Modern pacemakers are externally programmable and allow the cardiologist to select the optimum pacing modes for individual patients.
c) Need for a Pacemaker: Cardiac pacemakers are used for a number of reasons. These include:

1) A very slow heart rate leading to symptoms of fatigue, weakness and dizziness.
2) A diagnosis found with an electrocardiogram that indicates a potential for sudden drastic drops in the heart rate.
3) Injury to the heart muscle that may occur after a heart attack that interferes with your heart’s ability to control the heart rate.
4) To prevent the heart rate from dropping too low when you are taking certain medications to treat a very fast heart rate.

Permanent / Implantable pacemakers - Permanent pacemakers are pacemakers that are intended for long-term use.

As a general rule, permanent pacing is recommended for certain conditions that are chronic or recurrent and not due to a transient cause. Permanent pacing may be considered necessary or appropriate for certain people with symptomatic bradycardia or, less commonly, to help prevent or terminate tachycardia.

Implantation - The pulse generator of a permanent pacemaker is implanted into soft tissue beneath the skin, which is known as prepectoral implantation; this is located under the skin and fat tissue but above the pectoral or breast muscle. The pacemaker leads are typically inserted into a major vein (transvenously) and advanced until the electrodes are secured within the proper region(s) of heart muscle. The other ends of the leads are attached to the pulse generator, which is typically implanted under the skin and fat tissues in the upper outer portion of the chest.

(d) Biotelemetry: Wireless communication links between implanted pacemaker and outside equipment for programming the pacing pulses or data transferring is a promising function for future implantable biomedical devices especially in the field of telemedicine. During this communication, an electromagnetic field created by any metallic object near pacemaker can cause reflection, which ultimately may affect the smooth functioning of this device. The life of patient with implanted pacemaker may be at risk due to disturbance in pacemaker telemetry link, if one pulse is added or dropped, it will most probably not noticed by the patient. If the extended series of paces are inhibited due to these reflected waves, the patient feels sluggish or fainted.

II. Electromagnetic Interference (EMI)

Electromagnetic interference (EMI) can be defined as any signal, either biologic or non-biologic, that falls within a frequency spectrum that are being detected by the sensing circuitry of the pacemaker. They can interfere with the optimal function of the pacemaker and is always a concern for the patients with a pacemaker, since the risk of EMI is greatest in pacemaker dependent patients.

(b) EMI Sources: Most of the common home and workplace items that can generate EMI typically do not interfere with normal operation of implantable medical devices. Common electromagnetic sources are described in Table 1 below:

(a) Effect of EMI on Artificial Implantable Pacemaker: EMI may potentially affect a pacemaker in one of three ways: Stopping the pacemaker from delivering the stimulating pulses that regulate heart's rhythm; causing the pacemaker to deliver the irregularly; and causing the pacemaker to ignore heart's own rhythm and deliver pulses at a fixed rate.

EMI with pacemakers can be very complex, not only from the technical standpoint, but also from the view of public health issues. Pacemakers may be affected by various equipments in our daily life, varying from hospital equipments to security devices. Hospital procedures like electrocautery, cardioversion, defibrillation, magnetic resonance imaging, lithotripsy, radiofrequency ablation, diathermy etc., may interfere with the normal pacemaker function.

III. COMPUTATIONAL NUMERICAL METHOD

PML-FDTD Method: The Perfectly Matched Layer (PML) absorbing boundary condition was introduced by Berenger (1993) and Chew and Wee (1994) as a means for truncating Finite-Difference Time-Domain (FDTD) and Finite-Difference Frequency Domain (FDFD) lattices in order to accurately simulate electromagnetic antenna and
scattering problems in isotropic media. The application of finite difference grids to model complex radiation and scattering problems in electromagnetic and plasma physics have become increasingly popular due to both the intuitive and robust nature of the technique as well as the ever increasing speed and RAM of computers. The technique itself is very simple. To solve the fields as a function of time, we apply the finite-difference time-domain technique to the electromagnetic Maxwell equations. Maxwell’s curl equations are given as:

**Ampere’s law**

\[ \nabla \times \mathbf{H} = \sigma \mathbf{E} + \varepsilon \frac{\partial \mathbf{E}}{\partial t} \]

**Faraday’s equation**

\[ \nabla \times \mathbf{E} = -\mu \frac{\partial \mathbf{H}}{\partial t} \]

Where \( \mu \) is the free space permeability, \( \varepsilon \) represents permittivity and \( \sigma \) is conductivity.

### IV. RESULTS AND DISCUSSION

The results of produced reflections of electric and magnetic fields are mentioned which are taken at different time steps. As the time steps are increased or the distance between the pacemaker and EMI sources decreases the reflections becomes more and more.

The reflection due to EMI can cause damage to heart due to false presumption of implanted pacemaker as the normal heart beat because the pacemaker may not distinguish between the reflections caused due to EMI and the actual pulses (pacing) of the heart. This is a very severe situation which can cause even the death of the patient.

### V. CONCLUSION

By developing a matlab code, the effect of electromagnetic interference (EMI) on cardiac implantable pacemaker using perfectly matched layer and FDTD method is studied. Clear instructions and guidance are required to ensure that an EMI safe area is identified before proceeding with remote device handling. Advances in electronic technology, including hermetic shielding, filtering, bipolar sensing, and algorithms designed to reject sources of EMI have been of great help in returning patients with pacemakers to active lives in their communities after pacemaker implantation. It is important for physicians to remain vigilant about the potential risks of EMI from external sources with regard to pacemaker function.

### REFERENCES

Electromagnetic Interference Study of Implantable Cardiac Pacemaker Using Perfectly Matched Layer and Finite Difference Time Domain Method

Abstract: This paper covers some aspects of Microstrip antenna designs. The design and analysis of single feed Dual band and Dual polarized rectangular Microstrip antenna which operates at the central frequency of 2.23 GHz & 2.78 GHz. Radiation at frequency 2.23 GHz is Linear polarized & at frequency 2.78 GHz is circular polarized . Basically, transmission line and cavity model have been used to model both antennas. First, the design parameters for dual band and dual polarized of rectangular patch antenna have been calculated from the transmission line model equation. The antenna design is extended to enhancement of bandwidth of multi- frequency and multi-polarization rectangular Microstrip patch antenna using the slots at radiating edges.

I. INTRODUCTION

In recent years the demand for broad-band antennas has increased for use in high frequency and high speed data communication. Printed antenna's are economical and can be accommodated in the device package. Microstrip antennas are best form of printed antennas because they are light weight, low profile, low cost, ease to analyze and fabricate and are compatible with the integrated circuit.

In this paper, dual-polarized and dual frequency design of a single-feed rectangular microstrip antenna with a rectangular slots i.e approximate to square slot is placed Close to its probe feeding point. The two operating frequencies, having different radiation characteristics and different polarization planes i.e. one is linear polarization and other is circular polarization. Here dual-polarized radiation can be obtained with a reduced antenna size at a fixed operating frequency. Many prototypes of the proposed compact dual polarized by exciting the patch using a coaxial probe feed along the diagonal line of the rectangular patch, it is seen that dual-frequency operation [1,2] based on the two resonant frequencies $f_1$ and $f_2$ of the perturbed $TM_{10}$ and $TM_{01}$ modes can be generated. Linear polarization is used for mobile communication and circular polarization used for satellite communication. The dual-polarized patch antenna has been a popular research topic during recent years, the proposed antenna can double the capacity of Communication systems by means of the frequency reuse, and reduce the multipath fading of received signals in land-based mobile-communication systems by means of the polarization diversity. The new proposed design has a greater area reduction compared to the placard-shaped[5], arrow-shaped [6], slotted square shaped [7] antennas reported earlier. Two parameters affect the resonant frequency of the antenna, the slot width and slot length structure and changes vswr position. Here, the low-frequency ratio and area reduction mainly depended on the slot parameters. The design has been successfully implemented, and simulated results are presented.

II. PARAMETER DESIGN

The three essential parameters for the design of a rectangular Microstrip Patch Antenna are

**Frequency of operation ($f_o$):** The resonant frequency of the antenna must be selected appropriately. The Mobile Communication Systems uses the frequency range from 1800-5600 MHz. Hence the antenna designed must be able to operate in this frequency range. The operating frequency selected for my design is 3.0 GHz.

**Dielectric constant of substrate ($\varepsilon_r$):** The dielectric material selected for my design is FR4 which has a dielectric constant of 4.4. A substrate with a high dielectric constant has been selected since it reduces the dimensions of the antenna

**Height of dielectric substrate ($h$):** For the microstrip patch antenna to be used in cellular phones, it is essential that the antenna is not substrate is selected as 1.59 mm.

To design the rectangular MSA that operates at frequency
around 3 GHz, the optimal width can be found using [7]:

\[ W = \frac{1}{2}f_o \mu_0 \left( \sqrt{\frac{2}{\varepsilon}} - 1 \right) \]

\[ W = 30.44 \text{mm} \]

The effective length found by using [8]

\[ L = \frac{c}{2f_o} \sqrt{\mu_0 \varepsilon} \]

\[ L = 23.40 \text{mm} \]

Calculation of microstrip patch antenna results

<table>
<thead>
<tr>
<th>L</th>
<th>Length of the Patch</th>
<th>23.4mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>Width of the Patch</td>
<td>30.4mm</td>
</tr>
<tr>
<td>Ls</td>
<td>Length of Square slot</td>
<td>5mm</td>
</tr>
<tr>
<td>Ws</td>
<td>Width of Square slot</td>
<td>4mm</td>
</tr>
<tr>
<td>Rp</td>
<td>Probe radius</td>
<td>25mm</td>
</tr>
<tr>
<td>Lsr</td>
<td>Slot arm Length</td>
<td>2mm</td>
</tr>
<tr>
<td>Ws</td>
<td>Slot arm Width</td>
<td>1mm</td>
</tr>
</tbody>
</table>

**Simulated Result and Analysis**

In order to evaluate the performance of the proposed antenna, the antenna is simulated through the simulation tool IE3DTM. The analysis of the antenna for different physical parameter values has been done by varying one of them and keeping others as constant.

