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Highlights

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- Ferroresonant Oscillations
- Model In Wimax Network
- PC Controlled Multichannel

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Problem-based Learning: Influence on Students' Learning in an Electronics & Communication Engineering Course

By Priyanka Mahendru ,Prof. D.V.Mahindru
SRMGPC, Lucknow

Abstract - Problem -based learning is "Problem"....." based" ....."learning". Let us look at each of these words. A problem is something that is problematic to the student; something that cannot be resolved with the current level of knowledge and/or way of thinking about the issues. The nature of effective problems in problem-based learning is that they are ill-structured as opposed to well structured. The characteristics of ill-structured problems are that they are real-life and authentic but not teacher's exercises, messy not tidy, incomplete in the sense of lacking information needed for their resolution and iterative in the way that they produce further ideas,/hypotheses and learning issues (Barrows 1989; Stephen and Pyke 1977; Margeston 2001). It is vital that the problems are engaging , that they "smell real", are interesting and challenging to students. This engagement stimulates further learning and requires research, elaboration, further analysis and synthesis together with decisions and action plans.

The engineering profession requires engineers to deal with uncertainty and solve complex problems of the field, sometimes with incomplete data (Mills & Treagust, 2003; NAE, 2004). In addition, engineers need to be able to function as effective members of teams and have strong communication and problem-solving skills (NAE, 2004). However, today's engineering graduates lack these skills and have difficulty applying their fundamental knowledge to problems of practice (Mills & Treagust, 2003; NAE, 2005; Nguyen, 1998; Vergara, et al., 2009).

Keywords: PBL, Learning, Cooperative, Self directed, Well Structured, Deep Content, Knowledge, grounded

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Problem-based Learning: Influence on Students' Learning in an Electronics & Communication Engineering Course

Priyanka Mahendru [α], Prof. D.V.Mahindru [Ω]

Abstract – Problem -based learning is "Problem"....." based" ....."learning". Let us look at each of these words. A problem is something that is problematic to the student; something that cannot be resolved with the current level of knowledge and/or way of thinking about the issues. The nature of effective problems in problem-based learning is that they are ill-structured as opposed to well structured. The characteristics of ill-structured problems are that they are real-life and authentic but not teacher's exercises, messy not tidy, incomplete in the sense of lacking information needed for their resolution and iterative in the way that they produce further ideas,/hypotheses and learning issues (Barrows 1989; Stephen and Pyke 1977; Margeston 2001). It is vital that the problems are engaging , that they "smell real", are interesting and challenging to students. This engagement stimulates further learning and requires research, elaboration, further analysis and synthesis together with decisions and action plans.

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The main problem within engineering education is the gap between the active field and the passive classroom experience (Palmquist, 2007). In general, the traditional lecture method within engineering education is deductive, "beginning with theories and progressing towards application of those theories" and the instructor presents information without a discussion of why the mathematical models are being developed and what practical problems they will solve (Prince & Felder, 2006). and not specific to the situation in which the task needs to take place. This pedagogical approach falls short because the knowledge is not grounded. Dewey suggested that educators needed to encourage inquiry and that education should be grounded on experience and linked to real-life activities in order to motivate and develop students into upstanding citizens. The problem-based learning (PBL) has the potential to help students to cope with the demands of complexities of the field and problems they will face in their future careers.

This appears initially to make complex tasks more manageable; but we pay a hidden price: we can no longer see the consequences of our actions, and we lose our intrinsic sense of connection to a larger whole. When we want to see the big picture, we try to reassemble the fragments and organize all the pieces. The task is futile– similar to trying to reassemble the fragments of a broken mirror!

In addition, while science and engineering jobs experienced annual average growth rate of 6.7% (compared to 1.6% for total employment) between1950-2000, the attrition rate for students has steadily increased and the annual graduation rate decreased by 20%, (Felder, Felder, & Dietz, 1998; NSB, 2008). One of the complaints from engineering students is that the current teaching pedagogies (such as, traditional lecture format) emphasize explicit instruction, working individually, and norm-reference grading, which can make learning extrinsically motivating rather than intrinsically motivating(Felder, et al., 1998). The main problem within engineering education is the gap between the active field and the passive classroom experience (Palmquist, 2007). To study the impact of problem-based learning (PBL) on undergraduate Electronics & Communication engineering students' conceptual understanding and their perceptions of learning using PBL as compared to lecture. Fifty students enrolled in an Electronics & Communication course at SRMGPC, Lucknow , volunteered in this research project. Results found out that participants' learning gains from PBL were much higher their gains from traditional lecture

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grounded on experience and linked to real-life activities in order to motivate and develop students into upstanding citizens. This paper describes one such approach, problem-based learning (PBL) has the potential to help students to cope with the demands of complexities of the field and problems they will face in their future careers. The impact of Problem-based learning (PBL) on undergraduate Electronics & Communication engineering students' conceptual understanding and their perceptions of learning using PBL were compared to that of traditional lecture. Fifty students enrolled in an Electronics & Communication course at SRMGPC, Lucknow, participated in this research. Results concluded that participants' learning gains from PBL were much more their gains from traditional lecture.

Keywords: PBL, Learning, Cooperative, Self directed, Well Structured, Deep Content, Knowledge, grounded

I. Introduction

PBL, or Problem Based Learning, is an instructional method of group-based learning centered on utilizing each member of the group's own information, resources, and personal experiences. The group must then compile their knowledge in an effort to solve the open-ended problems. What makes this method of teaching interesting is that there is no one, real "right" answer.

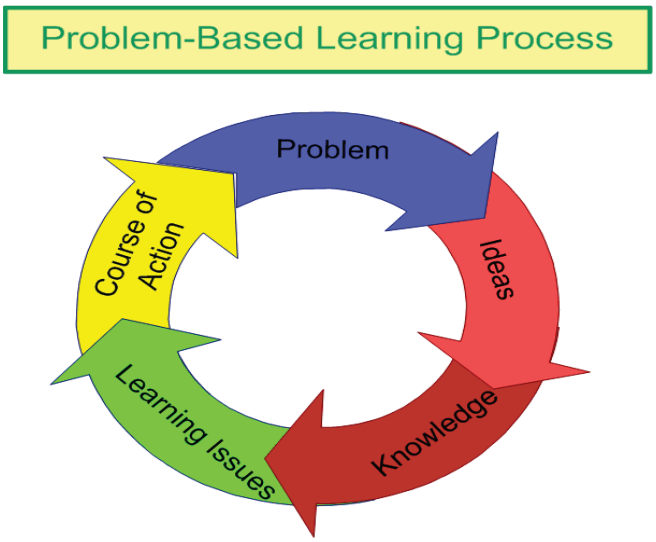
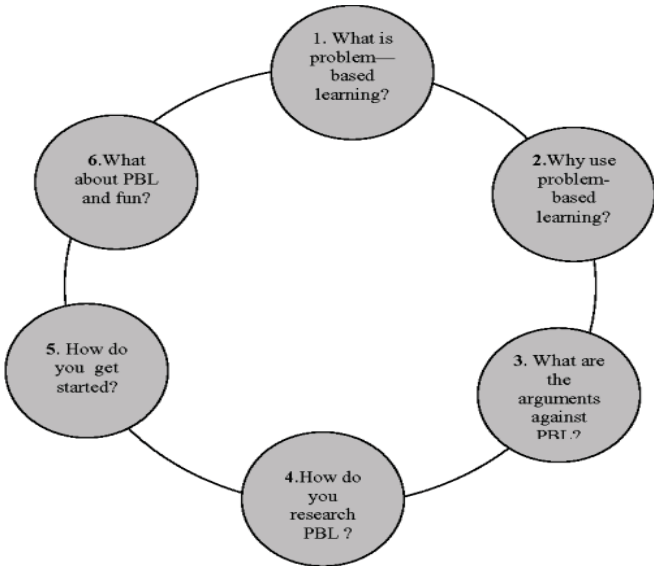


Figure 1: Problem Based Learning Process

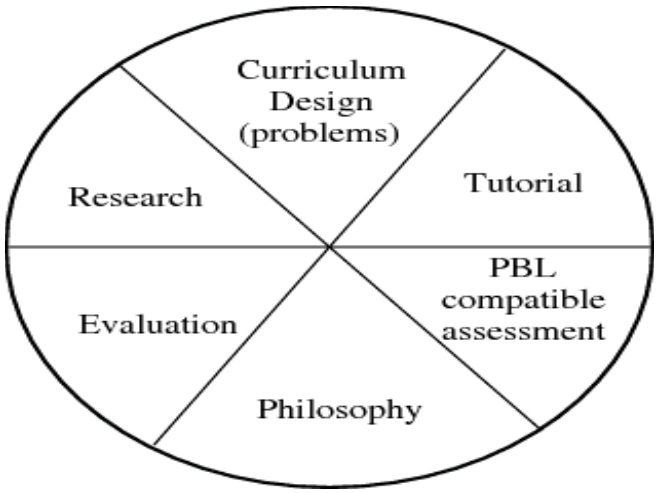
The following diagram gives you a visual overview of the structure of the PBL



II. Definition

Barrows defines PBL as follows:

The learning that results from the process of working towards the understanding of a resolution of a problem. The problem is encountered first in the



learning process (Barrows and Tamblyn 1980:1 my emphasis)

An operational definition of problem-based learning is as follows:

i) First students are presented with a problem.

ii) Students discuss the problem in a small group PBL tutorial. They clarify the facts of the case. They define what the problem is. They brainstorm ideas based on the prior knowledge. They identify what they need to learn to work on the problem, what they do not know (learning issues). They reason through the problem. They specify an action plan for working on the problem.

iii) Students engage in independent study on their learning issues outside the tutorial. The information

sources they draw on include: library, databases, and the web and resource people

iv) They come back to the PBL tutorial (s) sharing information, peer teaching and working together on the problem

v) They present and discuss their solution to the problem

vi) They review what they have learnt from working on the problem. All who participated in the process engage in self, peer and tutor review of the PBL process and each person's contribution to that process.

a) Problem-based learning is **"Problem"+"based" +"learning"**. Let us look at each of these words. A **problem** is something that is problematic to the student; something that cannot be resolved with the current level of knowledge and/or way of thinking about the issues. The nature of effective problems in problem-based learning is that they are ill-structured as opposed to well structured. The characteristics of PBL ill-structured problems are that they are real-life and authentic not teacher's exercises, messy not tidy, incomplete in the sense of lacking information needed for their resolution and iterative in the way that they produce further ideas,/hypotheses and learning issues (Barrows 1989; Stephen and Pyke 1977; Margeston 2001). It is vital that the problems are engaging, that they "smell real", are interesting and challenging to students. This engagement stimulates further learning and requires research, elaboration, further analysis and synthesis together with decisions and action plans.

The word "problem" in problem based learning needs to be interrogated. Problems are not always about something that is in difficulty that needs to be sorted out. An ill-structured design brief for an artist or an architect can be a problem. A dilemma for a doctor or a challenge for an engineer can be a problem. Problems are not always how to do something immediately practical in professional practice. Problems can also be about how to understand something. Problems can be presented to students in a variety of formats including: scenarios, puzzles, diagrams, dialogues, quotations, cartoons, e-mails, posters, poems, physical objects, and video-clips

One of the most important points about problems in problem-based learning is that it is not a question that first the students receive inputs of knowledge e.g. lectures, practicals, handouts etc. and then "apply" this knowledge to a problem they are presented with later in the learning process. This type of a situation is nor problem-based learning it is problem solving (Savin-Baden 2000). It is like making a cake when you have already been given the recipe and all the ingredients. One of the defining characteristics of the use of problems in problem-based learning is is that students are deliberately presented with the problem at the start of the learning process. This is like getting the challenge of preparing a celebratory meal for a special occasion where no recipes or ingredients are given.

III. Review of Previous Work

The engineering profession requires engineers to deal with uncertainty and solve complex problems of the field, sometimes with incomplete data (Mills & Treagust, 2003; NAE, 2004). In addition, engineers need to be able to function as effective members of teams and have strong communication and problem-solving skills (NAE, 2004). However, today's engineering graduates lack these skills and have difficulty applying their fundamental knowledge to problems of practice (Mills & Treagust, 2003; NAE, 2005; Nguyen, 1998; Vergara, et al., 2009). In addition, while science and engineering jobs experienced annual average growth rate of 6.7% (compared to 1.6% for total employment) between1950-2000, the attrition rate for students has steadily increased and the annual graduation rate decreased by 20%, (Felder, Felder, & Dietz, 1998; NSB, 2008). One of the complaints from engineering students is that the current teaching pedagogies (such as, traditional lecture format) emphasize explicit instruction, working individually, and norm-reference grading, which can make learning extrinsically motivating rather than intrinsically motivating(Felder, et al., 1998). The main problem within engineering education is the gap between the active field and the passive classroom experience (Palmquist, 2007).

In general, the traditional lecture method within engineering education is deductive, "beginning with theories and progressing towards application of those theories" And the instructor presents information without a discussion of why the mathematical models are being developed and what practical problems they will solve (Prince & Felder, 2006). and not specific to the situation in which the task needs to take place. Dewey (1938) argued. This pedagogical approach falls short because the knowledge is not grounded in context that such a traditional learning environment is too abstract and dull, leaving students with a sense of boredom and lack of motivation because they are presented with random information with no unifying factor. Instead, Dewey suggested that educators needed to encourage inquiry and that education should be grounded on experience and linked to real-life activities in order to motivate and develop students into upstanding citizens. Dewey also equated learning with doing and viewed learning as an activity, a process of discovery, where students need to be actively engaged in all aspects of the learning process (Savin-Baden, 2000).

Brown, Collins, and Duguid (1989) further emphasized that unless knowledge is developed in the context in which it is to be used, students will gain an understanding of abstract concepts, algorithms, and procedures; thus, the knowledge remains inert and

students are unable to use it. Brown and colleagues stated, "the activity in which knowledge is developed and deployed, is not separable from or ancillary to learning and cognition. Rather it is an integral part of what is learned" (p. 32). This is even more so the case for a complex enterprise such as engineering, which involves making decisions with real-world implications that carry risks and uncertain outcomes.

The teaching in undergraduate courses in the STEM disciplines has increasingly started adopting the more learner-centered teaching, such as problem-based learning (Lattuca, Terenzini, Volkwein, & Peterson, 2006). This shift is fueled by the need for future engineers to demonstrate the use of higher order thinking, problem solving, and more interpersonal aspects of a career, such as communication, social, and team-work skills (NAE, 2005). Specifically, the engineering field is seeing shifts in the types of engineers needed to emerge from college who are ready to participate as active and effective members of a global society. The National Academy of Engineers (NAE, 2004) developed a set of attributes future engineers will have to possess to be a competitive force within the field. Hence, it is important for engineering education to reexamine the use of typical lecture-based teaching methodology and consider incorporating learner-centered teaching. One such approach, problem-based learning (PBL) has the potential to help students to cope with the demands of complexities of the field and problems they will face in their future careers.