**Simulated radiation efficiency:**

![Efficiency Vs. Frequency](image-url)

The geometry of the proposed antenna is shown in fig.4.2. The rectangular patch of dimensions L x W separated from the ground plane with a foam substrate of \( \varepsilon_r \), thickness h and the rectangular slot(approximate square slot) placed at the center. The location of the approximate square slot on the patch can be specified by parameter Ws and Ls. The width and length of the slots are denoted by Ws and Ls. The rectangular patch is fed using 50Ω probe feed with radius is 0.25mm. A typical proposed antenna is implemented and investigated. It has dimensions L=23.4mm, W=30.4mm, Lt=5mm, Ws=4mm and is simulated on a substrate of \( \varepsilon_r = 4.4 \) and h=1.6 mm. A good impedance matching of the two operating frequencies can be obtained by using a microstrip feedline of length with arm length Lsr and width Wsr etched on a substrate of the same thickness and permittivity, and kept below the antenna to provide electromagnetic coupling.
III. CONCLUSION

In this paper, a simple and efficient technique of probe feeding and line feeding method has been introduced for an impedance matching improvement of the antennas. Main concern of the thesis is to study of Dual band and dual polarization patch antenna using different techniques and frequency ratio of the Microstrip antenna. The dual band and dual polarized Microstrip antenna is a more conventional approach for the implementation of a broadband antenna and for satellite communication where the low frequency ratio is used. Dual polarization antenna are used in weather radar. In general weather radar transmit and receive microwave at one polarization usually horizontal polarization but additional information that can be obtained from nature of the target, it requires more than one polarization. First, proposed dual band & dual polarized rectangular Microstrip antenna is designed to operate at frequency 2.28 GHz is Linearly polarized and at frequency 2.78 GHz is circularly polarized.

IV. REFERENCES


Variable Sine Frequency Generation Using Direct Digital Frequency Synthesizer

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Abstract: Direct Digital Frequency Synthesis (DDFS) is a mixed signal part i.e. it has both digital and analog parts. DDFS’s digital part is also known as Numerically Controlled Oscillator (NCO), which consists of a Phase Register, a Phase Accumulator (PA) and a ROM. The analog part has Digital-to-Analog Converter and a filter. NCO is a digital computing block which renders digital word sequences in time at a given reference clock frequency $f_{clk}$, which thereafter are converted into analog signals to serve as a synthesizer. This paper shows how the variable sine frequency is generated using the direct digital synthesis technique. Earlier synthesizer used the phase locked loop (PLL) method. The digital synthesizer provides many significant advantages over the PLL approach, such as fast settling time, sub-hertz frequency resolution, continuous-phase switching response and low phase noise.

Keywords: Direct digital frequency synthesizer; MATLAB; Phase locked-loop; DAC; NCO; ROM; DDS;

I. INTRODUCTION

Direct digital frequency synthesis (DDFS) is a method of producing an analog waveform—usually a sine wave—by generating a time-varying signal in digital form and then performing a digital-to-analog conversion. The operations within a DDFS device are primarily digital, therefore, it can offer fast switching between output frequencies, fine frequency resolution, and operation over a broad spectrum of frequencies.

The digital frequency synthesis approach employs a stable source frequency i.e. reference clock to define times at which digital sinusoidal sample values are produced. These samples are converted from digital to analog format and smoothed by reconstruction filter to produce analog frequency signals. A DDFS typically consists of a phase accumulator (PA) and a sine lookup table (LUT). The input to the phase accumulator is a frequency control word, which determines the periodicity of the phase accumulator. The PA is updated to the frequency control word or tuning word, at each clock, the output of the PA is fed to the LUT.

II. ARCHITECTURE OF SINE OUTPUT DDFS

The basic block diagram of a direct digital frequency synthesizer is shown in Figure 1.

![Figure 1. Basic functional block diagram of DDFS](image)

The main components of a DDFS are a phase accumulator, phase-to-amplitude converter (a sine look-up table), a Digital-to-Analog Converter and filter. A DDFS produces a sine wave at a given frequency. The frequency depends on three variables; the reference-clock frequency $f_{clk}$ and the binary number programmed into the phase register (frequency control word, $M$) length of n-bit accumulator. The binary number in the phase register provides the main input to the phase accumulator.

If a sine look-up table is used, the phase accumulator computes a phase (angle) address for the look-up table, which outputs the digital value of amplitude—corresponding to the sine of that phase angle—to the DAC. The DAC, in turn, converts that number to a corresponding value of analog voltage or current. To generate a fixed-frequency sine wave, a constant value (the phase increment—that is determined by the binary number $M$) is added to the phase accumulator with each clock cycle. If the phase increment is large, the phase accumulator will step quickly through the sine look-up table and thus generate a high frequency sine wave. If the phase increment is small, the phase accumulator will take many more steps, accordingly generating a slower waveform. The heart of the system is the phase
accumulator whose contents are updated once each clock cycle. Each time the PA is updated, the digital number or \( M \), stored in the phase register is added to the number in the phase accumulator register. If the number in the phase register is 00...01 and the initial content of the phase accumulator are 00...00. The phase accumulator is updated by 00...01 on each clock cycle. If the accumulator is 32-bits wide, \( 2^{32} \) clock cycles (over 4 billion) are required before the phase accumulator returns to 00...00, and the cycle repeats.

The output of the phase accumulator serves as the address to a sine (or cosine) lookup table/ROM/phase-to-amplitude converter. Each address in the LUT corresponds to a phase point on the sine wave from 0° to 360°. The LUT contains the corresponding digital amplitude information for one complete cycle of a sine wave. The LUT, therefore, maps the phase information from the phase accumulator into a digital amplitude word, which in turn drives the DAC. For \( n=32 \), and \( M=1 \). The phase accumulator steps through each of \( 2^{32} \) possible outputs before it overflows. The corresponding output sine-wave frequency is equal to the clock frequency divided by \( 2^{32} \). If \( M=2 \), then the phase accumulator register "rolls over" twice as fast, and the output frequency is doubled. For an n-bit phase accumulator (n generally ranges from 24 to 32 in most DDFS systems) there are \( 2^n \) possible phase points. The digital word in the phase register, \( M \) represents the amount the phase accumulator is incremented each clock cycle.

### III. FREQUENCY TUNING EQUATION

A sine wave is generally expressed as \( a(t) = \sin(\omega t) \) which is non-linear and not easy to generate except through constructing it from pieces. However, the angular information is linear because the phase angle rotates through a fixed angle for each unit of time. Thus, the angular rate depends on the frequency of the signal described as \( \omega = 2\pi f \) where \( \omega \) is the angular frequency. As shown in Figure 2, the phase increases linearly from 0 to \( 2\pi \) over one complete cycle of the sine wave.

![Figure 2: Sine magnitude and phase representation.](image)

Knowing that the phase of a sine wave is linear and that it depends on a reference clock period, with clock frequency \( f_{\text{clk}} \), the phase rotation (\( \Delta \phi \)) for that period can be determined by

\[
\Delta \phi = \omega \Delta t
\]

Where, \( \Delta \phi = \) change in phase of sine wave, \( \omega = \) angular frequency of wave, \( \Delta t = \) small change in time. Solving for \( \omega \) in Equation 1, gives

\[
\omega = \frac{\Delta \phi}{\Delta t} = \frac{2\pi f_{\text{clk}}}{\Delta \phi}
\]

The overflowing accumulator (phase accumulator, PA) clocked with \( f_{\text{clk}} \) generates the phase value sequence, where, \( \Delta t \) is the minimum amount of change,

\[
f_{\text{out}} = \frac{1}{\Delta t}
\]

Solving for from Equation 2 and substituting the reference clock frequency for the reference period in Equation 4, specifies the frequency of the output signal:

\[
f_{\text{out}} = \frac{f_{\text{clk}}}{\Delta \phi}
\]

Finally, for an n-bit accumulator the output signal will have the frequency specified

\[
f_{\text{out}} = \frac{f_{\text{clk}}}{2^n}
\]

Where \( \Delta \phi \), (in degree) is the phase increment word or frequency control word or frequency tuning word and \( f_{\text{clk}} \) is the clock frequency, \( n \) is the length of accumulator. This phase value is generated using the modulo overflowing property of an n-bit PA. The rate of the overflow is the output frequency given by Equation 5

\[
f_{\text{out}} = \frac{f_{\text{clk}}}{2^n}
\]

\( \Delta \phi \), is an integer, therefore the frequency resolution is found by setting \( \Delta \phi =1 \),

\[
f_{\text{out}} = \frac{f_{\text{clk}}}{2^n}
\]

A DDFS works on a point (memory location)-skipping technique (and a constant interpolation of the stored signal) and runs at constant update (clock)-rate or reference clock. As the DDFS output frequency is increased, the number of samples per waveform cycle decreases.
IV. SIMULATION RESULTS

As we know the basic equation for the DDFS output is given by:

$$f_{out} = \frac{M \cdot f_{in}}{2^n}$$

(8)

Now we will simulate the results for the different values of $M$ for the equation (8).

(a) Simulation of DDFS with $M=1$;

The first plot obtained from the MATLAB codes, shown in Figure 3, represents a scan through the “L-bit” wide memory of the LUT which contains $2^L$ numbers of data points. Each address contains a preset amplitude of the sine wave. The second plot in Figure 4 shows the phase accumulation, done by adding the frequency tuning word “$M$” to the previously accumulated phase at every clock tic. The figure 5 shows output value of DAC.

(b) Simulation of DDFS with $M=2$

We know that we have simulated the result of DDFS with $M=1$ as in figure 3, 4 and 5 shows. Here we keep the values of $L$ and $n$ same and only change the values of $M$ to get the different frequencies according to different values of M so the parameters are $L=8$, $n=8$ and $M=2$. The output of the sine amplitude LUT is same as of figure 3 and the output of phase accumulator as well as the DAC is shown in figure 6 and 7.

![Figure 3: sine wave amplitude LUT with 2^L points.](image)

![Figure 4: digital phase output of 8-bit accumulator](image)

![Figure 5: DDFS output with M=1](image)

![Figure 6: digital phase output of 8-bit accumulator and M=2](image)

![Figure 7: DDFS output with M=2](image)
V. CONCLUSION

In this paper we present the method of sine wave generation or sine frequency according to the value of phase tuning word. The DDFS is the digital method to generate the arbitrary wave form or the frequency. We can generate the any kind of frequency waveform not only sine wave frequency.

DDFS is the new technique which is digitally controlled and gives the better results as compared to analog techniques. The advantage of DDFS is already explained above such as fine frequency resolution, fast switching between output frequencies and etc.

VI. REFERENCES


Enhanced Security Techniques for Wireless Networks

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Abstract- The increasing popularity and usage of wireless technology is creating a need for more secure wireless networks. Wireless networks are particularly vulnerable to powerful security attacks. In this paper, we proposed a two-layered security algorithm, which enciphers the data, obtained from the RC-5 (RC-5 is a block cipher and RC-4 is a stream cipher), and this cipher is again given to the DES (Data Encryption Standards) for encryption. This doubly encrypted data is transmitted, and in the receiving side inverse operation is performed to obtain the data. Regarding security, the two-layered security algorithm takes two 64-bit keys one for RC-5 and the other for DES, and it provides a very good security for the data.