IV. Problem-based Learning-a Possible Solution

Problem-based learning (PBL) was developed in the 1950s to respond to criticism that traditional lecture failed to prepare medical students for problem-solving in clinical settings (Hung, Jonassen, & Liu, 2008). PBL is a non-traditional, active, inductive, student-centered approach that centers on the introduction of a real-life problem (Ehrlich, 1998). The problem is "a complex task created by the need to design, create, build, repair, and/or improve something" (Burgess, 2004, p. 42). The goals of PBL include fostering active learning, interpersonal and collaborative skills, open inquiry, real-life problem solving, critical thinking, intrinsic motivation, and the desire to learn for a lifetime (Barrows, 1998;

Hmelo-Silver, 2004; Savin-Baden, 2000; Springer, Stanne, & Donovan, 1999). Hmelo-Silver argued that PBL allows students to construct an extensive and flexible knowledge base, which goes beyond factual knowledge, allowing them to fluently retrieve and apply this knowledge in varied situations. Hence, PBL allows students to move beyond the mental understanding of information and learn to apply concepts to real-life formats. In addition, since the knowledge is also grounded in context, which requires the use of problem solving skills, educators purport that the conceptualization of knowledge better prepares students for future careers. Research on problem-based learning in the medical field has suggested that PBL leads to higher problem-solving skills as compared to the traditional lecture method while being equally effective at increasing students' factual knowledge.

For example, Antepohl and Herzig (1999) investigated whether students learned more and were more satisfied in a PBL course than a traditional lecture-based course using a post-test-only control group design. One hundred and twenty-three students were randomized to either a PBL section (N _63) or lecture-based section (N _60) of the same pharmacology course. All participants completed a written examination for pharmacology, which included 20 multiplechoice and 10 short answer questions to measure student performance, and a questionnaire that measured students' preferences for PBL or lecture-based instruction. The PBL group also completed a second questionnaire to assess their satisfaction with the PBL approach. The authors found no significant difference between the PBL and lecture students on the multiple-choice questions, but PBL students scored significantly higher than lecture students on the short answer questions. In addition, greater numbers of students preferred the PBL approach and PBL students also reportedhigher overall satisfaction for the course as compared to the control group. These results demonstrate that PBL provides similar learning benefits to lecture in terms of factual knowledge; however, PBL also leads to gains in complex levels of knowledge, such as comprehension and analysis of problems. Similar results were supported by a meta-analysis conducted to investigate the effects of problem-based learning in terms of impact on knowledge and skill acquisition (Dochy, Segers, Vanden Bossche, & Gijbels, 2003). Dochy and colleagues reviewed 43 empirical articles on problem-based learning in real-life classroom settings.

These studies had a variety of assessment measures that could be categorized into factual knowledge and application of knowledge, and included measures such as the NBME licensing test, modified essay questions, essay questions, multiple choice, oral exams, performance-based testing, free recall, standardized patient simulation, and cases. Thirty-three studies reported data on knowledge effect; while 25 studies reported data on application of knowledge (numbers do not add up to 43 because several studies reported data on more than one category). The authors found that PBL was better in allowing students to apply their knowledge (skill development), while there were no differences on the factual knowledge.

a) Problem-based Learning in Engineering Education

One of the main aims of engineering education is "to produce broad-based, flexible graduates who can think integratively, solve problems and be life-long learners" (Engineering Professors' Conference as stated in (Matthew & Hughes, 1994), p. 234).

Given that engineers need more than just factual technical knowledge to be successful in an ill-structured and complex environment, problem-based learning seems well suited to prepare future engineers. Problem-based learning in engineering is a natural fit since it espouses developing students' ability to solve ill-defined problems, increasing critical thinking skills, and broadening their communication skills (Johnson, 1999; Prince, 2004). Additionally, PBL provides students with life-long learning skills that they can use to effectively and efficiently acquire new skills and knowledge required in their career as engineers (Woods, 1996). Some of the classes in engineering curriculum, such as design and capstone courses, already incorporate (unintentionally) aspects of problem-based learning (Johnson, 1999). Several authors have also reported explicitly implementing PBL in their engineering courses; however, such use is still limited (Mills & Treagust, 2003). In one study, Bizjak (2008) described the incorporation of PBL in an electrical engineering graduate program in Slovenia. The authors found that students gained more substantial knowledge than with traditional methods, as evidenced by higher test scores. PBL also received positive feedback from students and faculty, who completed a survey questionnaire Specifically, students reported that PBL allowed them to gain confidence in their problem-solving abilities, prepared them for their future careers, and improved their interpersonal and collaborative skills.

In another electrical engineering example, de Camargo Ribiero (2008) conducted a qualitative study of student evaluation of the PBL approach in a classroom at a university in Brazil. Students reported that the PBL approach was more engaging and interesting as it allowed them to construct their own knowledge instead of absorbing teachers' words and they were able to seek information on their own to solve problems. Students also reported that they developed specific work skills such as, ability to research, produce syntheses, express ideas, communicate, and effectively work in teams to develop solutions to problems.

These results suggest that PBL is an effective pedagogical tool to engage and increase students' interest in problem solving as well as beneficial for their knowledge gains. There have also been some programmatic implementations of problem-based learning.

For example, Polanco and colleagues (2004) conducted a three-year evaluation of a problem-based learning integrated curriculum in a second-year engineering program at a Mexican university. The longitudinal data suggested that students taught with PBL achieved significantly higher grades and performed better than students who received traditional instruction in advanced engineering courses. Similarly, Woods (1996) examined the influence of a PBL curriculum on students in a chemical engineering program at McMaster University in Canada.

The results suggested that PBL students had more positive course perceptions and scored higher on the written three-hour exam as compared to the control group of engineering students. The author also found that PBL students' confidence in problem-solving skills and their willingness to solve challenging problems also increased substantially compared to traditional students, suggesting that PBL students' attitudes aligned with open-ended problem solving and self-directed learning.

Canavan (2008) also examined problem-based learning applied to electronic and electrical engineering at three universities in the United Kingdom. The results from the questionnaires and interviews suggested that students preferred the PBL approach because it allowed them to engage in deep thinking skills and assume more responsibility for their learning. The students also reported the PBL approach fostered more generic skills, such as communication skills, group work, critically evaluating information, and time and task management, which are crucial in "developing versatile and confident engineer of the future" (p. 179).

In spite of the recent use of more problem-based learning, research on the impact of these approaches on students' conceptual understanding is limited (Hung, et al., 2008;Mills & Treagust, 2003). Gijbel and colleagues (2005) argued that claims about the effectiveness of PBL have been exclusively based on the research from medical field and there is dearth of research on PBL outside of medicine related fields. This is especially true within engineering education with regard to the effectiveness of PBL on students' problem-solving and conceptual understanding (Mills & Treagust, 2003; Prince, 2004). Research on the use of problem-based learning within engineering has mainly involved student and/or faculty perceptions of effectiveness of this approach rather than empirically collected data on actual student outcomes (Mills & Treagust, 2003). Given the little research on the impact of problem-based learning on engineering students' conceptual understanding, it is important to provide empirical evidence for what educational innovations, such as PBL work, and create an empirical base for their use in engineering education. Such an empirical base is imperative to improve engineering education as highlighted by a recent American Society for Engineering Education report, which suggested the need to develop a "scientifically credible and shared knowledge base on engineering learning" (Jamieson & Lohmann , 2009).

The problem-based learning approach described in the study is based upon the floating facilitator model and is similar to self-directed, interdependent, small group problem-based learning (Prince & Felder, 2006; Woods, 1996). Within this PBL approach, students work in teams of 3–5 students with the instructor facilitating students' understanding of the material and students are responsible for their own learning (Prince & Felder, 2006).

The problem-based learning approach used in this study is different from project-based learning. During project-based learning students have gained the required knowledge base through formal instruction and central focus is on the final product, whereas problem based learning typically requires students to work on ill-structured problems while acquiring necessary knowledge base to complete the task and focus is on the learning process rather than final product (Prince & Felder, 2007).

In addition to assessing learning outcomes, researchers have tried to examine student perceptions of the PBL approach and how they match with actual learning. Research from psychology has suggested that students' judgments of learning are not accurate predictors of their actual learning outcomes (Dunlosky & Lipko, 2007; Glenberg, Wilkinson, & Epstein, 1982).

As per Dr Khaled Zehry; Dr. Neel Halder Problem based learning (PBL) is a teaching strategy to promote self-directed learning and critical thinking through problem solving. This educational approach has become a distinct methodology and has been widely adopted within medical education as a method of teaching.

PBL as an effective learning method is still debatable. Several systematic reviews have investigated this particular issue with no conclusive evidence 1. Although, the debate on measuring its effectiveness in disciplines is unlikely to cease2 and the concept of causal relationship to improvements has been questioned 3, more research on PBL should be done to shed more light on its effectiveness over traditional teaching methods. It will also be important to conduct more students' surveys on their views on PBL. A key to implement PBL successfully is for tutors to understand the learning theories behind it and to be able to adapt efficiently to the facilitator role rather than a traditional teaching Glenberg, Wilkinson, and Epstein found that students have an "illusion of knowing" and tend to be overconfident in their understanding of the material. Given that the majority of the research on problem-based learning has focused on student perceptions, it is important to examine whether perceptions are an accurate predictor for learning. Hence, our purpose in this study was to examine the impact of problem-based learning on students' learning and conceptual understanding. Specifically, this study addressed the following research questions:

a) What is the influence of a problem-based learning approach on undergraduate engineering students' conceptual understanding in an Electronics and Communication engineering course?

b) What are engineering students' perceptions of problem-based learning and how do they match with their learning outcomes?

V. Challenges

a) Engineering Landscape In India (Iit Bombay Study)

To get a better handle on the problem, IIT Bombay undertook a study on the engineering landscape in India.

The study aimed to answer questions such as:

- Has the engineering education system been able to provide, quantitatively and qualitatively, the engineers required for the growth of the Indian economy?
- Has it provided the research and development leadership required for our industry?
- In the context of globalization, is there a need to modify the higher engineering education system in India?

The study shows that against the sanctioned seats of 6.57 lakh for Under Graduate Engineering education in India, only 2.37 Lac engineering degrees were awarded in 2007-08. This very clearly highlights the shortfall. In2006, India awarded about 2.37 lakh engineering degrees, 20,000 engineering Masters Degrees and 1000 engineering PhDs, which means a total of 2.58 lakh engineering degrees of all types. This is clearly not enough! The awarding of degrees is also not evenly distributed across India. Five states – Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka and Kerala are said to account for almost 69% of the country's engineers. It is estimated that about 30% of the fresh engineering graduates are unemployed even one year after graduation; and this is even as many sectors complain of lack of talent. This clearly points that there is definite scope to improve quality of engineering education. Let us also look at the gender factor. At IIT Bombay, the percentage of women graduates to the total is about 8% at the B.Tech. level, 9% at the M.Tech level and about 17% at the Doctoral level including Science, Humanities and among the faculty – only about 10% of the IIT Bombay faculty comprises women. Gender disparity in the engineering stream exists around the world, not just in India, and special efforts are being made by institutions, Governments and professional organizations to rectify these. Some Indian states have provided incentives like free tuition for women studying engineering. Overall, the study rightly points out that India has the potential to be a leading research and design hub in the world. For this, we need to have a mechanism to identify important areas and develop policies and institutions accordingly.

Situations and problems we confront today demand composite responses and solutions.

b) New Kind of Engineer

Globalization has resulted in highly dynamic and complex market leading to the requirement of a new kind of Engineer.

c) Systems Thinking

This complexity demands a new way of thinking – it requires a Systems Thinking approach to macro level challenges and requires Engineers to keep one eye on the big picture even as they tackle specific tasks. Systems thinking provides a conceptual framework that helps make full patterns clearer and helps one to see how to modify these patterns more effectively.

This type of thinking is tricky to most of us because As Peter Senge says, it is a "discipline for seeing the whole". We are taught to break problems apart, to fragment the world! This appears initially to make complex tasks more manageable; but we pay a hidden price: we can no longer see the consequences of our actions, and we lose our intrinsic sense of connection to a larger whole. When we want to see the big picture, we try to reassemble the fragments and organize all the pieces. The task is futile– similar to trying to reassemble the fragments of a broken mirror!

d) Multi-Disciplinary Approach

Today's Engineers must also be able to view management activities through different lenses and work with people from different disciplines and diverse fields such as business, banking services and medicine.

We also have great minds, great thinkers. We just have to look for ways to bring them together. It is this fraternity of Engineers that will determine

"INDIA OF TOMORROW ".

We have travelled a very long journey and our "Intellect" is second to none. What we need is to mould young professionals to the needs of our Industry. The eyes of the world are on us. We have the opportunity to become a superpower. We all owe it to ourselves to shoulder the responsibility.

"Yesterday's collaborators are today's Competitors".

We will decide our role on the global stage. To meet this challenge we need engineers with "MULTI-DISCIPLINARY APPROACH"

e) Innovation-Led Growth

India's future growth will be driven not by cost but by innovation in terms of product offerings, process efficiency, value engineering and cost reduction.

f) Developmental Challenges

Even as we reach for the moon, there are millions here on earth for whom basic needs are elusive. No country can afford a skewed growth. If India has to achieve a 7% to 8% sustained growth, it needs not just "Corporate India" but the rural sector, the agricultural sector to grow as well. It is these areas that badly need the above cited engineering talent. The government, we and all of us together have to find ways to produce the above brand of Engineers motivated enough to make it an attractive option for them to take up these challenges.

However, today's engineering graduates lack these skills and have difficulty applying their fundamental knowledge to problems of practice (Mills & Treagust, 2003; NAE, 2005; Nguyen, 1998; Vergara, et al., 2009).In addition, while science and engineering jobs experienced annual average growth rate of 6.7% (compared to 1.6% for total employment) between1950-2000, the attrition rate for students has steadily increased and the annual graduation rate decreased by 20%, (Felder, Felder, & Dietz, 1998; NSB, 2008). One of the complaints from engineering students is that the current teaching pedagogies (such as, traditional lecture format) emphasize explicit instruction, working individually, and norm-reference grading, which can make learning extrinsically motivating rather than intrinsically motivating(Felder, et al., 1998). The main problem within engineering education is the gap between the active field and the passive classroom experience (Palmquist , 2007).

In general, the traditional lecture method within engineering education is deductive, "beginning with theories and progressing towards application of those theories" and the instructor presents information without a discussion of why the mathematical models are being developed and what practical problems they will solve (Prince & Felder, 2006). And not specific to the situation in which the task needs to take place. This pedagogical approach falls short because the knowledge is not grounded. Dewey suggested that educators needed to encourage inquiry and that education should be grounded on experience and linked to real-life activities in order to motivate and develop students into upstanding citizens. The problem-based learning (PBL) has the potential to help students to cope with the demands of complexities of the field and problems they will face in their future careers.