Keywords- DES and RC-5.

I. INTRODUCTION

In recent years, there emerged a lot of applications based on internet such as on-line shopping, stock trading, web based banking and electronic bill payment. Such confidential transactions over wire or wireless public networks demand end-to-end secure connections to ensure data authentication, privacy and integrity. Encryption algorithm plays an important role for information security guarantee. Encryption is the process of transforming plaintext data into cipher text in order to conceal its meaning and so preventing any unauthorized recipient from retrieving the original data. The main task of encryption is to ensure secrecy. Companies usually encrypt their data before transmission to ensure that the data is secure during transit. The encrypted data is sent over the public network and is decrypted by the intended recipient. The encryption algorithms are usually summarized into two popular types: - Symmetric key encryption and Asymmetric key encryption.

In Symmetric key encryption, only one key is used to encrypt and decrypt data. The key should be distributed before transmission between entities. Therefore key plays an important role in Symmetric key encryption. Strength of Symmetric key encryption depends on the size of key used.

For the same algorithm, encryption using longer key is harder to break than the one done using shorter key.

.......... This paper suggests that the combination of DES and RC5 algorithms can provide adequate prevention of security attacks in wireless networks. The analysis of this paper may present valuable insight for new approaches in handling security attacks in the field of wireless security.

II. ENCRYPTION/DECryption ALGORITHMS

A. DES Algorithm:-

DES was the first encryption standard to be recommended by NIST (National Institute of Standards and Technology). It was developed by an IBM team around 1974 and adopted as a national standard in 1997. The flow of DES algorithm is shown in Fig.1. DES is a 64-bit block cipher under 56-bit key. The algorithm processes with an initial permutation, sixteen rounds block cipher and a DES is a 64-bit block cipher under 56-bit key. The algorithm processes with an initial permutation, sixteen rounds block cipher and a final permutation. DES application is very popular in commercial, military, and other domains in the last decades. There are variants like 3DES [8], AES [9] by enhancing DES function.
B. **RC5 Algorithm:**

RC5 is a parameterized symmetric encryption algorithm. RC stands for "Rivest Cipher", or alternatively, "Ron's Code". RC5 parameters are; a variable block size, a variable key size and a variable number of rounds. Allowable choices for the block size are 32, 64 and 128 bits. The number of rounds can range from 0 to 255, while the key size can range from 0 bits to 2040 bits in size. RC5 has three modules: key expansion encryption and decryption. It is the latest in a family of secret key cryptographic methods; RC5 is more secure than RC4 but is slower. Generally, implementing ciphers in software is not efficient based on its speed in terms of computation and hence the use of hardware devices is an alternative. The RC5 algorithm uses three primitive operations and their inverses. Addition/subtraction of words modulo 2W. Rotation: the rotation of word x left by y bits is denoted x<<<y. The inverse operation is the rotation of word x right by y bits, denoted by x>>>y. In the key expansion module, the password key K is expanded to a much larger size in a key table S. The size of table S is 2(r+1), where r is the number of rounds.

The RC-5 algorithm, which consists of three components, a key expansion algorithm. An encryption algorithm, and a decryption Algorithm.

**RC5 Encryption:**

The input block is given in two w-bit registers A and B. We also assume that key expansion has already been performed so that the array S[0,...,t-1] has been computed. The encryption algorithm in pseudo-code:

\[
\begin{align*}
A &= A + S[0] \\
B &= B + S[1] \\
\text{For } i = 1 \text{ to } r \text{ do} \\
A &= ((A + B)<<<B) + [2*i] \\
B &= ((B + A)<<<A) + [2*i+1]
\end{align*}
\]

The output is in the registers A and B. We note the exceptional simplicity of this 5 line algorithm. We also note that each RC-5 round updates both registers A and B, whereas a “round” in DES updates only half of its registers. An RC-5 “half-round” (one of the assignment statements updating A or B in the body of the loop above) is thus perhaps more analogous to a DES round.

**RC5 Decryption:**

The decryption routine is easily derived from the encryption routine.

\[
\begin{align*}
\text{for } i = r \text{ down to } 1 \text{ do} \\
B &= (B - S[2*i+1]>>a) + A \\
A &= (A - S[2*i]>>b) + B \\
B &= B - S[1]
\end{align*}
\]

### III. PERFORMANCE ANALYSIS

Every security system must provide a bundle of security functions that assure the secrecy of the system. These functions are usually referred to as the goals of the security. These goals can be listed as following.

**Authentication:** Before sending and receiving the data, the sender and receiver identity must be verified.

**Secrecy or Confidentiality:** Usually these function is how most people identify a secure system. It mean only the authenticated people are able to interpret the message content and no one else.

**Integrity:** Integrity means that the content of communicated data is assured to be free from any type of modification between the end points (Sender and Receiver). The basic form of integrity is packet checksum in IPv4 packets.

**Service Reliability and Availability:** Since secure system usually get attacked by intruders, which may affect their availability and type of service of their users. Such system to provide a grant their users the quality of service they expect.
IV. RESULTS

Numerical results of DES Stream Cipher
Given input: b9195c5e35e11898
Key: 0123456789abcdef
Cipher output: 133457799bbcdff1
Decoding output: b9195c5e35e11898

Block Cipher
Given input: 0-9
Cipher output:
Block 0= BF60C844 0F3CPD15
Block 1= FEF876BA ADB30AA
Block 2= 99C15132 5K352735
Block 3= 33854E62 C76234D
Block 4= 5ABDE135 62559B4C
Decoding output:
Block 0= 00000000 00000001
Block 1= 00000002 00000003
Block 2= 00000004 00000005
Block 3= 00000006 00000007
Block 4= 00000008 00000009

Numerical results of RC-5
Given input: 01234567
Key: “ABCDE”
Encryptions:
Block 0= caa24ebd 5a310fbc
Block 1= dc0f6852 a3cbf488
Block 2= 3d6c4480 e90defcb
Block 3= 65c36991 32473c5f

Decryptions:
Block 0= 00000000 00000001
Block 1= 00000002 00000003
Block 2= 00000004 00000005
Block 3= 00000006 00000007

Numerical results of two-layer security algorithm
Given input to RC-5: 01234567
Key: “ABCDE”
RC-5 Encryption
Block 0= caa24ebd 5a310fbc
Block 1= dc0f6852 a3cbf488
Block 2= 3d6c4480 e90defcb
Block 3= 65c36991 32473c5f
RC-5 Encrypted data (cipher-1), given as input to DES
Key: 0123456789abcdef
DES output cipher-2:
Block 0= 60E3688 1E5392FB

V. CONCLUSIONS

In this thesis work, we have proposed a two-layered security algorithm (the combination of DES and RC-5 algorithms), which provides adequate prevention of security attacks in a wireless network. Analysis of this thesis may present valuable insight for new approaches in handling security problems in the field of wireless security. The security is completely dependent on key length of the algorithm used. When compared to the algorithms, which takes input key as 128-bit key, the proposed algorithm is more secure. In the case of 128-bit key algorithms, it is comparatively easier to hack the algorithm, if the type of the algorithm is known. Thus the proposed algorithm has double the security, as it takes two 64-bit keys, and cipher text produced is the result of two different algorithms.

This simulation of Data Encryption Standards and RC-5 was performed and the simulation results are presented. The simulation for two-layered security algorithm is run and desired result is obtained.

The proposed scheme, two–layered encryption algorithm can be extended to different types of security algorithms. The schemes can also be extended to higher levels, to provide more security. But the number of levels to be extended depends on many factors like execution time, complexity of algorithm etc. we suggest to examine the consequences by increasing the number of levels.

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Abstract- A description of an 8-bit Microprocessor based on the RISC design concept is presented in this report. The objective is to design a general-purpose RISC Microprocessor implemented on an FPGA. The Instruction Set is simple and has broad enough range to serve the Programmer’s purpose. In order to minimize the Pin Count, a Multiplexed Address and Data bus is used. The other components of the Microprocessor include the Arithmetic Logic Unit, Shifter, Rotator and Control unit. The Verilog code for all the above components is written in a hierarchical fashion starting with the smallest units and progressively, building upon them to develop the entire structure. Simulation of the entire FPGA is done to verify the functionality following which, synthesis and design implementation is carried out.

I. INTRODUCTION

Microprocessors and Microcontrollers have traditionally been designed around two Philosophies: Complex Instruction Set Computer (CISC) and Reduced Instruction Set Computer (RISC).

The CISC concept is an approach to the Instruction Set Architecture (ISA) design that emphasizes doing more with each Instruction using a wide variety of Addressing modes, variable number of operands in various locations in its Instruction Set. As a result, the Instructions are of widely varying lengths and execution times thus demanding a very complex Control Unit, which occupies a large real estate on chip.

On the other hand, the RISC Processor works on reduced number of Instructions, fixed instruction length, more general-purpose registers, load-store architecture and simplified Addressing modes which makes individual instructions execute faster, achieve a net gain in performance and an overall simpler design with less silicon consumption as compared to CISC. This gives the RISC Architecture more room to add on-chip peripherals, interrupt controllers, participate in a powerful trend in the embedded Processor market – the “system-on-a-chip”.

Our main objective is to design an 8-Bit Microprocessor. The Instruction cycle consists of three stages namely fetches, decode and execute. After every instruction fetch, Control Unit generate signals for the selected Instruction. Our architecture supports 16 instructions, which are described in the Table. They can be broadly classified into Arithmetic, Logical, Shifting and Rotational Instructions.

II. SYSTEM ARCHITECTURE

The Microprocessor has two eight-bit input signals A7 - A0 and B7 - B0 taken and Controlled from trainer switches and loaded into registers A and B respectively. Memory. Interface Signal is a signal READ (RD). This signal indicates that the selected memory location is to be read and data is to be put on the data bus.

A. Modules

Figure shows the block diagram of the Microprocessor, which consists of various Modules interconnected by an 8-bit internal data bus. Each of these modules along with its sub components is described in this section.

I. Register file

Arithmetic and Logical instructions require three source registers and one destination register. Of the three source registers, two are used as input registers and the other is used as an instruction register. A total of 4 bits would be required for any ALU instruction.

The actual implementation of any instruction is done with the instruction register and two 3:8 decoders. Figure shows the gate-level design of the general register. The Control Signals S [3:0] gate one of the two 3:8 decoders that decode the field to 1 of the 8 select lines. These decoder outputs can be used to drive the required output.

II. Arithmetic logic unit

Figure shows in detail the ALU, the 8-bit inputs A, B and the output Z. The ALU takes two operands from the A and B registers.
The ALU has the capability to perform 9 operations as shown in the figure. After every ALU instruction, the output register is updated. The various units inside the ALU are described below:

**Adder/Subtractor:** The 8-bit adder/subtractor in the ALU is a Reduced Full Adder built by using universal gates. A ripple carry adder is used in which the carry signal propagates from the LSB to the MSB and coming out as Cout.