VI. Methodology of –PBL

Problem-based learning (PBL) is a better alternative to traditional classroom learning.

With PBL, the teacher provides a problem to the students, usually a small group. In this system, teacher does not provide any kind of lectures, course contents, assignments or exercises.

The learning depends solely on the student's efforts, the sense he has to discover and work with content that is necessary to solve the problem. Hence the learning becomes active

A well designed problem provokes students to encounter and struggle with the control concepts and a principle of discipline. These skills include presentation

and communication skills, self assessment and reflection skills, group participation and leadership skills. PBL is generally done by small groups of students working together for a common goal. Finally the choice of the students based upon various factors makes them take decisions that result in effective solutions and learning process in general.

In PBL, the teacher acts as facilitator and mentor rather than a source of solutions.

a) Problem based learning helps the student to:

- Develop Skill of discovering different facts and develop habit of collecting latest information and updates in all fields
- Freedom to express the problem and solution in one's own way
- It helps in developing team spirit
- Help in improving communication skill
- Makes the student flexible in processing information and handling different problems

b) Problem-Based Learning follows following steps:-

(These steps can be repeated and recycled)

i. Understand the problem:

The teacher introduces an "ill-structured" problem to a group of students.

The group discusses the problem statement and lists its significant parts.

The problem may appear as very tough for the group to solve but that is the real inspiration source to work hard on it. The group has to work using their vision and technical skill to find solution.

ii. List the information already known to the group which can help the solution.

This includes both what each member of the group actually knows. Each information and idea of every group member is important.

iii. Develop, and write summary of, the problem statement in your own words.

Every person can understand the thing better in his own way expressions. Thus, a problem statement should come from the group's analysis of what the group knows, and what the group will need to know to solve it.

iv. List all possible solutions.

The problem is discussed in group. Various possible solutions may appear together, now to search which solution is best, the group can list them all, then order them from strongest to weakest

Now, they can choose the one which appear them the best, or most likely to succeed.

v. Prepare list of actions to be taken with a "time bound" Solution.

Now, when the possible solution is decided, the group should prepare a list of necessary actions to be taken to reach to the solution. All these actions must have a time limit to avoid any kind of delay and all team members should work together or the work can be divided also depending on the kind of actions needed.

vi. List information necessary to know.

Any information can be useful to fill in the missing gaps. Discuss possible sources like experts, books, web sites, etc.

vii. Submit the possible solution with data.

Usually the group has to present their findings and/or recommendations to their classmates. In short, the" process" and the "outcome".

viii. Presenting and defending your conclusions.

The group has found a good solution but to present it confidently and convincingly is more important than any other thing. Otherwise all labor will go waste. The group should be preparing to state both the problem and the conclusion clearly as well as summarize the process and difficulties encountered.

VII. Conclusions

a) *Deep Content Learning*

PBL supporters argue that PBL students remember more content over longer periods of time (i.e., 1-2 years or more) than conventional students who studied the same content (Gallagher, 1997; Hmelo & Ferrari, 1997). Thus, when evaluating if PBL leads to deep content learning, researchers should evaluate if PBL students Understand and are able to apply unit content to real-life situations (e.g., use information learned about chemical reactions when determining the chemical properties of different substances).

b) Problem-solving Ability

Another intended learning outcome of PBL is increased problem-solving ability. A problem exists when there is a discrepancy between our expectation and what we get. Specifically, PBL is designed to increase students' abilities to solve ill-structured problems (Gallagher et al., 1992). Ill-structured problems "have many alternative solutions, vaguely defined or unclear goals and unstated constraints, and multiple criteria for evaluating solutions" (Jonassen, p. 21).

c) Self-Directed Learning

Self-directed learning is "any increase in knowledge, skill, accomplishment, or personal development that an individual selects and brings about by his or her own efforts using any method in any circumstances at any time" (Gibbons, 2002, p. 2). PBL is specifically designed to increase students' abilities to direct their own learning

d) It is concluded that the impact of problem-based learning (PBL) on undergraduate Electronics &

Communication engineering students' conceptual understanding and their perceptions of learning using PBL as compared to traditional lecture is far better. Fifty students enrolled in an Electronics & Communication course at a SRMGPC, Lucknow, participated in this research. Retention was found to be fantastic.

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Microcontroller Based Blood Irradiator System

By Megha Mukherjee
SIGCOE, Mumbai University. Navi Mumbai, India.

Abstract - Irradiation of blood and blood products by gamma rays is a proven and safe method to inhibit T- Lymphocyte Proliferation and eliminate the risk of post transfusion graft versus host disease (T-GVHD). Transfusion-associated graft-versus-host disease (TA-GVHD) is a rare, but usually fatal, complication of transfusion. The risk associated with an individual transfusion depends on the number and viability of contaminating lymphocytes, the susceptibility of the patient's immune system to their engraftment and the degree of immunological disparity between donor and patient. This paper aims to acknowledge the importance of blood irradiator.The mainstay of prevention is gamma irradiation, which inactivates T lymphocytes whilst preserving the function oother blood cells. Leucodepletion by current filtration technology is inadequate [unproven] for this purpose. Gamma irradiation of cellular blood components is the best current technology to reduce the risk of T-GVHD to the recipients as confirmed by research and therefore being widely practiced world over in hospitals and blood banks as a life saving approach to this problem. Blood is usually irradiated in standard blood bags in dedicated blood irradiators using cobalt –60 or caesium –137 radioactive source. Thus this paper aims to contribute to the development of a control system is a based system microcontroller used for controlling the various input and output devices. The unit can be installed in a room without any additional shielding.

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MICROCONTROLLER BASED BLOOD IRRADIATOR SYSTEM

Strictly as per the compliance and regulations of:

Microcontroller Based Blood Irradiator System

Megha Mukherjee

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I. Introduction

a) Blood Irradiator System

Blood irradiators are widely used for the irradiation of blood samples and also for various research studies like mutation breeding, radiation sterilization etc. The compact self-shielded cobalt-60 gamma irradiators provide an irradiation dose of 9KGy/hr. The sample for irradiation is to be placed inside the sample chamber. The motorized drive and its associated mechanism enable precise position of the sample chamber at the centre of the radiation field inside the chamber. The recommended dose limit for blood sample ranges from 15Gy to 30Gy

b) Main Features of BI-2000

- Safe and self shielded: No additional shielding is required. The radiation field on the external surface of the unit is much below the permissible level.
- Dose uniformity: Sample rotation mechanism and stationary source pencils symmetrically placed in a cylindrical cage ensure good uniformity of radiation field within 25% variation or better.
- Computerized calculations of dose and termination of irradiation based on time as well as dose modes with Cobalt-60 source decay correction.
- Sample chamber door inter lock for safety operation.

c) Blood Irradiation

Blood is a specialized bodily fluid that delivers necessary substances to the body's cells such as nutrients and oxygen – and transports waste products away from those same cells. Blood consists of many components (constituents). These include: Plasma, White Blood Cells, Red Blood Cells, Platelets, Lymphocytes, Erythrocytes, Leucocytes and thrombocytes. Lymphocytes, Basophiles, Europhiles and Monocytes.

d) T-GVHD

Transfusion –associated graft versus host disease is a complication of blood transfusion in which the donor T-Lymphocytes mounts an immune response against the recipient's lymphoid tissue. Donor lymphocytes are identified as foreign and destroyed by the recipient's immune system. These donor lymphocytes proliferate and damage target organs, especially bone marrow, skin, liver and gastrointestinal tract. The risk associated with an individual transfusion depends on the number and viability of contaminating lymphocytes, the susceptibility of the patient's immune system to their engraftment and the degree of immunological disparity between donor and patient. However, in situation where recipient are immune deficient such as cancer patients and those who are going organ transplantation are not able to destroy the donor lymphocytes. This result in T-GVHD.T-GVHD is developing four to thirty days after transfusion

II. Need of Blood Irradiator

When blood is given to patients who are immuno- deficient such as cancer patients or patients being operated for organ transplants, blood needs to be irradiated with low dose of radiation to inhibit T-Lymphocyte proliferation. Without this, these Lymphocytes may tend to take over the immune system of the recipient and attack the healthy organs resulting in T-GVHD or Transfusion induced graft versus host disease. This may lead to complications and may be fatal. Even in the case of immuno sufficient patients, this can take place, if the donor happens to be a close first degree relative due to the lymphocytes getting past the immune system of the recipient undetected

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like a Trojan horse. Treating of the blood with radiation is considered a sure way to prevent such complications.

III. System Design

After getting the required dose the sample is lifted out of the chamber using the control drive mechanism automatically. The microcontroller based fully automated system accurately adjust the irradiation time and generates control signals for activating different output devices and take appropriate control action by reading the inputs from various input devices.

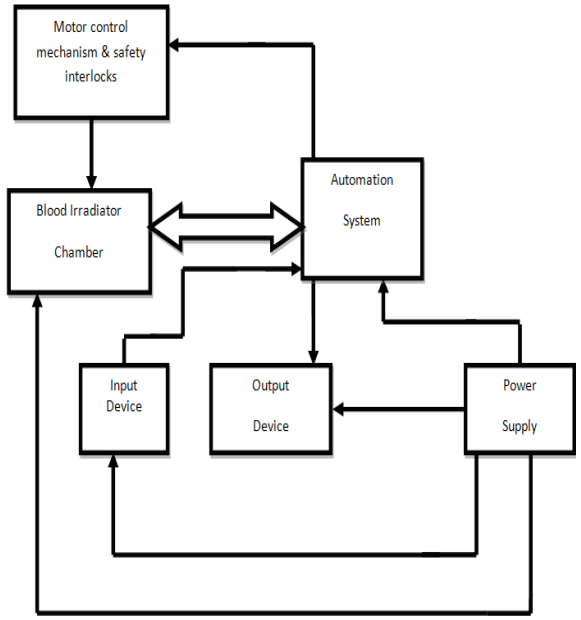

Fig I: Block Diagram of control system.

a) Input Devices

Keypad

The 4x3 matrix keypad is a general-purpose keypad. It consists of 16 switches arranged in 4 rows and 4 columns. It can connect to the MCU 8-bit port directly. Is provide o choose between different options and to select different operation settings by the user. It's provided to enter the parameters for irradiation like dose rate, initial activity. This is our keypad module which has the following keys:

- Increment Key
- Decrement Key
- Right shift Key
- Left Shift Key
- OK Key

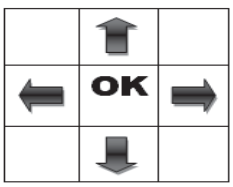

Fig II: Keypad

b) Output Devices

LED

A light-emitting diode (LED) is a semiconductor diode that emits incoherent narrow-spectrum light when electrically biased in the forward direction of the p-n junction, as in the common LED circuit.

LCD

The user interface is developed through the LCD display.

- Display various menus for the user.
- Displays the parameters and different modes of operation the operator has selected.
- Guide the user to interactively choose different menus and select different parameters for taking decisions.

Automation Devices

The automation system consists of a microcontroller (Atmel AT89C52 microcontroller) based fully automated system. The peripherals are interfaced with the microcontroller and the communication is done through the IO ports. Accurately adjusts the irradiation time and generating control signals for different input & output devices.

Power supply

This unit will supply the various voltage requirements of each unit. A variable regulated power supply is used to continuously adjust the output voltage to the requirements. This unit consists of transformer, rectifier, filter, regulator and power LED. Transformer rating is 30VA (2A current rating). Rectifier will be center tap rectifier. Filter value is 2200μF. Regulator is 7805.

Microcontroller

- The automation system consists of a microcontroller (Atmel AT89C52 microcontroller) based fully automated system.
- The peripherals are interfaced with the microcontroller and the communication is done through the IO ports.

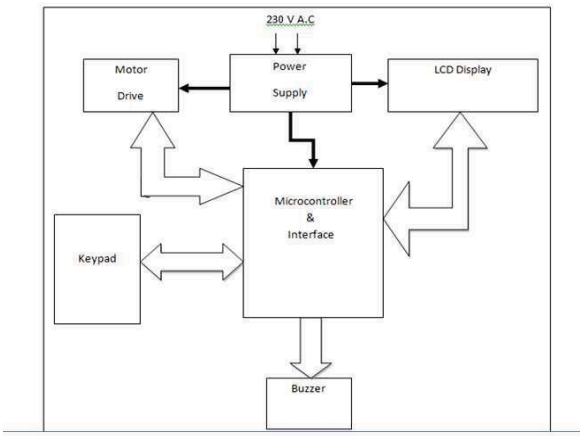

Fig III: Automation system

• Accurately adjusts the irradiation time and generating control signals for different input & output devices.

• Generates control signals for different input & output devices to precisely place the sample to the centre of the source.

• Automatically removes the sample after irradiation for the calculated time.

• It is programmed to read the dose rate of the sample then calculate the exact irradiation time.

Motor drive Mechanism

• The motorized drive mechanism is a D.C Motor whose speed is 100 r.p.m and its associated drive mechanism enables precise positioning of the irradiation chamber at the centre of the radiation field inside the sample chamber.

• This becomes an important mechanism as the position of the chamber should be accurate such that the sample is accurately exposed to the radiations. These radiations should accurately fall on the sample chamber in order to remove the impurities.

• Stationary source pencils, symmetrically placed in a cylindrical cage ensure good uniformity of radiation field in the sample chamber. In addition a mechanism is also provided for rotating/stirring samples during irradiation.

• Sample chamber door interlocks are provided for safety operation such that during the irradiation time the doors should not open as they may hamper the whole process and also expose the harmful gamma radiations to the environment and the operator.

The DC motor that we have used serves the following purpose:-

• For controlling the position of the sample in the gamma chamber we use to interface dc motor with microcontroller to a port which will give high or low logic to rotate the motor in any of the direction.

• Here to lower the sample in to the chamber we use to convert the angular motion of motor in to liner motion.

• For controlling the vertical motion of actuator we have use to limit switch know as upper and lower limit switch.

• The rating of the motor is 24V/1A.

• Rating of microcontroller 5v/10mA

IV. Development Tools

a) *Embedded (Keil) C*

The use of C language to program microcontrollers is becoming too common. And most of the time it's not easy to build an application in assembly which instead you can make easily in C. So it is important that you know C language for microcontroller which is commonly known as Embedded C. As we are going to use Keil C51 Compiler, hence it is called as Keil C.

b) *Orcad package*

OrCAD is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly to create electronic prints for manufacturing of printed circuit boards, by electronic design engineers and electronic technicians to manufacture electronic schematics and diagrams, and for their simulation.

c) *Operation*

The control system is built for controlling the irradiation time for a sample as per required. The keypad provided is use to control the process as denoted on screen. When we switch on the circuit following screens are displayed in a sequence:-

• The first screen will display the title of the project is display

• In the second screen we have to enter the dose rate which we have to give according the quantity of the sample. The following operations are performed by the key as they are pressed. Increment the values when "UP" Key is press similarly when "DOWN" Key is press it will decrement the values and store the values invariable. Move the cursor right or left according to the direction of key pressed. "OK" key is used to store the data and go to next operation.

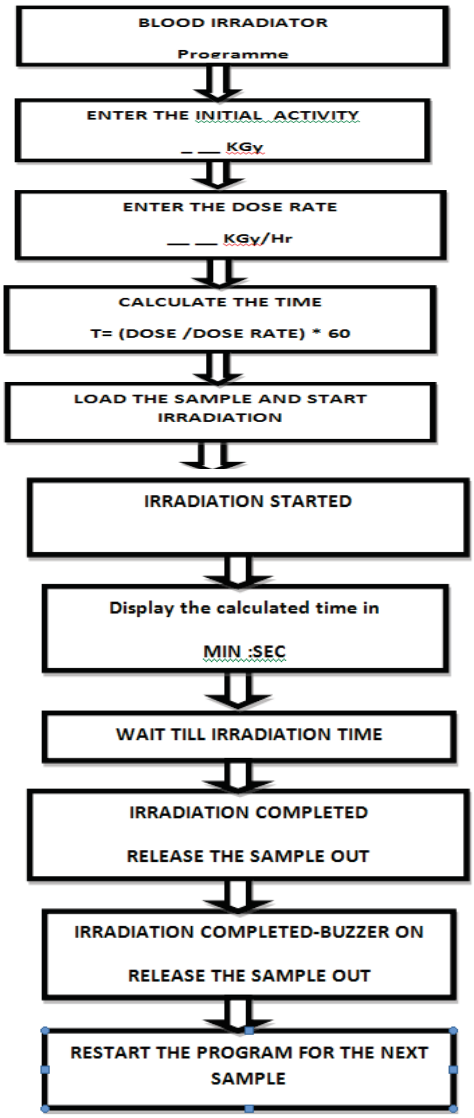

Fig V: Flowchart sequence of events

• In the third screen we have to enter the dose rate which we have to give according the quantity of the sample. The above operations will be performed by the key as they are pressed

• Calculate the time of irradiation by formula Time= (initial activity/dose rate) *60

• After calculating the time the dc motor will rotated in clockwise direction and as the mechanical link the sample holder will move in up direction. As the sample holder is move up, place the sample and press "OK" key to move to next operation. As the key is pressed the dc motor rotated in anti- - -clockwise direction and as the mechanical link the sample holder will move in down direction. Here as the sampled is loaded to the irradiation chamber the controller will ask the user whether to start the irradiation then press "OK" Key after a delay of few millisecond the controller will go to next screen.

• As soon as the sample is loaded irradiation starts and the calculated time is displayed on the screen. The time is display and start decrementing as down counter first sec followed by min. This countdown can be stop by pressing "OK" key in mid of time As the irradiation time hit zero this screen appear indication that irradiation completed and after pressing "OK" key the dc motor will rotated in clockwise direction and as the mechanical link the sample holder will move in up direction. Now after the irradiation time is completed the buzzer will be ON to indicate irradiation is complete. Now the sample can be removed.

V. Conclusion

The Gamma Chamber is very effective, as compared to other systems for Blood Irradiation. The radiation from Gamma chamber degrades the intensity of T- Lymphocytes which is the main cause for TA-GVHD disease in low immune patients. The irradiation can be controlled effectively by microcontroller which accurately calculates the time with the initial activity and dose rate entered by the user. The position of the sample in the chamber is precisely controlled by microcontroller by means of interfacing with DC motor.

VI. Future Scope

The same concept can be used for the following requirements:-

- Sterilization of healthcare products
- Cancer Treatment
- Irradiation of water
- Microbial decontamination of spices, herbs and vegetable seasonings
- Food and food product preservation
- Inhibition of sprouting in onions and potatoes
- Gemstone Coloration & enhancement
- Radiation effect of materials
- Mutation breeding
- Food preservation
- Radiation sterilization

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Statistical Investigation of ECG Signal of Sleep Apnea Patient

By Chandan Das,Mofazzal H. Khondekar
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Abstract - The Hurst Exponent of the time series of a normal patient and apneal patient suggest that they are anti-persistent and the later has more self similarity compared to the former. It has been established that they are AR process and nonstationary. The Semblance analysis suggests strong correlation both positive and negative between them. Tentative mathematical models of the normal an apneal patient has also been suggested using Yule Walker method.

Keywords:: *Hurst exponent, ECG, autocorrelation, partial autocorrelation, Wavelet, Semblance.*

GJRE-F Classification : *FOR Code: 090609*

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Statistical Investigation of ECG Signal of Sleep Apnea Patient

Chandan Das [α] , Mofazzal H. Khondekar [β]

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Keywords: Hurst exponent, ECG, autocorrelation, partial autocorrelation, Wavelet, Semblance.

I. Introduction

Sleep apnea is the occurrences of interrupted breathing during sleep. Obstructive sleep apnea is a well-known disorder in which relaxation of muscles in the throat repeatedly close off the airway during sleep; the person wakes just enough to take a gasping breath. This process is repeated many times during sleep and usually is not remembered the next day. Those suffering from severe obstructive sleep apnea typically complain of sleepiness, irritability, forgetfulness, and difficulty in concentrating. They may have difficulties in their occupational or social lives and be prone to motor vehicle accidents. The disorder has been medically linked to hypertension, which in turn puts people at greater risk of heart failure and stroke.

An electrocardiogram (ECG or EKG, abbreviated from the German Elektrokardiogramm) is a graphic produced by an electrocardiograph, which records the electrical activity of the heart over time [1]. Its name is made of different parts: electro, because it is related to electronics, cardio, Greek for heart, gram, a Greek roots meaning "to write". Specific waveforms within the ECG represent the electrical activity associated with mechanical events such as ventricular contraction and relaxation (systole and diastole). Analysis of the various waves and normal vectors of depolarization and re-polarization yields important diagnostic information [2].

ECG signals of the normal patient and apnea patient being taken for a period of 15minutes [3, 4] with the sampling interval of 4 msec. In this paper we will try to find out the nature of variability of the above two ECG signals using Finite Variance Scaling Method (FVSM). But before we proceed for the above action we have to consider that in practical cases all the observed data involve some amount of circumstantial errors which may creep in due change in environment, or systematic error which is due to factors inherent in the manufacture of the measuring instrument arising out of tolerances in the components of the instruments. Study of such data in presence of error may often not succeed to give true information. There is the need to remove these errors up to a satisfactory level. For these purpose we frequently use different methods of filtration in the time-dependent data. Here Simple Exponential Smoothing technique has been used for the filtration purpose.

The Hurst Exponent obtained from FVSM quantifies the relative affinity of a time series either to regress strongly to the mean or to cluster in a direction. Autocorrelation plots are used for checking randomness in a data set. This randomness is estimated by computing autocorrelations for data values at varying time lags. For random time series, such autocorrelations are near zero value for every time-lag, whereas for deterministic series, one or more of the autocorrelations will have notably non-zero values.

Partial autocorrelation plots are used here for model identification in Box-Jenkins models of the time series.

Semblance Analysis using the continuous wavelet transform has been done to investigate the similarity of the phase relationship locally between the two signals which is a function of frequency and time of the signals.

II. Theory

a) Simple Exponential Smoothing

Exponential Smoothing helps to produce a smoothed Time Series by assigning exponentially decreasing weights as the observation in the time series get older. Simple Exponential Smoothing [5] the prescribed model for a time series data $\{x_i\}; where\, i \quad 1,2,3,\ldots\ldots\ldots,n$ after being exponentially smoothed is $y_1 = x_1$ And $y_i \quad \alpha x_i + (1-\alpha) y_{i-1}; i \quad 1,2,3,\ldots\ldots,n$ where y_i is the smoothed data at the i-th position and α (0< α< 1) is a parameter. This is equivalent to $y_1 = x_1$ and

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$$y_i = \alpha x_i + \alpha(1-\alpha)x_{i-1} + \alpha(1-\alpha)^2 x_{i-2} + \ldots.$$

$$..+\alpha(1-\alpha)^{i-2}x_2 + \alpha(1-\alpha)^{i-1}x_1 \quad for\ i = 1,2,3,\ldots\ldots,n$$

where the sum of the corresponding weights α, α (1-α), α (1-α) ^{2},α (1-α) $^{i-2}$ and (1-α) $^{i-1}$ is equal to unity. Thus in effect, each smoothed value is a convex linear combination of all the previous observations as well as the current observation.

III. Finite Variance Scaling Method

A familiar version of Finite Variance Scaling Method (FVSM) is the Standard Deviation Analysis (SDA) [6, 7, 8], which is based on the assessment of the standard deviation D (t) of the variable x (t).

In a time series {x (t_i)} observed at the instants t_i for i=1, 2…, n it yields

$$D(t_i) = \left[\left\{\frac{\sum_{i=1}^{n} x^2(t_i)}{i}\right\} - \left\{\frac{\sum_{i=1}^{n} x(t_i)}{i}\right\}^{\frac{1}{2}}\right] \quad 1$$

For n=1, 2, 3…….j

Eventually it is observed [6, 7 and 8]

$$D(t) = t^H \quad 2$$

The exponent H is known as the Hurst exponent. It is evaluated from the gradient of the best fitted straight line in the log-log plot of D (t) against t. The value of the Hurst exponent ranges between 0 and 1. A value of 0.5 indicates a true random walk (a Brownian time series). In a random walk there is no correlation between any element and future element. A Hurst exponent value 0<H<0.5 will exist for a time series with anti-persistent behavior (negative autocorrelation) [9]. If the Hurst exponent is 0.5<H<1.0, the process will be a long memory process. A Hurst exponent value in this range indicates persistent behavior (or, a positive autocorrelation).

IV. Autocorrelation and Partial Autocorrelation

Autocorrelation is a statistical method used for time series analysis. It refers to the correlation of a time series with its own past and future values. The values of the autocorrelation coefficients serve two purposes. It can detect non-randomness in a data set. If the values in the data set are not random, then autocorrelation can help the analyst chose an appropriate time series model.

The set of autocorrelation coefficients arranged as a function of separation in time is the sample autocorrelation function (acf). If x_i be signal of length N and $\bar{x}$ be its overall mean i.e. $\bar{x} = \sum_{t=1}^{N} x_t$

The autocorrelation coefficient at lag k is given by:

$$r_k = \frac{\sum_{i=1}^{N-k}(x_i - \bar{x})(x_{i+1} - \bar{x})}{\sum_{i=1}^{N}(x_i - \bar{x})^2} \quad 3$$

The plot of the autocorrelation coefficients as a function of lag is called the correlogram.

Positive autocorrelation signifies the persistent trend in the series where the system likes to remain in the same state from one observation to the next. Whereas negative autocorrelation is distinguished by an inclination for positive departures from the overall mean $\bar{x}$ to follow a negative departure, and vice versa.

In order to find the connection between x_i and x_{i+k} partial autocorrelation is used where linear influence of the random variables lying between $x_{i+1},\ldots,x_{i+k-1}$ is filtered out of the x_i and x_{i+k} then the correlation of the transformed random variables is calculated. If we define a function $P(k)$ as

$$P(k) = \begin{pmatrix} 1 & \rho_1 & \cdots & \rho_{k-1} \\ \rho_1 & 1 & \cdots & \rho_{k-2} \\ \vdots & \vdots & \vdots & \vdots \\ \rho_{k-1} & \rho_{k-2} & \cdots & 1 \end{pmatrix} \quad 4$$

Then partial autocorrelation can be expressed as, [10]

$$\phi_{kk} = \frac{\Delta(P(k)^*)}{\Delta(P(k))} \quad 5$$

Where $P(k)^*$ is same as $P(k)$ except the kth column in equation 4 is replaced by ρ_k. ρ_k Is the autocorrelation function at lag k.

Partial autocorrelation is a commonly used tool for model identification. If the sample autocorrelation plot indicates that an AR model may be appropriate, then the sample partial autocorrelation plot is examined in order to identify the order. We look for the lag on the partial autocorrelation plot beyond which its values essentially become zero, more specifically where the values of the coefficients are considerably less than a 95% confidence level i.e. $\pm 2/\sqrt{N}$.

V. The Continuous Wavelet Transform and Semblance Analysis

The continuous wavelet transform (CWT) [11] of a signal $x(t)$ is given by

$$CWT(u,s) = \int_{-\infty}^{\infty} x(t) \frac{1}{|s|^{0.5}} \psi^* \left(\frac{t-u}{s} \right) dt \qquad 6$$

Where Ψ is the mother wavelet, and Ψ^* is complex conjugate of Ψ, s allows the wavelet to be stretched to various scales and u allows the wavelet to be translated to by various displacements. The CWT basically is the convolution of the signal with scaled version of the mother wavelet. Here, the complex Morlet wavelet has been used, which is defined as [11, 12]

$$\psi(x) = \frac{1}{\pi f_b} e^{j 2\pi f_c x} e^{-x^2 / f_b} \qquad 7$$

Where f_b tunes the wavelet bandwidth and f_c is the wavelet centre frequency. For $f_c = 1.0$, scale becomes equivalent to wavelength. The behaviour of the signal on different scales can be revealed by varying the scale s (in Eq. (6)). When the mother wavelet chosen here is complex and hence its real and imaginary parts generate a Hilbert transform pair, to order to have orthogonality. Since the mother wavelet is complex, the CWT will also be complex which has a phase at every time and scale. The cross-wavelet transform [13, 14] defined as:

$$CWT_{1,2} = CWT_1 \times CWT_2^* \qquad 8$$

CWT_1 & CWT_2 are the continuous wavelet transforms of two signals $x(t)$ and $y(t)$ $CWT_{1,2}$ is a complex quantity having an amplitude given by

$$A = |CWT_{1,2}| \qquad 9$$

and local phase θ given by:

$$\theta = \tan^{-1}\left(\Im(CWT_{1,2}) / \Re(CWT_{1,2}) \right) \qquad 10$$

θ varies between -π and +π.