**Logical Unit:** We provide all the possible logical operations (nand, nor, exor, not, and, or, xnor) in the ALU.

### III. CONTROL UNIT

The Control Unit is the heart of the Microprocessor. It accepts as input, those signals that are needed to operate the Controller, and provides as output all the control signals necessary to effect that operation. Figure shows a block level view of the Control Unit, with its input and output signals. The outputs of the Control Unit are the control signals that generate the control sequences for the operational codes of the machine.

### IV. DESIGN OF THE ROM:

The CPU has a built in ROM which enables us to program simple code and execute it. The List of signals in the ROM is:

I. Address: address sent by the control unit.
II. Data out: the data that is contained the given address.
III. Read: the signal to enable reading from the ROM
IV. Ready: the signal to indicate when the ROM is ready for reading.
V. Clk: the main clock signal. 6. Reset: the initial reset signal.

### V. SOFTWARE IMPLEMENTATIONS

Verilog HDL has evolved as a standard hardware description language. A hardware descriptive language is a language used to describe a digital system. It means that by using HDL one can describe any hardware at any level. Verilog HDL is one of the two most common Hardware Description Languages (HDL) used by integrated circuit (IC) designers. HDL’s allows the design to be simulated earlier in the design cycle in order to correct errors or experiment with different architectures. Designs described in HDL are technology-independent, easy to design and debug, and are usually more readable than schematics, particularly for large circuits. More recently Verilog is used as an input for synthesis programs which will generate a gate-level description for the circuit. Some Verilog constructs are not synthesizable. Also the way the code is written will greatly affect the size and speed of the synthesized circuit. Most readers will want to synthesize their circuits, so I wrote a test bench for getting different output taking out at different input and different interval.

The simulator which is used for the language is Xilinx ISE and Modelsim. I write down the testbench for my project and then I run it into the simulator.

A Field-programmable Gate Array (FPGA) is an integrated circuit designed to be configured by the customer or designer after manufacturing—hence "field-programmable". The FPGA configuration is generally specified using a hardware description language (HDL), similar to that used for an application-specific integrated circuit (ASIC) (circuit diagrams were previously used to specify the configuration, as they were for ASICs, but this is increasingly rare). FPGAs can be used to implement any logical function that an ASIC could perform. The ability to update the functionality after shipping, partial re-configuration of the portion of the design[1] and the low non-recurring engineering costs relative to an ASIC design (notwithstanding the generally higher unit cost), offer advantages for many applications.

SRAM based FPGAs have a short design cycle, steadily decreasing cost, and growing performance, power consumption remains a concern. The trend from one FPGA device family to another is that the number of Configurable Logic Blocks (CLBs) and maximum operating frequency scale exponentially, while corresponding decreases in operating voltage have been much slower to arrive, resulting in an exponentially increasing maximum power consumption.that determines how efficiently a user’s design is implemented on an FPGA.
There have been many FPGA power reduction approaches addressing different design levels. Several techniques for low power FPGA design have appeared in literature addressing the VLSI design of an FPGA. Research has also considered various synthesis-level power optimizations, such as technology mapping to LUT-based FPGAs techniques.

Fig. 3 Spartan 3E FPGA Kit V. FUTURE DEVELOPMENT

Now my focus is on the implementation of the verilog code. Using FPGAs simulated, synthesized and implemented using Xilinx FPGA.

I. • Include timer and counter
II. • Make hardware

VI. SIMULATION RESULT

Fig2.Simulation result

VII. CONCLUSION

8 bit RISC Processor has been design and will implemented in hardware on Xilinx Spartan 3E.

The design has been achieved using Verilog HDL and simulated with Modelsim. Digilent Spartan 3E development board has been used for the hardware part. Most of the goal is achieved and simulation shows that the processor is working perfectly. Future work will be added by increasing the number of instructions and make a pipelined design with less clock cycles per instructions and more improvement will be added in future work.

VIII. REFERENCES

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Wormhole Attack Discovery Techniques: A Review

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Abstract— Security has been an area of concern in the wireless network like Mobile Ad hoc NETwork (MANET) as compared to the wired ones. A Mobile Ad hoc NETwork (MANET) is a system of wireless mobile nodes that self-organize themselves in the changing network topologies. A specific type of attack, the Wormhole attack does not require exploiting any nodes in the network and can interfere with the route establishment process. In this paper we have discussed the various detection and prevention techniques of Wormhole attack in MANETs.

Keywords— MANET; Malicious nodes; Security; Wormhole attack.

I. INTRODUCTION

A Mobile Ad hoc NETwork (MANET) is a system of wireless mobile nodes that dynamically self-organize themselves in arbitrary & temporary network topologies. In mobile ad hoc network nodes can directly communicate with all other nodes within their radio ranges; whereas nodes that are not in the direct communication range use intermediate node(s) to communicate with each other [5]. The main characteristics of these networks are summarized as [6]:

- Nodes can perform the roles of both hosts and routers.
- No centralized controller and infrastructure.
- Intrinsic mutual trust.
- Dynamic network topology.

Major Vulnerabilities of the Mobile Ad Hoc Networks [5][2]:
- Lack of Secure Boundaries.
- Threats from Compromised nodes inside the Network.
- Lack of Centralized Management Facility.
- Restricted Power Supply.

II. WORMHOLE ATTACK IN MANET

A wormhole attack is a particularly severe attack on MANET routing where two attackers, connected by a high-speed off-channel link, are strategically placed at different ends of a network, as shown in Figure 2.1. These attackers then record the wireless data they overhear, forward it to each other, and replay the packets at the other end of the network. Replaying valid network messages at improper places, wormhole attackers can make far apart nodes believe they are immediate neighbours, and force all communications between affected nodes to go through them.

The intruders A and B are connected by an off-channel link (i.e. wired or satellite link), which they use to tunnel network data from one end of the network to the other. Without a wormhole, nodes 7 and 3 are 4 hops apart, - their messages to each other should go through nodes 2, 6, and 5. When intruders A and B activate a wormhole, nodes 7 and 3 are able to directly overhear each others’ messages, and are lead to believe they are immediate neighbours. Once this happens, all further communications between nodes 3 and 7 will be going through the wormhole link introduced by A and B [3][4].

Open Wormhole attack: In this type of wormhole (Fig. 2.2), the attackers include themselves in the route discovery.
procedure. Other nodes are aware that the malicious nodes lie on the path but they would think that the malicious nodes are direct neighbours.

In this mode a malicious node at one part of the network and hears the RREQ (route request) packet. It tunnels it to a second colluding party at a distant location near the destination For example, consider Fig. 2.4 in which nodes A and B try to discover the shortest path between them, in the presence of the two malicious nodes X and Y. Node A broadcasts a RREQ, X gets the RREQ and encapsulates it in a packet destined to Y through the path that exists between X and Y (U-V-W-Z).

Closed Wormhole Attack: In this (Fig.2.3) the attackers do not modify the content of the packet, even the packet in a route discovery packet. Instead, they simply tunnel the packet form one side of wormhole to another side and it rebroadcasts the packet.

Half open wormhole attack: In this (Fig.2.4) one side of wormhole does not modify the packet and only another side modifies the packet, following the route discovery procedure.[2] [7]

Wormhole attack modes:

Wormhole using Encapsulation:

Wormhole using Out-of-Band Channel:

Out of band channel can be achieved, for example, by using a long range directional wireless link or a direct wired link. This mode of attack is more difficult to launch than the previous one since it needs specialized hardware capability. Consider Fig. 2.5 Node A sends a RREQ to node B, and nodes X and Y are malicious nodes having an out-of-band channel between them. Node X tunnels the RREQ to Y, which is a legitimate neighbor of B. Node Y broadcasts the packet to its neighbors, including B. B gets two RREQs—A-X-Y-B and A-C-D-E-F-B. The first is both shorter and faster than the second, thus chosen by B.

Wormhole with High Power Transmission:

In this mode, when a single malicious node gets a RREQ, it broadcasts the request at a high power level, a capability which is not available to other nodes in the network. Any
node that hears the high-power broadcast rebroadcasts it towards the destination. By this method, the malicious node increases its chance to be in the routes established between the source and the destination even without the participation of a colluding node.

Wormhole using Packet Relay:

In wormhole using Packet Relay a malicious node relays packets between two distant nodes to convince them that they are neighbours. e.g. without stating its address as the source in the packets header so that X is virtually invisible. This results in an extraneous inessential A - B link which in fact is controlled by X, as shown in Fig.2.6 Node X can afterwards drop tunnelled packets or break this link at will. [7]

III. DETECTION AND PREVENTION OF WORMHOLE ATTACKS

Detection and prevention of wormhole has been a major area of research from the past few years. The main task is to find out the presence of wormhole in the network.

Most ad hoc network communication uses the Slot Authenticated MAC protocol to secure communication. Message authentication codes are a standard approach for authentication: the sender S and receiver R must share a secret key K, which they use in conjunction with a message authentication code function (for example HMAC) to authenticate messages they exchange. To send a message M to R, S sends:

\[ S \rightarrow R: <M, \text{HMAC}_K(M)> \]

Where the notation \( \text{HMAC}_K \) represents the HMAC message authentication code computed over message M with key K.

A. Some Wormhole Detection or Prevention Techniques

Several solutions have been proposed in the literature for the wormhole attack, the solutions can be categorized into location based, time based, key based, statistics, and graph based solutions etc. This section gives a brief overview of these solutions:

Packet Leashes:

Packet Leash is a mechanism to detect and defend against wormhole attacks. The mechanism proposes two types of leashes for this purpose: Geographic and Temporal. When temporal leashes are used, the sending node append the time of transmission to each sent packet \( t_s \) in a packet leash, and the receiving node uses its own packet reception time \( t_r \) for verification. The sending node calculates an expiration time \( t_e \) after which a packet should not be accepted, and puts that information in the leash. To prevent a packet from travelling farther than distance \( L \), the expiration time is set to:

\[ t_e = t_s + \frac{(L/c) - d}{2} \]

Where \( c \) is the speed of light and \( d \) is the maximum clock synchronization error.[2] [1]

Time-of-flight:

One possible way to prevent wormholes is to measure round-trip travel time (RTT) of a message and its acknowledgement, estimate the distances between the nodes based on this travel time, and determine whether the calculated distance is within the maximum possible communication range. The RTT \( \delta \) of a message in a wireless medium can, theoretically, be related to the distance \( d \) between nodes, assuming that the wireless signal travels with a speed of light \( c \):

\[ d = \delta \frac{c}{2} \]
\[ \delta = 2d/c \]

The neighbour status of nodes is verified if \( d \) is within the radio transmission range \( R \):

\[ R > d \text{ (within transmission range)} \]
\[ R > \delta \frac{c}{2} \]
\[ \delta < 2R/c \]

RTT eliminates use of tight clock synchronization; a node only uses its own clock to measure time. [2] [1]
Statistics based solution:

In statistical based solution the main idea is based on the observation that certain statistics of the discovered routes by routing protocols will change dramatically under wormhole attacks. Hence, it is possible to examine such statistics to detect this type of routing attacks.