The Semblance S is defined as:[15]

$$S = \cos^n(\theta) \qquad 11$$

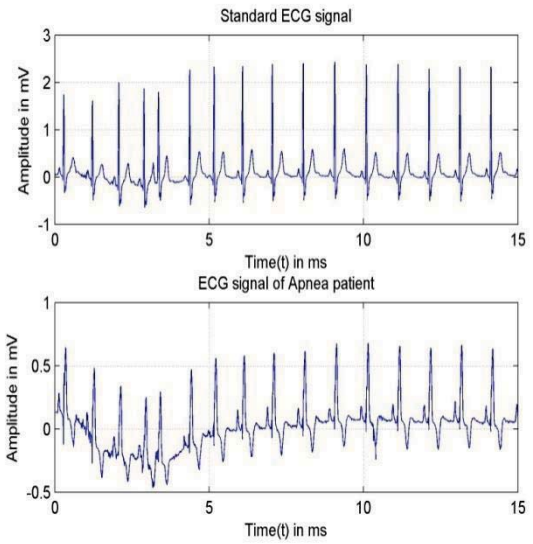
For every odd values of. $n \geq 0$

S may take a value between -1 and +1. The value of S gives the degree of correlation between the two signals as below:

$$S = \begin{cases} -1 & x \text{ and } y \text{ has negative correlation} \\ 0 & x \text{ and } y \text{ has NO correlation} \\ +1 & x \text{ and } y \text{ has positive correlation} \end{cases}$$

So if the value of S is close to -1, it implies that x and y has high negative correlation whereas its value close to +1 implies a high positive correlation between the signals. The value close to 0 indicates a poor correlation between the two signals.

VI. Results



The ECG signal for the normal patient and the apnea patient are shown in fig.1

Fig.1: ECG signals

The $D(t)\ vs.\ t$ curve for the two signals are shown in fig.2

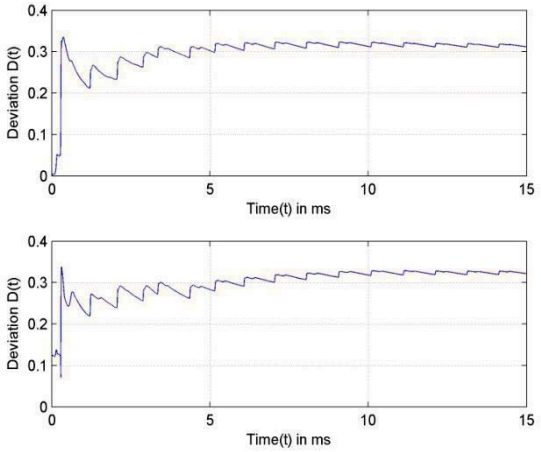


Fig.2: Deviation versus Time curve of ECG signal

We have applied the FVSM to obtain the Hurst exponent H for the time series ECG signals of the normal patient and apnea patient being taken for a period of 15minutes [3,4] with the sampling interval of 4 msec. The values of H obtained are given in table 1.

Table: 1

Signals	Hurst Exponent H
Normal Patient	0.2779
Apnea Patient	0.1300

The autocorrelation coefficients of the two signals for various lags up to 20 are given in fig.3

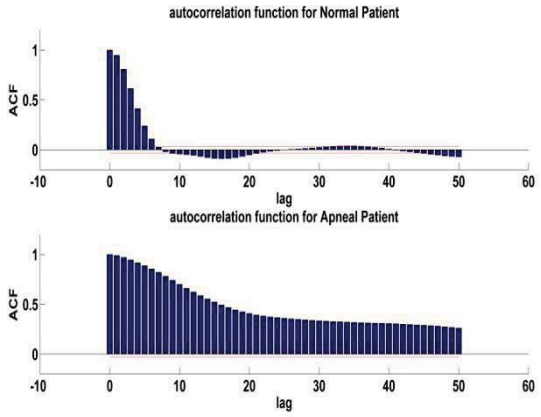


Fig.3: Autocorrelation of two ECG lead signal

The partial autocorrelation coefficients are given in fig.4

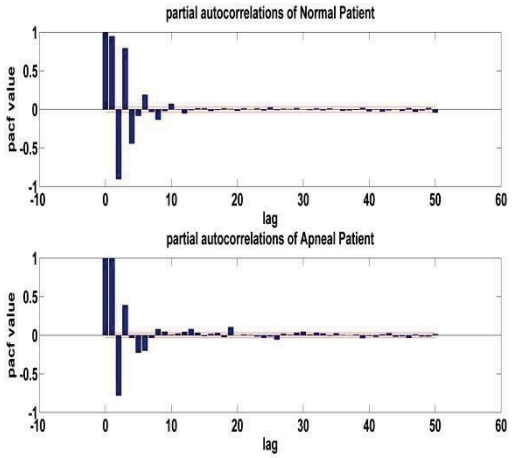


Fig.4: Partial Autocorrelation of two ECG lead signal

The Semblance analysis results shown in fig.5

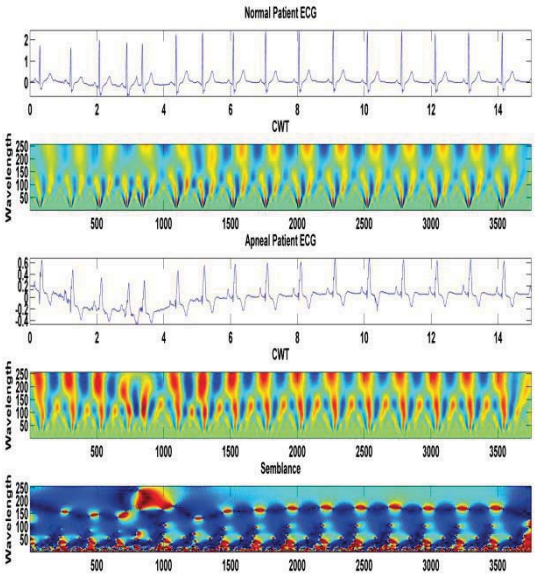


Fig.5: Semblance analysis of two signals

Bright red corresponds to a semblance of +1, 50% green to a semblance of zero, and dark blue to a semblance of -1.

VII. DISCUSSION

The Hurst exponent that we have obtained for both the normal and apneal patient are less than 0.5 which suggest that the signals are having anti-persistent behavior i.e. there are trends of a decrement in values followed by an increment and vice versa and it is more pronounced in case of the apneal patient.

The Fractal Dimension (D) is related to the Hurst exponent by the equation of D=2-H. Hence the D for the normal patient is 1.7221 and for the apneal patient it is 1.87. These values of D suggest that the

apneal patient signal has more self similarity than that of a normal patient.

From the auto-correlogram as shown in fig.3 we find that the autocorrelation coefficients die down to zero more rapidly than that of the apneal patient. The autocorrelation coefficients for apneal patient seem not to die down to zero except for large values of the lag. It signifies that the apneal patient's time series has a stronger trend compared to that of a normal patient. The auto-correlogram also suggests that both the systems from which the signals originated are Autoregressive (Markov) process (AR). The tendency of the autocorrelation coefficients of the apneal patient not to die quickly as compared to those of the normal patient can be taken as an indication of stronger nonstationarity of the former signal with respect to the later.

From the partial auto-correlogram as in fig.4 we can claim that normal signal is auto-regressive process of order 9 i.e. AR (9) but the patient signal is auto-regressive process of order 4 i.e. AR (4). Using the Yule Walker Equation [10], the model of the two data series can be estimated as

$$x_t = \delta + \sum_{i=1}^{9} \varphi_i x_{t-i} + e_t$$ for normal patient

And

$$x_t = \delta + \sum_{i=1}^{4} \varphi_i x_{t-i} + e_t$$ for apneal patient

Where $$\delta = \left(1 - \sum_i \varphi_i\right)\mu$$

For normal patient $\delta = 0.0792$ and for apneal patient $\delta = 0.006$.

The values of the coefficients φ_i as calculated by Yule walker Equation are given in the table 2.

Table: 2

i	φ_i for normal patient	φ_i for apneal patient
1	2.841	2.0254
2	-3.1143	-1.381
3	1.2009	0.3446
4	0.5002	0.0023
5	-0.5196	
6	-0.1257	
7	0.2836	
8	-0.0776	
9	-0.0163	

Solving the equation of the polynomial $\phi(z) = 1 - \sum_{i=1}^{p} \varphi_i z^i = 0$ we have obtained the complex roots which are found to be less than unit circle, which establish the nonstationarity of the signals. $p = 9$ for the normal patient and $p = 4$ for apneal patient.

Semblance analysis gives the phase relationship between the two signals. It is found that the two signals are highly negatively correlated at lower scales at regular intervals of time where as at higher scales these are highly positively correlated at regular intervals of time. At even higher scales (more than 200) the signals are mostly negatively correlated except at the time between 3-4 minutes.

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Analysis of Effect of MOV on Chaotic Ferroresonant Oscillations in unloaded Transformers by Chaos Theory

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Abstract - In this paper the effect of a parallel metal oxide surge arrester on the ferroresonance oscillations of transformers is studied. It is proved that ferroresonance phenomenon in transforemer can be classified in chaotic dynamics systems. In this contribution chaos occurs in system from a sequence of period doubling bifurcation (PDB). Analysis of dynamics of ferroresonant circuit is carried out using bifurcation theory. It is expected that the arresters generally cause ferroresonance drop out. Simulation has been done on a three phase power transformer with one open phase. Effect of varying input voltage is studied. The simulation results reveal that connecting the arrester to transformers poles, exhibits a great mitigating effect on ferroresonant over voltages. Phase plane along with bifurcation diagrams are also presented. Significant effect on the onset of chaos, the range of parameter values that may lead to chaos and magnitude of ferroresonant voltages is obtained, shown and tabulated.

Keywords : *component; Power Transformer, Phase Plane Diagram, Bifurcation Diagram, Chaotic Ferroresonance, Chaos Theory, Nonlinear Core loss Model, Metal Oxide Arrester (MOA).*

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Abstract - In this paper the effect of a parallel metal oxide surge arrester on the ferroresonance oscillations of transformers is studied. It is proved that ferroresonance phenomenon in transforemer can be classified in chaotic dynamics systems. In this contribution chaos occurs in system from a sequence of period doubling bifurcation (PDB). Analysis of dynamics of ferroresonant circuit is carried out using bifurcation theory. It is expected that the arresters generally cause ferroresonance drop out. Simulation has been done on a three phase power transformer with one open phase. Effect of varying input voltage is studied. The simulation results reveal that connecting the arrester to transformers poles, exhibits a great mitigating effect on ferroresonant over voltages. Phase plane along with bifurcation diagrams are also presented. Significant effect on the onset of chaos, the range of parameter values that may lead to chaos and magnitude of ferroresonant voltages is obtained, shown and tabulated.

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I. Introduction

Ferroresonance is a complex nonlinear electrical phenomenon that can cause dielectric & thermal problems to components power system. Electrical systems exhibiting ferroresonant behaviour are categorized as nonlinear dynamical systems. Therefore conventional linear solutions cannot be applied to study ferroresonance. The prediction of ferroresonance is achieved by detailed modeling using a digital computer transient analysis program [1]. Ferroresonance should not be confused with linear resonance that occurs when inductive and capacitive reactance of circuit is equal. In linear resonance the current and voltage are linearly related and are frequency dependent. In the case of ferroresonance it is characterized by a sudden jump of voltage or current from one stable operating state to another one. The relationship between voltage and current is depends not only on frequency but also on other factors such as system voltage magnitude, initial magnetic flux condition of transformer iron core, total loss in the ferroresonant circuit and moment of switching [2].

Ferroresonance may be initiated by contingency switching operation, routine switching, or load shedding involving a high voltage transmission line. It can result in Unpredictable over voltages and high currents. The prerequisite for ferroresonance is a circuit containing iron core inductance and a capacitance. Such a circuit is characterized by simultaneous existence of several steady-state solutions for a given set of circuit parameters. The abrupt transition or jump from one steady state to another is triggered by a disturbance, switching action or a gradual change in values of a parameter. Typical cases of ferroresonance are reported in [1], [2], [3] and [4]. Although analyzing methods such as harmonics balance method can be use for analyzing nonlinear differential equations, but solving these equations lead to a set of complex algebraic equations [3]. Thus, scientists should use other methods to solve nonlinear dynamic equations. One of these methods is bifurcation theory which some articles use from this method [5, 6, 7]. Bifurcation theory enables us to describe and analyze qualitative properties of solutions (fixed points) when system parameters change. Studying ferroresonance by bifurcation theory has been carried out [8, 9, 10, 11]. But there are some problems in these articles. For example method used in [15] is valid only in limited cases while creating a bifurcation diagram by a continuation method can be more systematic and save computational effort [3]. The samples of ferroresonace in power system have been described in [12, 4, 13]. Analyzing chaotic ferroresonant behavior in power transformer and dependence of this behavior on system parameters such as amplitude of voltage source, capacitance and resistance of system, core loss, initial conditions and e and effect of neutral resistance in damping ferroresosnant oscillations and change in system

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behavior from chaotic to multi frequency in [3, 7, 14, 15, 16, 17] have been studied. Evaluation of route to chaos in transformer with modeling and solving equations in conditions that defined model for core loss is considered linear and effect of complexity of circuits breaker models in transmission and distribution lines with considering effect of damping in system and elimination of caused harmonics in [10, 18] have been studied. Theory of nonlinear dynamics has been found to provide deeper insight into the phenomenon. [19], [11], [20] and [21] are among the early investigations in applying theory of bifurcation and chaosto ferroresonance. The susceptibility of a ferroresonant circuit to a quasi-periodic and frequency locked oscillations are presented in [22]. The effect of initial conditions is also investigated. The effect of transformer modeling on the predicted ferroresonance oscillations has been studied in [23]. Using a linear model, authors of [24] have indicated the effect of core loss in damping ferroresonance oscillations. The importance of treating core loss as a nonlinear function of voltage is highlighted in [22]. An algorithm for calculating core loss from no-load characteristics is given in [25]. Evaluation of chaos in transformer, effect of resistance of key on the chaotic behavior transformer and subharmonics that produced with ferroresonance in this type transformer and quantification of the chaotic behavior of ferroresonant transformer circuits are studied in [20], [25] and [26].

II. System Modeling for Transformer

Transformer is assumed to be connected to the Power System while one of the three switches are open and only two phases of it are energized, which produces induced voltage in the open phase. This voltage, back feeds the distribution line. Ferroresonance will occur if the distribution line is highly capacitive. System involves the nonlinear magnetizing reactance of the transformer's open phase and resulted shunt and series capacitance of the distribution line.

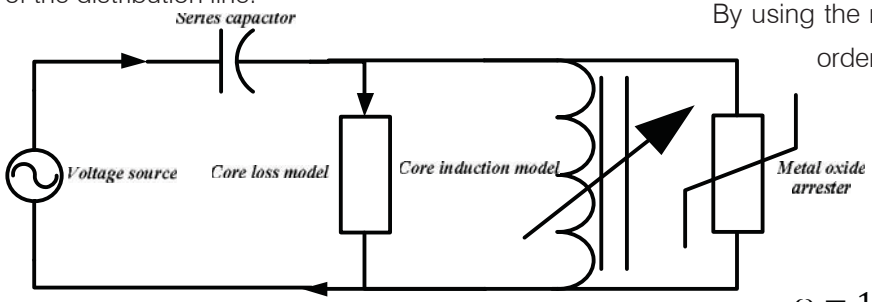

Figure. 1 Circuit of system

Base system model is adopted from [3] with the MOV arrester connected across the transformer winding which is showed in Fig. 1 Linear approximation of the peak current of the magnetization reactance can be presented by Eq. (1):

$$i_l = a\lambda \quad (1)$$

However, for very high currents, the iron core might be saturated where the flux-current characteristic becomes highly nonlinear. The li $\lambda - i_l$ characteristic of the transformer can be demonstrated by the polynomial in Eq. (2)

$$i_l = a\lambda + b\lambda^q \quad (2)$$

Arrester can be expressed by the Eq. (3):

$$V = K I^{\alpha} \quad (3)$$

V represents resistive voltage drop, I represents arrester current and K is constant and α is nonlinearity constant. The differential equation for the circuit in Fig. 1 can be derived as follows:

$$\omega E \cos \omega t = p^2 \lambda + \frac{p\lambda}{RC} + \left(\frac{1}{C}\right)$$

$$\left(a\lambda + b\lambda^q\right) + \left(\frac{1}{C}\right)\left(\frac{|p\lambda|}{K}\right)^{\alpha} sign(p\lambda) \quad (4)$$

Where dt d$p = \frac{d}{dt}$ and ω represents the power frequency and E is the peak value of the voltage source, shown in Fig. 1.

Presenting in the form of state space equations, λ and $p\lambda$ p will be state variables as follows:

$$\lambda = x_1 , \; p\lambda = x_2 \; (5)$$

$$x_1 = x_2 \; (6)$$

$$x_2 = \omega E \cos \omega t - \frac{x_2}{RC} - \left(\frac{1}{C}\right)\left(ax_1 + bx_1^{\,q}\right)$$

$$-\left(\frac{1}{C}\right)\left(\frac{|x_2|}{K}\right)^{\alpha} sign \; x_2 \quad)7($$

Multiple Scales Method

By using the multiple scales method one obtains a first order approximation for the solution of Eq. (7) as:

$$x_1 = h\cos(\omega t - \gamma) + O(\varepsilon) \quad (8)$$

The parameters μ, a and k are independent of ε. Further, the frequency of system is such that

$$\omega = 1 + \varepsilon\delta \quad (9)$$

Where δ is named external detuning. By using the multiple scales method, we seek of first order uniform expansion of Eq. (7) in the form:

$$x_1(t;\varepsilon) = x_{1,0}(T_0, T_1) + \varepsilon x_{1,1}(T_0, T_1) + \cdots \quad (10)$$

Where $T_0 = t$ and $T_1 = \varepsilon T_0$. In term of T_1 the time derivative becomes:

$$\frac{d}{dt} = D_0 + \varepsilon D_1 + \varepsilon^2 D_2 + \cdots \tag{11}$$

Substituting Eq. (10) and Eq. (11) into Eq. (36) and equating coefficient of like power of ε, we obtain:

$$O(\varepsilon^0):$$
$$D_0^2 x_{1,0} = 0 \tag{12}$$

$$O(\varepsilon):$$
$$D_0^2 x_{1,1} + a x_{1,1} + 2D_0 D_1 x_{1,0} + \mu D_0 x_{1,0} + b x_{1,1}^q = k\cos\omega_0 t \tag{13}$$

The solution of Eq. (12) can be expressed as:

$$x_{1,0} = A(T_1)T_0 + A_0 \tag{14}$$

Substituting Eq. (14) in Eq. (13):

$$D_0^2 x_{1,1} + a x_{1,1} + b x_{1,1}^q = -2A' - \mu A + \frac{k}{2} e^{i\delta T_1} + cc \tag{15}$$

Where cc is complex conjugate of preceding terms and the prime indicates the derivation with respect to T_1. Using Eq. (7) in eliminating the lead to secular terms in $x_{1,1}$ from Eq. (12), we obtain:

$$2A' - \mu A + \frac{k}{2} e^{i\delta T_1} = 0 \tag{16}$$

If A is defined in the polar form $A = \frac{1}{2}\alpha e^{i(\beta+\delta T_1)}$, where α, β are functions of T_1 with separating real and imaginary part in Eq. (13):

$$\alpha' e^{i(\beta+\delta T_1)} + \alpha i(\beta' + \delta) e^{i(\beta+\delta T_1)} + \frac{1}{2}\alpha e^{i(\beta+\delta T_1)} - \frac{k}{2} e^{i\delta T_1} = 0 \tag{17}$$

From Eq. (17), we obtain Eq. (18) and Eq. (19):

$$\alpha' \cos\beta - \alpha\beta' \sin\beta - \alpha\delta\sin\beta + \frac{1}{2}\alpha\cos\beta = 0 \tag{18}$$

$$\alpha' \sin\beta + \alpha\beta' \cos\beta + \alpha\delta\cos\beta + \frac{1}{2}\alpha\sin\beta = 0 \tag{19}$$

With multiplying – sinβ in Eq. (18) and cosβ in Eq. (19) we have:

$$\alpha\beta' + \alpha\delta + \frac{k}{2}\sin\beta = 0 \tag{20}$$

With multiplying cosβ in Eq. (18) and sinβ in Eq. (19) we have:

$$\alpha' + \frac{1}{2}\alpha - \frac{k}{2}\cos\beta = 0 \tag{21}$$

Setting $\alpha' = 0$ and $\beta' = 0$ in Eq. (20) and (21) we find that their fixed points are given by:

$$\alpha_0\delta + \frac{k}{2}\sin\beta_0 = 0 \tag{22}$$

$$\frac{1}{2}\alpha_0 - \frac{k}{2}\cos\beta_0 = 0 \tag{23}$$

Squaring and adding Eq. (22) and (23) yield the frequency response equations:

$$\alpha_0^2\delta^2 + \frac{1}{4}\alpha_0^2 = \frac{1}{4}k^2 \tag{24}$$

The stability of the fixed points depends on the eigenvalues of the jacobian matrix (22), (23); that is, the eigevalue of:

$$A = \begin{bmatrix} 1/2 & \frac{k}{2}\sin\beta \\ \frac{k}{2\alpha^2}\sin\beta & -\frac{k}{2}\cos\beta \end{bmatrix} \tag{25}$$

Determinant of [λI − A yields eigenvalues:

$$\lambda^2 + \left(\frac{k}{2\alpha}\cos\beta\right)\lambda - \frac{k}{4\alpha}\cos\beta - \frac{k^2}{4\alpha^2}\sin^2\beta = 0 \tag{26}$$

Where λ is eigenvalue. Substituting the polar form of A into Eq. (11) and substituting result into Eq. (12), we find that, to first approximation x1is given by:

$$x_1 = \alpha\cos(\omega t + \beta) + \cdots \tag{27}$$

$$\text{If } k = 0 \xrightarrow{\text{yields}} \begin{cases} \alpha\beta' = -\alpha\delta \\ \alpha' = -\frac{1}{2}\alpha \end{cases} \tag{28}$$

For nontrivial solutions, α ≠ 0 and it follows from Eq. (28) that:

$$\beta = -\delta T_1 + \beta_0,\ T_1 = \varepsilon t \xrightarrow{\text{yields}} \beta = -\varepsilon\delta t + \beta_0 \tag{29}$$

Substituting Eq. (29) into Eq. (27), we find that to the first approximation, the free oscillations of Eq. (7) are given by:

$$x_1 = \alpha\cos(\omega_0 t + \beta_0) + \cdots \tag{30}$$

Where α is given by Eq. (28), which has the normal form of a supercritical pitchfork bifurcation. Equation of eigenvalues introduce as the following equation:

$$\lambda^2 + \left(\frac{1}{2}\alpha_0 - \frac{1}{2}\right)\lambda - \frac{1}{4} - \delta^2 = 0 \tag{31}$$

We obtain first order approximation of Eq. (8) by multiple scale method and by using the chaos theory we discuss in case of stability.

Bifurcation and chaos theory

Bifurcation theory describes and studies behavior of system with change in one or more parameters of system and discusses in case of stability and instability of fixed points in the values of system parameters.
Suppose system is defined as Eq. (32):

$$\dot{X} = f(x, \gamma) \tag{32}$$

Where x is a state vector. In fact flux and voltage in terminal of transformer are state variables. γ is a parameter of system that can be value of series capacitance or amplitude of input voltage. for γ = γ c at which the vector field f losses its structural stability is called a bifurcation point and γc the value of bifurcation. For analyzing and studying in bifurcation diagram we use of jacobian matrix, J = Df as the linearization of f at (x0, γ0) which points x0 are fixed points.

If eigen values of jacobian matrix are considered as λ_i when real$\{\lambda_i\} \neq 0$ jacobian matrix is hyperbolic and other wise nonhyperbolic.

Saddle node bifurcation

When J is nonhyperbolic, i.e. J has a zero eigenvalue and no other eigen value with zero real part, saddle node bifurcation (SNB) occurs. SNB is caused with changes in the number of fixed points. Indeed, one stable fixed point and unstable fixed point cause SNB. Necessary and enough conditions for SNB are:

Necessary conditions:

$$f(x_0, \gamma_0) = 0,\ \det\left(J(x_0, \gamma_0)\right) = 0 \tag{33}$$

Enough conditions:

$$\left.\frac{\partial f}{\partial x}\right|_{(x_0,\gamma_0)} = 0 \tag{34}$$

$$\left.\frac{\partial f}{\partial \gamma}\right|_{(x_0,\gamma_0)} \neq 0 \tag{35}$$

$$\left.\frac{\partial^2 f}{\partial x^2}\right|_{(x_0,\gamma_0)} \neq 0 \tag{36}$$

Pitch fork or transcritical bifurcation points appoint necessary conditions, too. For more detail see [30].
Hopf bifurcation

If J has a pair of complex conjugate on the imaginary axis and other eigenvalues lying off the imaginary axis, hopf bifurcation (HB) occurs. if periodic solutions are unstable, bifurcation is said to be subcritical and supercritical if stable.

Thus, connects fixed points to periodic solutions. SNB and HB are stationary point. Periodic solutions that are caused by a HB can increase bifurcations and complexity of system behavior, themselves. Limit cycles which are caused by a HB can involve system into chaotic region and global bifurcation occurs.

Stability of periodic solutions is determined by its characteristic.

Suppose $x = \varphi(x_0, t) + \vartheta(t)$ be a small perturbation to the periodic solution to Eq. (30) and $\vartheta(0) \ll 1$. We obtain:

$$\dot{x} = f(x) = f(\varphi\ x_0, t\ + \vartheta(t)) \qquad (37)$$

$$= f(\varphi(x_0, t) + \frac{d}{dt} f(\varphi(x_0, t) \times \vartheta + O(\vartheta^2) \qquad (38)$$

$$\dot{x} = \dot{\varphi}(x_0, t) + \dot{\vartheta}(t) = f(\varphi(x_0, t) + \vartheta_0 \qquad (39)$$

Thus,

$$\dot{\vartheta} = f(\varphi(x_0, t) + O(\vartheta^2) \qquad (40)$$

If $\frac{d}{dt} f(\varphi(x_0, t)$ be equal with A (t) Because (x_0, t) is periodic in T, A (t) is periodic, too. Thus:

$$\dot{\vartheta} = A(t)\vartheta, A(t) = A(t + T) \qquad (41)$$

Fundamental matrix for Eq. (75) is Ψ (T) , such as:

$$\dot{\Psi}(t) = A(t)\Psi(t), \Psi(0) = I \qquad (42)$$

$$\vartheta(t) = \Psi(t)\vartheta(0) \qquad (43)$$

Now, we define the mondoromy matrix M to be Ψ (t). Eigenvalues of M are multipliers, denoted by Mi , i = 1, n. If all eigenvalues of M lie in the unit circle, we find out,

$$\lim_{n\to\infty} |\vartheta(nt)| = 0 \qquad (44)$$

For a periodic solution one of multipliers is equal to +1, with corresponding eigenvector tangential to the periodic orbit at x.

Stability of a limit cycle is determined by its multipliers and depending on the way in which multipliers venter or leave the unit circle.

Cyclic fold bifurcation

If one of multipliers enters or leaves the unit circle along the positive real axis cyclic fold bifurcation (CFB) occurs. In Fig. 2 (a) is example of this bifurcation.

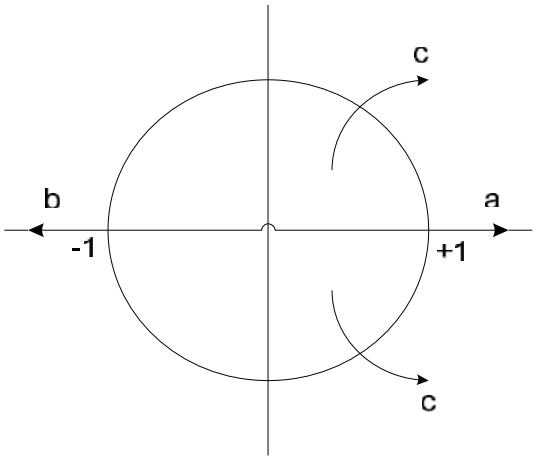

Fig. 2. Multiplier crossings of the unit circle

Period doubling

If one of the multipliers leaves unit circle along the negative real axis bifurcation is said to be a period doubling bifurcation (PDB) (b in Fig. 2).
This bifurcation causes new solutions with period 2T. If this behavior continues, causes solutions with infinitive period. These solutions are aperiodic which are called chaotic solutions. If one of the lyapunov exponents be positive for systems of ODEs, is representing of chaotic behavior in system.

Torus bifurcation

If a complex conjugate pair of multipliers with Re{mi } ≠ 0 leaves the unit circle, causes quasi-periodic solution. C indicates this behavior. Quasi periodic solutions have period that is equal to in commensurate of main period T. In phase plane diagram these solutions create figures in form of torus.

Routes to chaos

Chaotic solutions are aperiodic and unstable solutions. These solutions depend on initial conditions. In this section we imply 4 routes to chaos: PDB

Crises
Intermittency
Torus bifurcation
Intermittency is a route to chaos. In this route oscillation in regular mode occasionally interrupted by turbulent burst of aperiodic oscillations at irregular intervals and chaos emerges in system. In case of torus bifurcation if stable periodic solution undergoes to a supercritical secondary hopf bifurcation with changes in parameter of system. This causes two quasi periodic solutions with two in commensurate frequencies.
When parameter increases torus is destroyed and system becomes chaotic. Sudden changes in parameter of system cause crises and system becomes chaotic. When crises occur chaotic attractor enters unstable periodic solutions or saddle points.
Crises have different types. Some of these types are:

Exterior crisis, blucsky catastrophe or dangerous bifurcation, interior crisis and attractor merging crisis. For more detail, see [27].