**Fig. 3.1 Statistics based solution of wormhole**

Hop-count analysis:

Common problems/flaws in current proposals is that those require additional hardware or have high cost or require large MANETs with many nodes and routes.

Neighbour node monitoring:

Neighbor Node Monitoring is used to detect neighbors that are not within the maximum transmission range but pretend to be neighbors. In order to reduce network overheads by additional packets, this mechanism is achieved during the route discovery process. Originally, the intermediate node which has a route to destination can send a RREP to source.

**Fig3.2 Neighbour monitoring**

Watchdog:

Watchdog determines misbehaviour by copying packets to be forwarded into a buffer and monitoring the behaviour of the adjacent node to these packets. Watchdog snoops to decide if the adjacent node forwards the packets without modifications or not. If the packets that are snooped match with the observing node’s buffer, then they are discarded; whereas packets that stay in the buffer beyond a timeout period without any successful match are flagged as having been dropped or modified.

Pathrater:

Pathrater on an individual node works to rate all of the known nodes in a particular network with respect to their reliabilities. Ratings are made, and updated, from a particular node’s perspective. Nodes start with a neutral rating that is modified over time based on observed reliable or unreliable behaviour during packet routing.

Wormhole discovery from wormhole’s effect:

This approach is geared towards discovery and prevention of only one kind of wormhole behaviour: packet loss. It relies on authenticated acknowledgments of data packets to rate links: if a link is dropping packets, the acknowledgements do not get through; link is rated low and avoided in the future. [9]

Nodes with directional antennas:

When directional antennas are used, nodes use specific ‘sectors’ of their antennas to communicate with each other. Therefore, a node receiving a message from its neighbor has some information about the location of that neighbor, it knows the relative orientation of the neighbor with respect to itself. This extra bit of information makes wormhole discovery much easier than in networks with exclusively omni-directional antennas. [1]

**Table 1. Summary of different solutions of wormhole attack**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>REQUIREMENT</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packet leashes, Geographical</td>
<td>GPS coordinates of every node; Loosely synchronized clocks (ms)</td>
<td>Robust, straightforward solution; inherits general limitations of GPS technology</td>
</tr>
<tr>
<td>Packet leashes, Temporal</td>
<td>Tightly synchronized clocks (ns)</td>
<td>Impractical; required time synchronization level not currently achievable in sensor networks</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Time of flight</td>
<td>Hardware enabling one-bit message and immediate replies without CPU Involvement</td>
<td>Impractical; likely to require MAC-layer modifications</td>
</tr>
<tr>
<td>Directional Antennas</td>
<td>Directional antennas on all nodes or several nodes with both GPS and directional antennas</td>
<td>Good solutions for networks relying on directional antennas, but not directly applicable to other networks</td>
</tr>
<tr>
<td>Statistical Analysis</td>
<td>no requirements</td>
<td>Works only with multi-path on demand protocols</td>
</tr>
<tr>
<td>Neighbor monitoring</td>
<td>A timer</td>
<td>Not only detects the fake route but also adopts preventive measures against action wormhole nodes from reappearing during the route discovery phase</td>
</tr>
<tr>
<td>hop count analysis</td>
<td>no requirements</td>
<td>causes a high load on the network since routing messages must be flooded over the network several times during one single route discovery process</td>
</tr>
</tbody>
</table>

V. REFERENCES


IV. CONCLUSIONS

In this paper, we address the various solutions available for the wormhole attack in Mobile Ad hoc NETworks. The study focus on how wormhole attack can be detected and prevented in a network. The study here establishes the foundation for future work towards designing a mechanism for identifying the nodes and links that are actively involved in the wormhole attack.
Design and Implementation of an Interleaving Switch-Based Crossbar Architecture

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Abstract- In system on-chip (SoC) communication mechanisms employed are an important contribution to their overall performance. Now a day in many areas of real-time applications of SoCs realizing on FPGA due to its flexibility and simplification in designing tool. Although offering the module-increasing flexibility, its bandwidth and scalability still become problem. As a remedy to these problems, switch-based conceptual model and framework has been introduced to improve the flexibility, bandwidth and scalability.

I. INTRODUCTION

Today field programmable gate-arrays (FPGAs) are used for a wide sector of applications. The usage in former times was focused on rapid-prototyping system for integrating test systems. After the testphase, often an ASIC approach substituted these systems for mass-production. Due to dramatic growth in circuit-design complexity regarding Moor’s Law, the ability of implementing complex architecture in a single chip always presents new challenges. One of the issues found by designers while implementing large SoCs is the communication among their components. Buses are an increasingly inefficient way to communicate, since only one source can drive the bus at a time, thus limiting bandwidth. NoCs are increasing in popularity because of their advantages: larger bandwidth, and lower power dissipation through shorter wire segments. Communications in large SoCs are so important that many designers have adopted the NoC approach. The challenges consist in offering the best connectivity and throughput with the simplest and cheapest architecture of methodology; whereas, many topologies and architectures have been investigated. This is well illustrated in [4], where researchers propose a two-level FIFO approach in order to simplify the design of the arbitration algorithm and improve the bandwidth. However, this method tends to be expensive in term of hardware. Although the completely embedded tools of FPGA manufactures such as Xilinx and Altera are offered to help their customers to design the complex Multi Processor System on-Chip (MPSoCs), their environments only offer the bus based paradigm or point-to-point connection. More complex MPSoCs may require higher bandwidths than a bus-based system can offer, or may need to be more efficient than point to-point connections.

II. COMMUNICATION PROBLEM

In Fig. 1, all communication in a process group becomes many communications involving an arbitrary subset of processor from the system’s point of view. In order to efficiently support data communication, a system has to support one-to-one (unicast), one-to-many (multicast), many to-one (gathering) and many-to-many communication primitives in hardware. Actually, most interconnection can support unicast, but not gathering and multicasting. In Fig. 2(a) shows a multicast communication with three destinations where process P0 has to send the same data to three processors: P1, P2 and P3. Without the multicast functionality on interconnection, the system can use unicast functionality to send data to all destinations sequentially. However, blocking will occur, if P0 is executing sending state to P1, and P1 has not yet execute receiving state, P0 is blocked; meanwhile, P2 is executing receiving state, and is blocked because P0 has not yet executed sending state.
Obviously, system resources are wasted due to unnecessary blocking.

III. SWITCH-BASED CROSSBAR STRUCTURE

The major components that make up the switch-based crossbar consist of Input Port module, Switch module and Output Port module. Depending on the kind of channels and switches, there are two alternatives for designing switch-based crossbar: unidirectional and bidirectional [6]. In this paper, unidirectional switch-based crossbar is selected and simplified with 6x6 switch-based crossbar structure shown in Fig. 1 Constraint because of resource.

Fig. 2 shows the 10-bit Last Significant Bit (LSB) of switching protocol, which defines the number of packets required transferring from a Source Node to a Destination Node, where the maximum is 1,024 packets per time, and the rest define the Destination Node. For example, when the Source Node1 wants to transfer 100 packets to the Destination Node number 3 and 4, the 16-bit switching protocol has to be 0011_0000_0110_0100 (0x3064H).

Obviously, transmitting data from a Source Node to a Destination Node require crossing the link between the Source Node and the Input Port module, and the link between the Output Port module and the Destination Node where the Switch module in data path will dynamically establish the link for the Output Port module according to switching protocol. According to the 6x6 switch-based crossbar architecture, its switching protocol shows in Fig. 2.
IV. IMPLEMENTATION
The problems in section 2 and the primitive modules of the switch-based crossbar architecture in section 3 are implemented and realized on the target FPGA in this section. All primitive modules are structured by VHDL, verified their behaviors with Model Sim 6.2c, synthesized their resource usages and estimated frequency on the Xilinx FPGA Virtex 2P XC2VP30 by ISE tool as shown in Table 1. To realize the target FPGA, 6x6 interleaving switch-based crossbar is introduced. Arranging the primitive modules to conform to Fig. 1, the switch-based crossbar shows the total resource and estimated frequency in Table 2.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Flip Flops</th>
<th>LUTs</th>
<th>Estimation Freq (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output module</td>
<td>117[0.4%]</td>
<td>615[2.25%]</td>
<td>209.54</td>
</tr>
<tr>
<td>Input module</td>
<td>37[1.28%]</td>
<td>427[1.5%]</td>
<td>474.50</td>
</tr>
<tr>
<td>Switch module</td>
<td>-</td>
<td>76[0.27%]</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1 FPGA occupation

V. TEST ENVIRONMENT AND EXPERIMENTAL RESULT
The 6x6 interleaving switch-based crossbar designed and implemented in section 4 is evaluated on test environment as shown in Fig. 9. The Source Nodes and the Destination Nodes connecting with our crossbar can reconfigurable where several IP cores can take place. Before testing, 16-bit counter modules are placed on all Source Nodes, and the available FPGA I/O pins are mapped to all Destination Nodes.

Fig. 10 and 11 show the captured data while one Source Node and six Source Nodes are transferring the 256 packets to the same Destination Nodes with interleaving functionality on our crossbar.

Table 3 shows the measured time period and the calculated bandwidth per Destination Node where a number of the Source Nodes have varied from 1 up 6. The bandwidth results come out from this formula: \( BW = N \times \text{Packet} + \text{bit} + N \times \text{Input data} / \text{Time Period} \) where BW is bandwidth, N of Packet is the number of packets, bit is data width, N of Input data is the number of input data, and Time period is...
the time period of data out signal measured at the Destination Node.

VI. CONCLUSION

This paper proposes and implements the interleaving mechanism to overcome the output delay (latency) while operating many-to-one and one-to-many data communication. The proposed crossbar has achieved the bandwidth from 335.42 up 741.31 Mbit/sec measured when 256 packets (16 bit per packet) are fed at 100 MHz based on the test environment. The resource usages realized on the Xilinx FPGA Virtex 2Pro XC2VP30 are 3.33 % and 16.05 % for slice Flip-flop and LUTs respectively, and estimated frequency respond is 113.854 MHz. Moreover, resource usage and bandwidth are acceptable when it is compared with the general propose switch-based system and bus-based system.