For recognizing chaotic oscillations, we use from lyapu exponent. If eigen values of system are λilyapunov exponent:

$$L_i = \lim_{t\to\infty} \frac{1}{t} \ln(\lambda_i(t)), i = 1, n \quad (45)$$

If lyapunov exponent be positive, routes will repel other routes and other wise will attract other route. In case of stability of fixed points, when all lyapunov exponents are negative, these points are stable and in limit cycle lyapunov exponent is zero. Necessary and enough condition for chaotic behavior system are one or more positive lyapunov exponents. For more details, see [28].

II. Simulation Results

Typical values for various system parameters considered for simulation are as given below [5]:

$$q = 5 \rightarrow \begin{cases} b = 0.0005 \\ a = 0 \end{cases}$$

$$q = 7 \rightarrow \begin{cases} b = 0.001 \\ a = 0 \end{cases}$$

$$q = 11 \rightarrow \begin{cases} b = 0.0072 \\ a = 0.0028 \end{cases} ;$$

$$\omega = 1\ p.u., R = 100\ p.u., C = 0.047\ p.u.$$
$$E = 0 - 6\ p.u., K = 2.501, \alpha = 25.$$

Initial conditions:

$$\lambda(0) = 0, p\lambda(0) = 1.44\ p.u.$$

Table (1) shows different values of E, considered for analyzing the circuit in absence of surge arrester.

Table 1. (A) Behaviour of System Without Mov For E= 1,2, 3

E / q	1	2	3
5	Priodic	Priodic	Priodic
7	Priodic	Priodic	Chaotic
11	Priodic	Priodic	Chaotic

(B) Behaviour of System without Mov For E= 4, 5, 6

E / q	4	5	6
5	Chaotic	Chaotic	Chaotic
7	Chaotic	Chaotic	Chaotic
11	Chaotic	Chaotic	Chaotic

Table 2 includes the set of cases which are considered for analyzing the circuit including arrester:

Table 2. (A) Behaviour of System with Mov for E= 1, 2, 3

E / q	1	2	3
5	Priodic	Priodic	Priodic
7	Priodic	Priodic	Priodic
11	Priodic	Chaotic	Priodic

(B) behaviour of system with mov for e= 4, 5, 6

E / q	4	5	6
5	Priodic	Priodic	Priodic
7	Priodic	Priodic	Chaotic
11	Chaotic	Chaotic	Chaotic

Time domain simulations were performed using the MATLAB programs which are similar to EMTP simulation [3]. For cases including arrester, it can be seen that ferroresonant drop out will be occurred.Fig. 3 show the phase plane plot of system states without arrester for E=1 p.u.

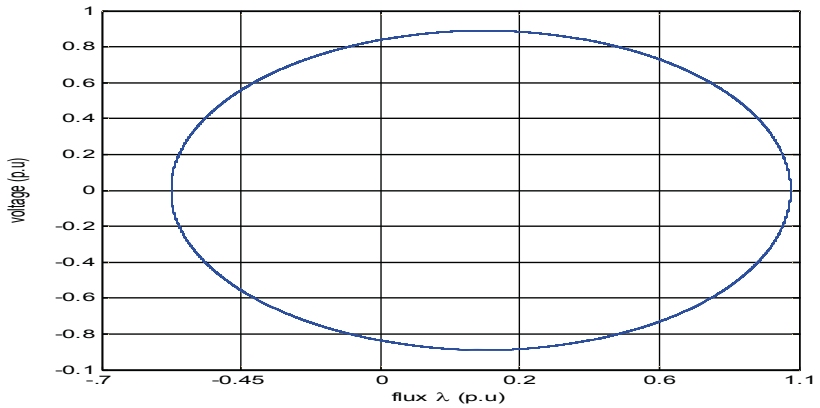

Figure. 3 Phase plane diagram for E=1, q=11 without MOV

When Vin increases system is entered into saturation section of magnetization curve and ferroresonance occurs. In Figs. 4, 5, 6, 7 this phenomenon is shown. Behavior of system is single frequency but PDB has occurred. Magnetization curve in Fig. 4 and phase plane diagram in Fig. 5 and voltage and flux waveforms are shown in Figs. 6 and 7. These figures are gained whenVin = 3.5, q = 7. Phase plane diagram shows this reality that behavior of system is a single frequency behavior. But voltage and flux waveforms show that behavior of system has an undesirable effect on system insulation and maybe damage it.

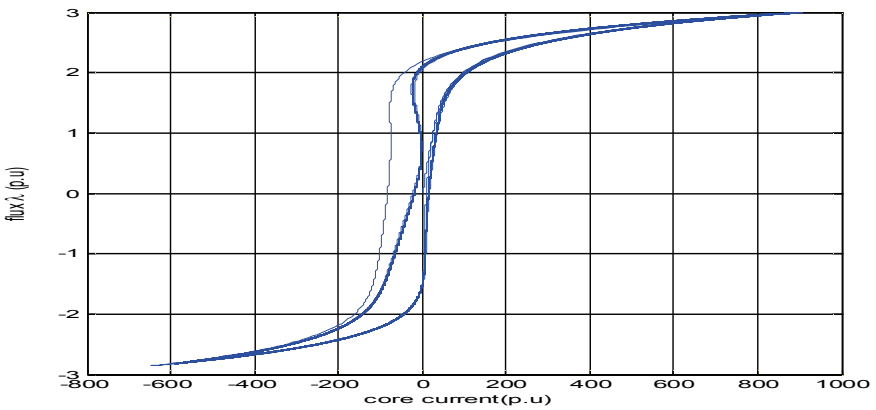

Fig. 4: Nonlinear transformer magnetization curve for second nonlinear core loss model forVin = 3.5, q = 7 4

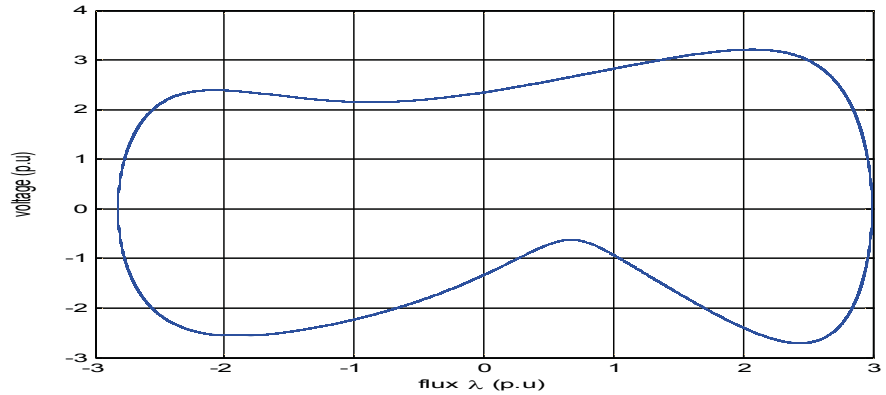

Fig. 5: phase plane diagram for Vin = 3.5, q = 7

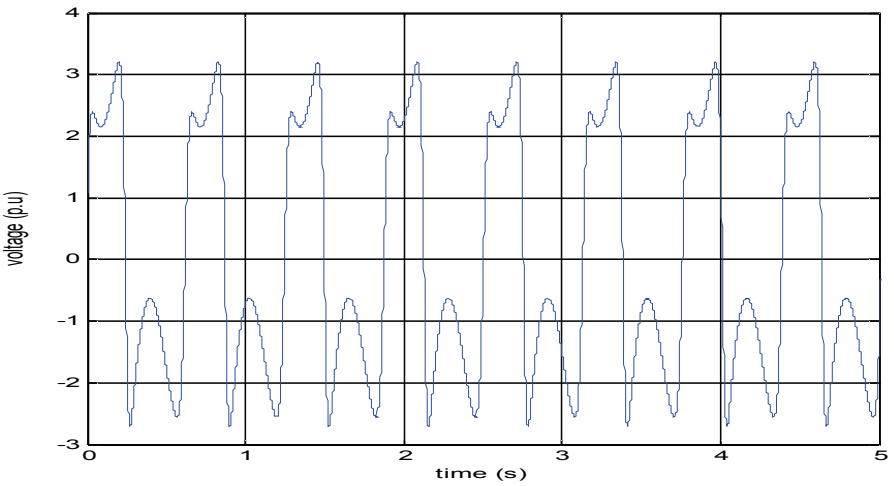

Fig. 6: Voltage waveform for V = 3.5, q = 7

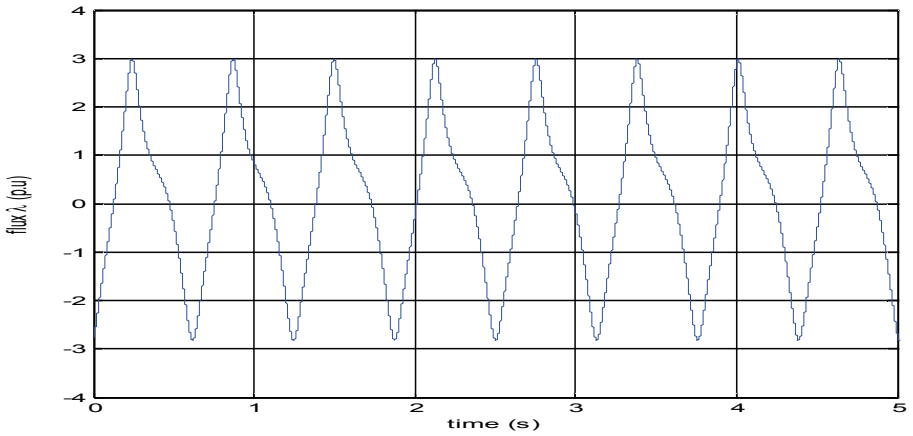

Fig. 7: Flux waveform for V_{in} =3.5,q=7

Fig. 8: shows the phase plane plot and time domain simulation of system states without arrester for E=4 p.u.which depicts chaotic behavior and Fig. 9 shows the corresponding time domain wave form.

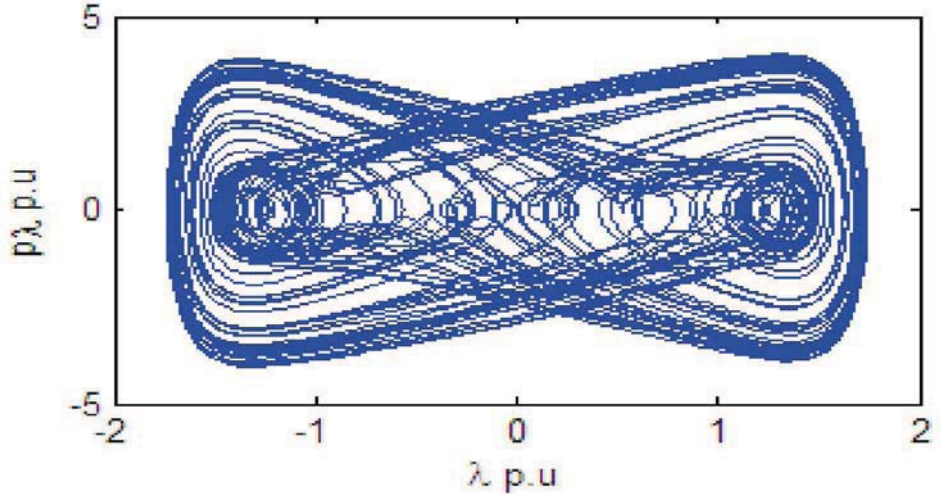

Figure 8: Phase plane diagram for E=4, q=11 without MOV

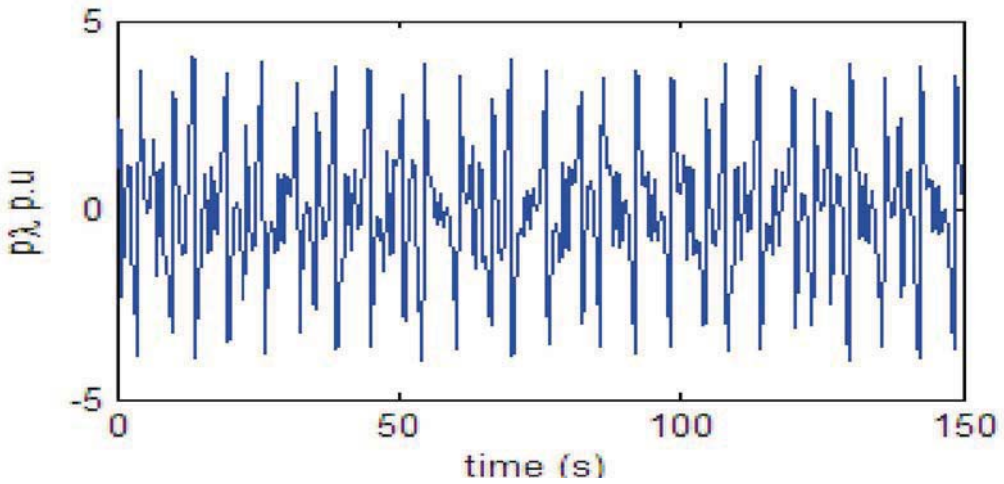

Figure.9 : time domain chaotic wave form for E=4, q=11 without MOV

Also figures 10-12 show the bifurcation diagram of chaotic behaviours for three of values of q. The system shows a greater tendency for chaos for saturation characteristics with lower knee points, which corresponds to higher values of exponent q.