VII. REFERENCES


Sliding Wear Performance of Thermally Sprayed Coating of Al2O3-TiO2 and WC-CO-CR on EN-31

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Abstract: Wear of the surface is the major problem of all materials. This wear can be reduced by doing some coating on the surface of material. On En-31 material, thermal spray coating is carried using Detonation spray gun and two different coating powders are used and these are mixture of oxides (Al2o3-Ti02) and carbides (Wc-Co-Cr). The thermal-sprayed coatings were characterized by SEM analyses. Wear tests are carried on both coated and uncoated material on a pin-on-disc wear test rig and results are evaluated that Wc-Co-Cr coatings are having less wear as compared to Al2O3-TiO2.

Keywords: Thermal Sprayed Coatings; Sliding Wear; Sem; En-31

I. INTRODUCTION

Wear of materials results in a very high economic loss to every country. Wear-related problems can be minimized mostly either by using high-cost wear resistant Alloys/metals that are better than the existing low-cost alloys, or by improving the wear resistance of the existing metals and alloys by surface modification. As wear is a surface phenomenon and occurs mostly at outer surfaces, it is more appropriate and economical to use the latter method than the former. In many machine parts, which have sliding or rolling contacts, low friction and high wear resistance are demanded to increase efficiency, service life and to decrease running costs. Generally speaking, a material that has low friction usually has low wear resistance. On the other hand material that has high wear resistance has high friction co-efficient.

WC–Co–Cr thermally sprayed coatings have proven to be interesting wear resistant coating materials than Al2O3-TiO2 coatings since the hard WC grains provides generally good bonding to the metallic matrix, e.g. Co–Cr. The WC particles in the coating lead to high coating hardness and high abrasive wear resistance, while the metal binder Co–Cr supplies the necessary coating toughness.

The thermal spraying technique has also grown into a well-accepted industrial technology. Due to the continuously rising cost of materials as well as increased material requirements, the thermal spraying has gained more and more importance during the past two or three decades. Developments in thermal spraying techniques as well as advances in powder and wire production have resulted in surface coatings with excellent properties under service conditions, enlarging its field of application.

II. EXPERIMENT PROCEDURE

The test samples were made of En-31 steel. The samples are rectangular shapes of size 20mm×15mm×5mm. On these samples Al2o3-Ti02 and Wc-Co-Cr coatings were deposited on En-31 substrate by Detonation spray gun. Shot blasting is done prior to coating on substrate material so as to prepare surface for coating. The counter surface used in this experimental testing was in the form of flat-ended pin with 8mm diameter and 30mm length were made of En-31 material. On these pins Al2o3-Ti02 and Wc-Co-Cr coatings were employee on tip of pins. The coatings were deposited at SVX M Powder coatings Pvt. Ltd., Greater Noida, India. Testing was carried out using a rotating motion rig designed to create a pin-on-plate sliding contact configuration. A small shuttle carriage, containing test plate, was moving due to rotation of an electric motor to which it was. The pin was loaded against the disc through a dead weight loading system. The wear tests for coated as well as uncoated specimens were conducted under the normal loads of 70N. The track dia for the pins were kept at 80mm. The speed of rotation of the disc for all the cases was adjusted to 450rpm. It is constant for all samples so that the linear sliding velocity remains constant. A variation of ±5 rpm was observed in the rotation of the disc.

Wear tests were carried out for a cycle comprised of 5 min, 5min, 10min, 10min, 20min, 40min sliding wear of the single specimen on the pin-on-disc machine. After each cycle, the specimen was removed from the holder, cooled to
room temperature, brushed lightly to remove lose wear debris, weighed, and fixed again in exactly the same position in the holder for the next cycle, so that the orientation of the sliding surface remains unchanged. Weight losses for the specimens were measured with a weight balance having an accuracy up to third decimal place. The pins were examined under SEM to study the morphology and composition of the coatings of the worn-out surfaces.

III. RESULTS

Characteristics of Thermal-sprayed Al₂O₃ + (13%) TiO₂ and Wc-Co-Cr coatings

Thickness: A coating thickness of 200μm was achieved for both the Al₂O₃ + (13%) TiO₂ and Wc-Co-Cr coating materials on the En-31 substrates by the Thermal-sprayed process.

SEM analysis:

SEM micrographs showing the surface morphology of the Thermal spray Al₂O₃ + (13%) TiO₂ and Wc-Co-Cr coated EN-31 are shown in fig.1. The microstructures in all the cases revealed the presence of splats, surrounded by the splat boundaries. This splat morphology is a typical feature of thermal spray coatings. The splats are irregular in shape for Al₂O₃ + (13%) TiO₂ coating. The size of splat is relatively bigger in Al₂O₃ + (13%) TiO₂ coating whereas the microstructure is comparatively uniform in Wc-Co-Cr coating.

SEM analysis of the worn surface:

The SEM micrograph for the worn-out surface of the pins of uncoated En-31 subjected to wear at normal load of 70N with disc rotating at 450rpm, after a track dia. of 80mm has been shown in Fig. 2(a). The figures clearly show the presence of wear tracks on the surfaces. The surfaces have become rougher with unidirectional growth of the structure, probably along the direction of rotation. Further, it looks like the surface has lost the material in the form of microchips, probably due to ploughing of the surface by the wear debris between the contact surface of the pin and the disc. Figures 2(b) and (c) show the surface morphology for the Thermal-sprayed spray Al₂O₃ + (13%) TiO₂ and Wc-Co-Cr coated samples subjected to wear at a normal load of 70N. It can be perceived from the comparison of these micrographs with those of corresponding thermal-sprayed specimens (Fig.1) that the coatings have, by and large, retained their original microstructure even after wear testing. There are only a few signs of deformation of the splat structures for the coated cases. Further, if we compare both the coated pins, the deformation of Al₂O₃+ (13%) TiO₂ will be slightly more as
Sliding Wear Performance of Thermally Sprayed Coating of Al2O3-TiO2 and WC-CO-CR on EN-31 compared to Wc-Co-Cr. This is probably due the presence of carbides which makes Wc-Co-Cr harder than Al2O3+ (13%) TiO2 as in this oxide is there.

![Uncoated](image1)

![Coated with Al2O3+(13%)TiO2](image2)

![coated with Wc-Co-Cr](image3)

Fig. 2 SEM micrographs of the En-31 subjected to wear at a normal load of 70N with disc rotating at 450 rpm along with track dia of 80mm.

### IV. CONCLUSIONS

1. The thermal-spray process provides the possibility of depositing Al2O3 + (13%)TiO2 and Wc-Co-Cr powders on the En-31 with a uniform coating thickness.

2. SEM analysis revealed splat morphology with distinct boundaries for the thermal-sprayed coatings, which is a characteristic feature of thermal sprayed coatings.

3. The wear resistance of the En-31, thermal-spray Al2O3 + (13%) TiO2, and Wc-Co-Cr coatings followed the general trend: Wc-Co-Cr > Al2O3 + (13%) TiO2 > En-31.

4. The uncoated En-31 showed significant presence of wear scars along with peeling of its contact surfaces in the form of microchips, under a normal load of 70N. However, the coatings did not suffer any significant changes in their contact surfaces.

5. The coatings were found to be successful in keeping their surface contact with the substrate En-31 when subjected to wear tests.

### REFERENCES


Comparison of the Factors Affecting the Wind Energy Potential of Tamil Nadu and West Bengal

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Abstract: Firstly we have discussed the economic model for wind energy production, which includes various economic variables which affect the wind energy production of a place. Then various techniques have been discussed for calculating the economic variables of a particular place. The economic model used has one dependent variable and four independent variables. Kilowatt produced each hour (Kw/h) is the dependant variable and wind, temperature, barometric pressure, and direction of wind are the inputs that are going to predict the output, i.e. they are independent variables. Wind speed and temperature throughout the year for Tamil Nadu and West Bengal has been studied and a conclusion is drawn regarding the wind energy potential of the two states.

Keywords: Barometric pressure; wind variance; heteroskedasticity; autocorrelation

I. INTRODUCTION

There are various factors which influence the production of wind energy at a particular place. In the model introduced in the paper we have four independent inputs i.e. they are not dependent on the value of output, and one dependent output. Wind energy is a very cheap and easily available form of energy nowadays, therefore government is introducing various incentive programs to promote the growth of wind energy production. To establish a wind energy plant at a particular place the first step is to test the site for the right conditions, and this is the most important step towards the development of a plant.

II. ECONOMIC MODEL

In the model under use there are four inputs and one output. The kilowatt/hour energy produced is the dependent output and wind temperature, barometric pressure, direction of wind and the amount of wind at a particular place are the inputs which decide the output. At a particular wind plant there are number of turbines installed. Each turbine generates its own output, hence broad range of outputs then to calculate the value mean and standard deviation is found for each turbine.

Variable wind – anemometer is used to measure the speed of the wind. In choosing a site this factor plays a vital role, and one has to see that when the wind is blowing the hardest. Along with it consistency of wind is also very important in choosing a site. Various turbines with different specifications operate differently in varying wind speed. Variable wind factor has been used as squared in the model to calculate the output. It has a direct relation with the output as higher the winds higher will be the output.

Temperature – it is one of the three variables which determine the mass of the air. The output of each turbine is affected by the density of the air. If the temperature of a particular place is high then the air present will be less dense i.e. as temperature increases the density of air decreases. Air with low density is lighter and it will have less impact on the propellers of the turbine. Therefore to have more output temperature of a place should be less so that the density of air will be more and hence more impact on the propellers. Therefore temperature has an indirect relation with the output.

Barometric pressure – it is defined as the force that air exerts on a surface. Higher the pressure of air the greater will be the density and hence more impact on the propeller. Therefore barometric pressure has a direct relation with the output.

Direction of wind – it is to determine where the wind is originating from. It is measured in degrees. The direction of the plant can be decided accordingly after determining the direction of the wind.
III. THE ECONOMETRIC MODEL

\[ Y_t = \beta_0 + \beta_1\text{wind} + \beta_2\text{wind}^2 + \beta_3\text{temp} + \beta_4\text{Bpressure} + \beta_5\text{turbine1} + \beta_6\text{turbine2} + \beta_7\text{year} + \beta_8\text{wind direction} \]

Here, \( Y_t \) is output from three different turbines, \( \beta \) are the coefficients which decide that which factor influence the output in what amount, wind is the monthly average of wind speed of a place, if the coefficient is positive then if wind speed increases the output increases. \( \text{Wind}^2 \) represents the wind variance. It will tell us that whether large fluctuations in wind are detrimental to output production or not.

If we draw a curve between first derivative of \( Y_t \) with respect to wind variance then it will be a parabola, and the peak of the curve will give the value of wind speed at which the output will be maximum.

\( \text{Temp} \) represents the value of temperature. The coefficient will be negative to represent that when temperature increases the output decreases. \( \text{Bpressure} \) represents barometric pressure and its coefficient must be positive but in some cases it can be negative also. \( \text{Turbine} \) represents the type of turbine used in the plant. The coefficient corresponding to the turbine used will be one rest will be zero. Similarly the values for year and wind direction can be estimated.

IV. ESTIMATION OF COEFFICIENTS

To determine the values of coefficients the model will have OLS (ordinary least squares) run on it. Through this statistical significance of each input can also be determined. After this the model will be tested for heteroskedasticity using the Breusch and Pagan test. Test can also be performed to see whether the wind is linear or non-linear. If it is non-linear then there will be a point at which whether the wind blows harder or softer the output will decrease. And if it is linear then wind will have a direct relation with the output. To check the autocorrelation present in the model Durbin- Watson test can be performed.

V. RELATION BETWEEN WIND POTENTIAL OF TAMIL NADU AND WEST BENGAL

Tamil Nadu has the highest wind energy potential in India. It can produce about 6000MW of energy that constitutes about 47% of the total wind potential of India. Muppandal wind farm is the largest in the subcontinent, producing about 22MW of wind energy. On the other hand West Bengal is the lowest wind energy potential state in India. The total installation in West Bengal is just 1.10 MW as there was only 0.5 MW addition in 2006-2007 and none between 2007–2008 and 2008–2009.

Temperature – As it has already been stated that temperature has an indirect relation with the wind energy production. Therefore the place where the duration of winters will be more will have more potential. In summers the temperature in Tamil Nadu is about 43\(^\circ\)C maximum whereas in West Bengal the highest temperature can reach up to 45\(^\circ\)C. As a conclusion the temperature of West Bengal is more than Tamil Nadu and hence less wind energy potential. Similarly we can compare the winter temperatures. In Tamil Nadu the temperature falls up to 18\(^\circ\)C whereas in West Bengal minimum temperature is 15\(^\circ\)C. Although the winters are cooler in west Bengal but the duration is less i.e. the winters are very short in West Bengal as compared to Tamil Nadu. This proves that temperature plays a vital role in determining the potential of a place and also explains why Tamil Nadu has higher potential than West Bengal.

Wind Speed –

In the map shown above-
- White – wind speed < 5.6m/s
- Red – 5.6 to 6.5m/s
- Green – 6.4 to 7.0m/s
- Orange – 7.0 to 7.5m/s

From the given map it is clearly seen that Tamil Nadu has red, green and a small portion of orange in its southern
regions. This implies that the wind speed varies from 5.6 to 7.5m/s in Tamil Nadu, and hence a huge wind energy potential. Similarly if we see West Bengal, it has only white portion i.e. the wind speed is <5.6m/s and hence low wind energy potential. This proves that wind speed plays a major role in determining the potential of a place and also why Tamil Nadu has more potential that West Bengal.

VI. CONCLUSION

The wind energy potential of a place i.e. the output in KW/hr depends upon four independent factors those are temperature, wind speed, barometric pressure, and direction of wind. A model is defined so that an estimate can be done that which factors affects in what quantity. Relation of output with each input is established. The wind energy potential of Tamil Nadu and West Bengal are explained and reasons are explained that why Tamil Nadu has maximum potential and West Bengal has minimum potential. This relation is established considering two inputs i.e. temperature and wind speed.

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Routing Attacks in Wireless Sensor Networks and its Preventive Measures

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Abstract: - For many applications secure routing is vital to the recognition and use of Wireless Sensor Networks (WSN). Though, due to the inherently constrained capabilities of sensor nodes providing secure routing in WSNs is a challenging task. Most do not take security into account as a main goal even though a wide variety of routing protocols have been proposed for WSNs. When designing robust security mechanisms for WSNs, routing attacks can have devastating effects on WSNs and present a major challenge. There is a need for lightweight and robust security mechanisms due to the inherent constraints found in WSNs. It is evident that it is extremely difficult to retrofit existing protocols with defenses against routing attacks during the examination of the wormhole routing attack and some of the proposed countermeasures. To carefully design new routing protocols in which attacks such as wormholes can be rendered meaningless is suggested as one of the ways to approach this rich field of research problems in WSNs. In this paper we analyze the various attacks that can be carried in a Wireless Sensor Network and the ways to handle these attacks.

Keywords: Routing Attacks, Spoofed, altered, or replayed routing information, Selective forwarding, Sinkhole attacks, Sybil attacks, Wormholes.

I. INTRODUCTION

In modern communications, Wireless and mobile ad-hoc networks are now considered to be the ultimate frontier. Without the need for a fixed infrastructure the technology allows nodes in a network to communicate directly with each other using wireless transceivers. In traditional wireless networks such as wireless LANs in which inter-node communication takes place through base stations this is distinctly different from the mode of operation used. A particular type of ad-hoc network is the Wireless Sensor Network (WSN). Smart sensors, typically the size of a coin, equipped with advanced sensing functionalities (thermal, pressure, acoustic, etc), a small processor, and a short-range wireless transceiver are the typical participating nodes. In order to build a global view of the monitored region the nodes exchange data. Through one or more gateway nodes this data is typically made accessible to the user. To provide very attractive, low cost solutions to a variety of real world problems WSNs have tremendous potential. The Military surveillance, commercial, environmental, medical, manufacturing and home automation are the application scenarios for WSNs. In the use of wireless technologies the past decade has witnessed an explosive growth. A very active area of research, the WSNs have become in particular.

II. CHALLENGES

Due to the constrained capabilities of sensor node hardware and the properties of their deployment, providing secure routing in WSNs is a complicated and challenging task. Given below are a brief outline of some of the major constraints present in WSNs:

(i) The medium is wireless
Due to its broadcast nature, the wireless medium is inherently vulnerable. To eavesdrop, intercept, and replay the transmitted data packets and inject malicious ones, an adversary can easily perform these attacks.

(ii) The environment is hostile
They face the possibility of destruction or physical capture by attackers since the WSN nodes are typically deployed in hostile environments.

(iii) The resources are limited
One of the biggest challenges in the design of robust and often resource-hungry security mechanisms are perhaps the extremely limited resources (power, bandwidth, CPU, memory) of sensor nodes. Extremely efficient security algorithms are necessitated by these constraints.

(iv) The deployment is Ad-Hoc
The WSN topology is subject to regular changes which are meant by the ad-hoc nature of sensor deployment. It must be
able to operate in such dynamic environments in any security mechanisms.

III. GOALS FOR SECURE ROUTING IN WSNS
It is important to understand what the goals of secure routing in a WSN should be before we can begin to look at routing attacks in WSNs. To ensure that a message reaches a correct receiver in an accurate form and within a reasonable time delay is the role of a routing protocol in any network environment. We would like to be able to guarantee the confidentiality, integrity, authenticity, and availability of all messages even in the presence of more powerful and resourceful adversaries in an ideally secure WSN routing scenario. We would like to be able to receive all messages intended for it and be able to verify the integrity of every message as well as the identity of the sender for every eligible receiver in a WSN. It should not be possible for them to infer the content of any messages even if an adversary was able to participate in the actual routing.

IV. ROUTING ATTACKS
Sensor network routing protocols are sometimes more susceptible to attacks against general ad-hoc routing protocols since they are quite simple.

Note the difference between attacks that try to manipulate user data directly and attacks that try to affect the underlying routing topology in the descriptions below:-

(i) Spoofed, altered, or replayed routing information
To target the routing information exchanged between nodes is the most direct attack against a routing protocol. Adversaries may be able to create routing loops, attract or repel network traffic, extend or shorten source routes, generate false error messages, partition the network, increase end-to-end latency, etc by spoofing, altering, or replaying routing information [1,2].

(ii) Selective forwarding
That the participating nodes will faithfully forward the received messages is the assumption on which the multi-hop networks are often based on. Malicious nodes may refuse to forward certain messages and simply drop them, ensuring that they are not propagated any further in a selective forwarding attack.

(iii) Sinkhole attacks
To lure nearly all the traffic from a particular area through a compromised node and creating a metaphorical sinkhole with the adversary at the center is the goal of an adversary in a sinkhole attack. Sinkhole attacks can enable many other attacks (selective forwarding, for example) since nodes on, or near, the path that packets follow has many opportunities to tamper with application data [4]. By making a compromised node look especially attractive to surrounding nodes with respect to the routing algorithm sinkhole attacks typically work. For example, to a base station an adversary could spoof or replay an advertisement for an extremely high quality route. The quality of route with end-to-end acknowledgements containing reliability or latency information might actually be verified by some protocols. By transmitting with enough power to reach the base station in a single hop, or by using a wormhole attack, a laptop-class adversary with a powerful transmitter can actually provide a high quality route in this case. It is likely that each neighboring node of the adversary will forward packets destined for a base station through the adversary, and also propagate the attractiveness of the route to its neighbors due to either the real or imagined high quality route through the compromised node.

(iv) The Sybil attack
A single node presents multiple identities to other nodes in the network in a Sybil attack [7]. The effectiveness of fault-tolerant schemes such as distributed storage, dispersity and multipath can be significantly reduced by the Sybil attack. Where every pair of neighboring nodes uses a unique key to initialize frequency hopping or spread spectrum communication it may be extremely difficult for an adversary to launch such an attack in a network for instance, routing and topology maintenance. By using a single adversary presenting multiple identities Replicas, storage partitions, or routes are believed to be using disjoint nodes [8]. Geographic routing protocols are significantly threatened by the Sybil attacks

(v) Wormholes
An adversary tunnels messages received in one part of the network over a low latency link and replays them in a different part in the wormhole attack. A single node situated between two other nodes forwarding messages between the two of them is the simplest instance of this attack. On the other hand, by relaying packets along an out-of-bound channel available only to the attacker wormhole attacks more commonly involve two distant malicious nodes colluding to understate their distance from each other. By creating a well-placed wormhole an adversary situated close to a base station may be able to completely disrupt routing [9].

(vi) HELLO flood attack
The HELLO flood is a novel attack against sensor networks. To announce themselves to their neighbors many protocols
require nodes to broadcast HELLO packets, and a node receiving such a packet may assume that it is within (normal) radio range of the sender. With large enough transmission power a laptop-class attacker broadcasting routing or other information could convince every node in the network that the adversary is its neighbor and this leads to a false assumption. For instance, by advertising a very high quality route to the base station to every node in the network an adversary could cause a large number of nodes to attempt to use this route, but those nodes sufficiently far away from the adversary would be sending packets into oblivion. In a state of confusion the network is left. All its neighbors might be attempting to forward packets to the adversary as well and this leads to a node realizing the link to the adversary is false and could be left with few options.

(vi) Acknowledgement spoofing
On implicit or explicit link layer acknowledgements, several sensor network routing algorithms is relied on. An adversary can spoof link layer acknowledgments for “overheard” packets addressed to neighboring nodes due to the inherent broadcast medium. Convincing the sender that a weak link is strong or that a dead or disabled node is alive is included in the goals. For instance, using link reliability a routing protocol may select the next hop in a path. A subtle way of manipulating such a scheme is artificially reinforcing a weak or dead link.

V. PREVENTIVE MEASURES

(i) The Sybil attack
Using the identities of the nodes that an insider has compromised she cannot be prevented from participating in the network, but she should only be able to do so. An insider is able to masquerade any (possibly even nonexistent) node by using a globally shared key. Verification of identities must be done. This might be done using public key cryptography in the traditional setting, but generating and verifying digital signatures is beyond the capabilities of sensor nodes. To have every node share a unique symmetric key with a trusted base station is one of the solutions. To verify each other’s identity and establish a shared key two nodes can then use a Needham-Schroeder like protocol [11]. To implement an authenticated, encrypted link between them a pair of neighboring nodes can use the resulting key. The base station can reasonably limit the number of neighbors a node is allowed to have and send an error message when a node exceeds it in order to prevent an insider from wandering around a stationary network and establishing shared keys with every node in the network. Consequently, a node is restricted to communicating only with its verified neighbors when it is compromised.

(ii) HELLO flood attacks
To verify the bidirectionality of a link before taking meaningful action based on a message received over that link is the simplest defense against HELLO flood attacks [12]. It not only verifies the bidirectionality of the link between the two nodes, but also if a well-funded adversary had a highly sensitive receiver or had wormholes to a multiple locations in the network, a trusted base station that limits the number of verified neighbors for each node will still prevent HELLO flood attacks on large segments of the network when a small number of nodes have been compromised.

(iii) Wormhole and sinkhole attacks
When the two are used in combination, Wormhole and sinkhole attacks are very difficult to defend against. Because they use a private, out-of-band channel invisible to the underlying sensor network Wormholes are hard to detect. In protocols that use advertised information such as remaining energy or an estimate of end-to-end reliability to construct a routing topology sinkholes are difficult to defend against because this information is hard to verify. Hop-count can be completely misrepresented through a wormhole since routes that minimize the hop-count to a base station are easier to verify. Sinkholes are easier to create when routes are established simply based on the reception of a packet as in TinyOS beaconing or directed diffusion because there is no information for a defender to verify. The best solution is to carefully design routing protocols in which wormholes and sinkholes are meaningless because it is extremely difficult to retrofit existing protocols with defenses against these attacks.

(iv) Selective forwarding
A compromised node has a significant probability of including itself on a data flow to launch a selective forwarding attack if it is strategically located near the source or a base station even in protocols that are completely resistant to sinkholes, wormholes and the Sybil attack. These types of selective forwarding attacks can be countered by Multipath routing [14].

(v) Authenticated broadcast and flooding
Adversaries must not be able to spoof broadcast or flooded messages from any base station since base stations are trustworthy. Every node in the network can potentially be compromised since this requires some level of asymmetry and no node should be able to spoof messages from a base station, yet every node should be able to verify them. For localized node interactions authenticated broadcast is also useful. To broadcast HELLO messages to their neighbors is
the requirement of nodes in many protocols. These messages should be authenticated and impossible to spoof. By using either digital signatures and/or having packet overhead that well exceed the length of typical sensor network packet, proposals have been made for authenticated broadcast intended for use in a more conventional setting. TESLA is a protocol for efficient, authenticated broadcast and flooding by using only symmetric key cryptography and requiring minimal packet overhead. TESLA achieves the asymmetry necessary for authenticated broadcast and flooding by using delayed key disclosure and one-way key chains constructed with a publicly computable cryptographically secure hash function. Replay is prevented since messages authenticated with previously disclosed keys are ignored. Loose time synchronization is the requirement of TESLA. Since it requires the set of compromised nodes to form a vertex cut on the underlying topology to prevent a message from reaching every node in the network. Flooding can be a robust means for information dissemination in hostile environments. High messaging and corresponding energy costs, as well as potential losses caused by collisions are the downsides of flooding. To reduce the messaging costs and collisions which still achieve robust probabilistic dissemination of messages to every node in the network SPIN and gossiping algorithms are techniques.

VI. CONCLUSION

We have demonstrated that currently proposed routing protocols for these networks are insecure since secure routing is vital to the acceptance and use of sensor networks for many applications. To design a sensor network routing protocol that satisfies our security goals we leave it as an open problem. For first approximation for defense against mote-class outsiders, the Link layer encryption and authentication mechanisms may be a reasonable, but cryptography is not enough to defend against laptop-class adversaries and insiders. Careful protocol design is needed as well.

VIII. REFERENCES


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Use of Hardfacing by Welding to Increase the Wear Properties of Material

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Abstract—Hardfacing is method of abrasion resistant metal applied by welding on the surface of softer material to increase wear properties. A hard electrode is used for hardfacing by manual metal arc welding on material which has low hardness comparison to hard electrode. There are so many operating problems regarding production and loss of production in industry. The main reason of this is wear. By hardfacing material is become more hard and also increase wear properties. The life time of tool will be increase with use of hardfacing.

Keywords—Wear resistance; Hardfacing; Hard Electrode; En31; SEM; EDS.

I. INTRODUCTION

Hardfacing is a group of welding related techniques, called also cladding or overlaying processes, having for purpose to restore dimensions of worn surfaces of used implements by depositing new and improved material to extend their useful working life.

Alternatively, when applied to a new part, to protect a common metal with a layer of a complex alloy presenting different characteristic properties that better resist wear, abrasion, impact or corrosion, to improve the usefulness of the original item(1)

Hardfacing, also known as “Hardsurfacing”, is the application of build-up of deposits of specialized alloys by means of welding process to resist abrasion, corrosion, high temperature, or impact. Such an alloy may be deposited on the surface, an edge, or merely the point of a part subject to wear. Welding deposits can functionalize surfaces and reclaim components extending their service life. key technology to fulfil these requirements and to apply hardfacing alloys.(2)

II. BENEFITS OF HARDFACING

Hardfacing is a low cost method of depositing wearresistant surfaces on metal components to extend service life. Although used primarily to restore worn parts to usable condition, hardfacing is also applied to new components before being placed into service.

In addition to extending the life of new and worn components. hardfacing provides the following benefits:

I. Fewer replacement parts needed.
II. Operating efficiency is increased by reducing downtime.
III. Less expensive base metal can be used.
IV. Overall costs are reduced.

III. CONSUMABLE SELECTION

Welding material selection depends upon three major factors:

Base Metal — Primarily affects the choice of build-up materials.

Manganese steel is used for components subject to high impact loading. Rebuild to size using manganese steel weld deposits.

Carbon and alloy steel components are rebuilt to size using low alloy steel weld deposits.

Type of Wear — The primary consideration in selecting the final hardfacing layers is the type of wear to been countered in service. These include:

Metal-to-Metal Friction — Wear from steel parts rolling or sliding against each other with little or no lubrication.

Severe Impact — Wear from severe pounding which tends to squash, gouge and crack the surface. Manganese steel deposits, which work harden in service, provide the greatest impact wear resistance.
Abrasion Plus Impact — Wear from gritty material accompanied by heavy pounding which tends to chip or crack, as well as grind, away the surface.

Severe Abrasion — Wear from gritty materials is often accompanied by heavy compression or moderate impact. Hard deposits are required to resist abrasion but they may also need substantial impact resistance.

Arc Welding Method — The choice of arc welding method depends primarily upon the size and number of components, available positioning equipment and frequency of hardfacing. Available methods are as follows:

Manual Welding using stick electrodes requires the least amount of equipment and provides maximum flexibility for welding in remote locations and all positions.

Semiautomatic Welding uses wire feeders and self-shielded, flux-cored Lincore electrodes increasing deposition rates over manual welding.

Automatic Welding requires the greatest amount of initial setup, but provides the highest deposition rates for maximum productivity. It can be done with combinations of:

I. Neutral flux and alloy wire.
II. Alloy flux and mild steel wire.
III. Self-shielded flux-cored wire with or without flux(3)

IV. EXPERIMENTAL DETAILS

In actual En-31 is material of tiller blade which is used in ploughing in fields. The tiller blade teeth have to bear heavy loads of ploughing soil and also subjected to abrasion wear due to the abrasive nature of soil particles when teeth acting to break up soil as teeth of tiller blade are dragged through it. So the teeth of tiller blade got damaged and wear tear takes place. Generally alloy steel is used to make an tiller blade teeth and hard facing of some wear resistant materials can be applied on the material of tiller blade teeth, so that its life will improve against abrasive wear.(4)

For hardfacing of specimen the LH-3 hardfacing electrode is used. It is made from alloy steel in order to increase the wear resistance on tiller blade surface and comparative wear tests were conducted in the field and laboratory. After use of LH-3 hardfacing electrode it was found that significantly different statistically and further suggested when the cost is taken into consideration.(5)

V. ELECTRODES

The reason for these electrodes being chosen was that they provide high resistance to wear. The structural and the mechanical properties of the material are much more severely affected by carbon than by all of the other alloying elements, and carbon in creases the strength of the weld metal. Manganese also increases the strength properties of the weld metal and provides deoxidation in the weld bath. Chromium is the alloying element participating in the composition of a variety of weld metals to improve the mechanical properties and to increase the corrosion resistance.(6)

VI. SPECIFICATION OF LH-3

The material of specimen is EN 31(base material) is hardfaced with the use of manual metal arc welding. The wear was determined by measurements of the changes of dimensions and weight during ploughing of sandy clay soil. With the help of hardfacing it is observed that the wear resistance has been increased and also the weight losses of tool is lower and dimensions of the Tool has been sustained. Hardfaced plough shares also offer lower production costs in comparison to regular plough shares. In the conclusion it can be say that hardfacing is best method for the wear protection.(7)

VII. HARDFACING CHARACTERISATION

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<th>Mn%</th>
<th>Si%</th>
<th>P%</th>
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SEM First Image of Hardfaced En-31
VIII. CONCLUSION

It has been found out that hard facing is an alternative for the protection of material against abrasive wear. The tiller blade which fail due to abrasive wear can be protected against abrasive wear by using hard facing. The different types of hard facing materials which are wear resistant can be employed on the substrate surface of tiller blade material and their relative comparison can be made regarding the protection provided to the surface of tiller blade. This protection method may be an efficient solution for tiller blade wear protection.

IX. REFERENCES

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