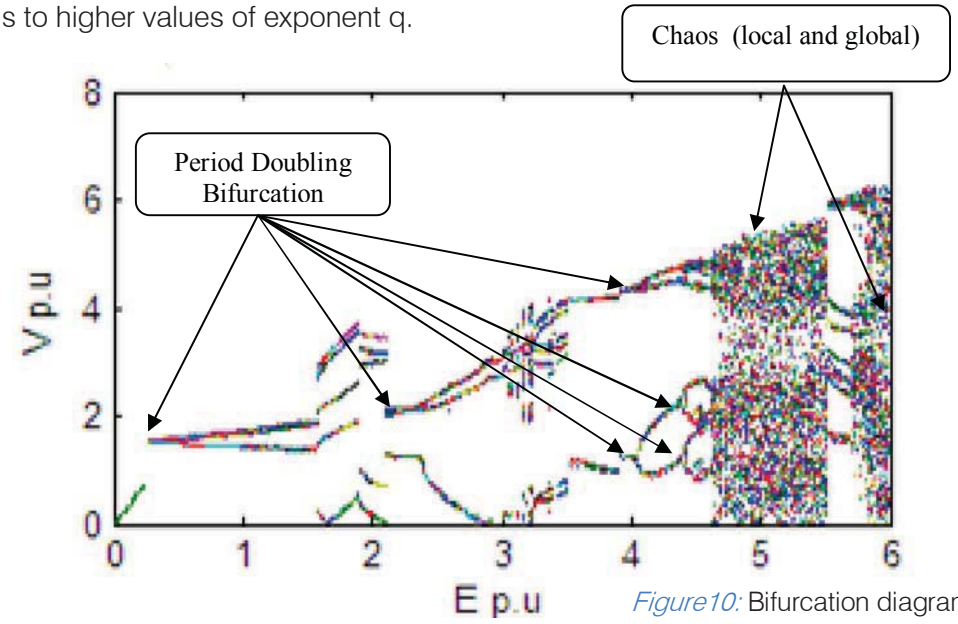

Figure10: Bifurcation diagram for q=5 without MOV

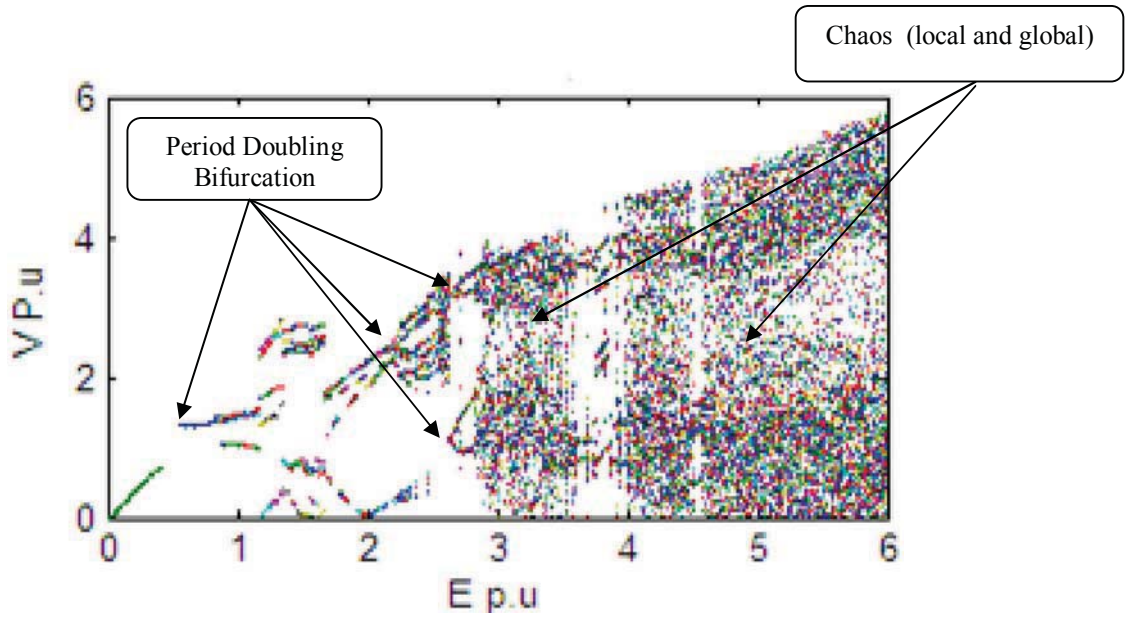

Figure 11 Bifurcation diagram for q=7 without MOV

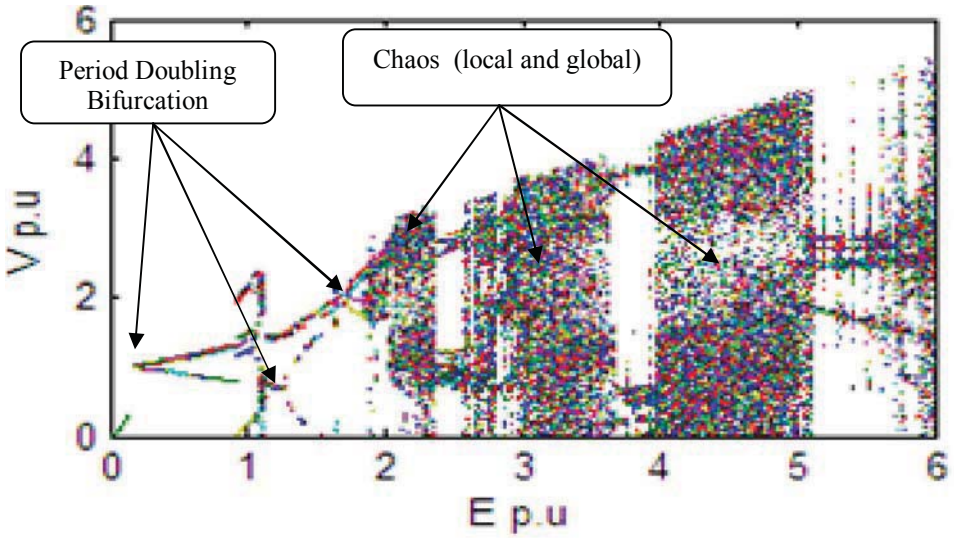

Figure 12: Bifurcation diagram for q=11without MOV

Fig. 13, Fig. 14 and Fig. 15 show that chaotic region mitigates by applying MOV surge arrester. Tendency to chaos exhibited by the system increases while q increases too.

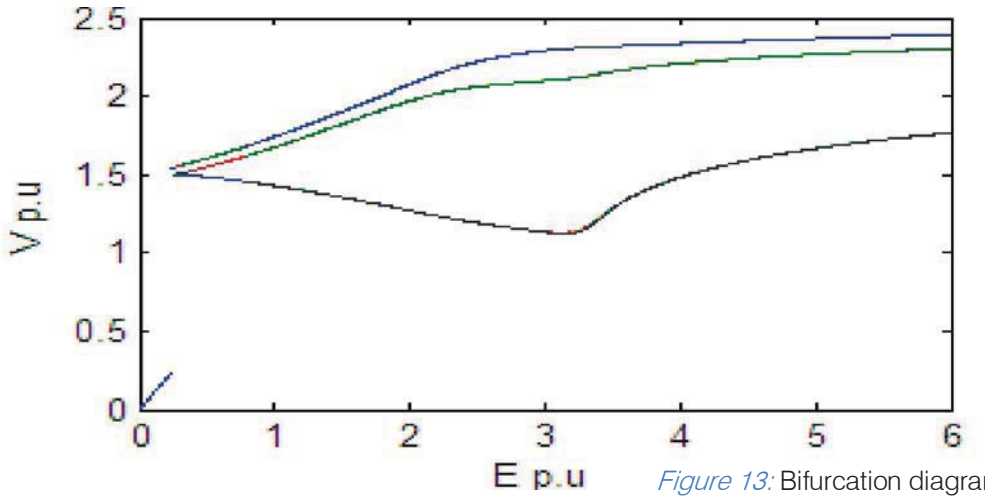

Figure 13: Bifurcation diagram for q=5 with MOV

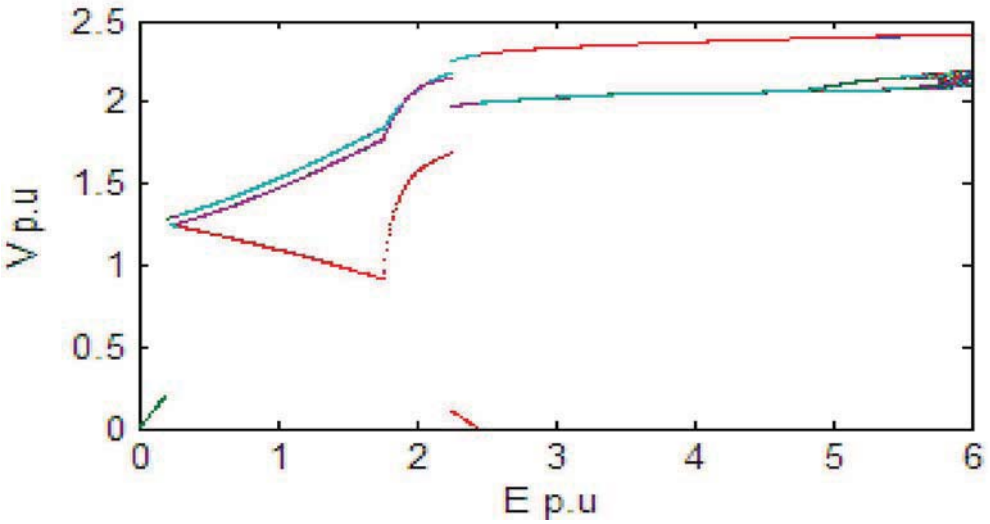

Figure 14 : Bifurcation diagram for q=7 with MOV

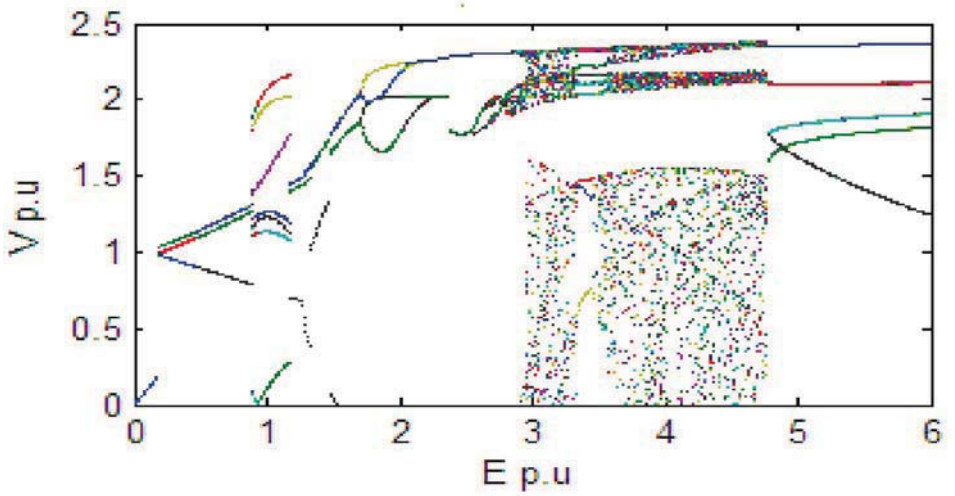

Figure 15: Bifurcation diagram for q=11 with MOV

With consideration to Fig. 13, Fig. 14 and Fig. 15 MOV makes a mitigation in ferroresonance chaotic behavior in transformer that in down value of q the chaotic region are removed and the behavior will be periodic, for greater value of q for example for q=11 independent chaotic regions which can be created under MOV nominal voltage have survived so chaotic behavior has been eliminated. Figs. 16, 17 show that chaotic region mitigates by applying MOA surge arrester. The system shows a greater tendency for chaos for saturation characteristics with lower knee

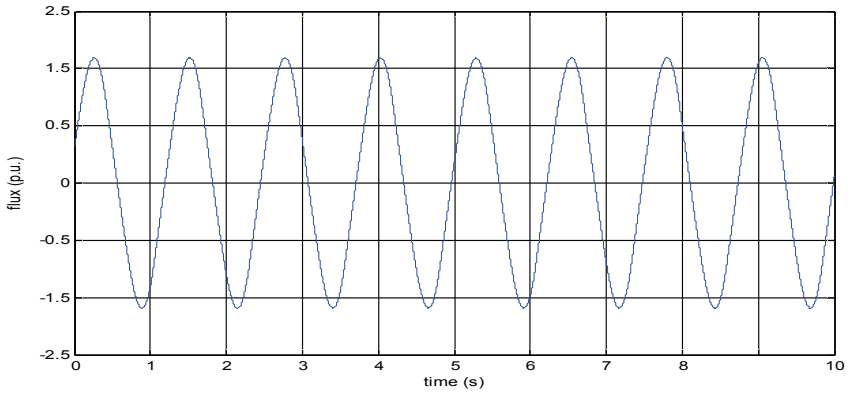

Fig. 16: Flux waveform with MOA at vin= 3.1p.u.

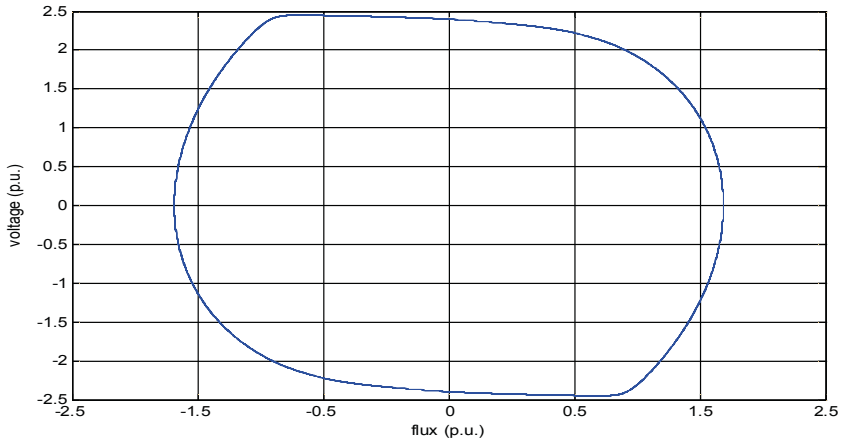

Fig. 17: Phase plane diagram with MOA at vin= 3.1p.u.

Considering to Fig. 17 MOA makes a mitigation in ferroresonance chaotic behavior in the transformer that in down value of q the chaotic region are removed and the behavior will be periodic, for greater value of q such as q=11 independent chaotic regions which can be created under MOA nominal voltage have survived so chaotic behavior has been eliminated. Tendency to chaos exhibited by the system increases while q increases too.

III. Conclusion

Chaotic ferroresonant oscillations of unloaded transformer nonlinear core loss model have been described. The presence of the arrester results in clamping the Ferroresonant over voltages in the studied system. The arrester successfully suppresses or eliminates the chaotic behaviour of proposed model. Consequently, the system shows less sensitivity to initial conditions in the presence of the arrester. It is seen from the bifurcation diagram that chaotic ferroresonant behavior depends on parameter q. MOV makes a mitigation in ferroresonance chaotic behavior in transformer that in down value of q the chaotic region are removed and the behavior will be periodic. System stability increased with decreasing q and chaotic regions are eliminiated. It is found when q=11 at vin=4 p.u. beahavior of system is chaotic while for q=7 in the same value of vin system is in subharmonic mode and its stability is more than case that q=11. It was shown that chaos occurs in transformer from a sequence of PDB. It was found that nonlinear magnetization curve has a great influence on bifurcation diagrams and domains of ferroresonance occurrence. nonlinear core loss model has been used in dynamics equations. It was found that the nonlinear core loss model causes the mitigation and delay in chaotic ferroresonant oscillations. Also presence of nonlinear term in core loss function causes PDBs become more regular.

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Queuing Algorithem Based Quality of Service (Qos) For Scheduling Environment Model in Wimax Network with Opnet Modeler

By Arun Kumar, Dr. A K Garg
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Keywords : *WiMAX, Load, Delay, Throughput, OPNET etc.*

GJRE-F Classification : *FOR Code: 100510*

Strictly as per the compliance and regulations of:

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Keywords: WiMAX, Load, Delay, Throughput, OPNET etc.

I. Introduction

IEEE 802.16 [1] is a very promising system enabling broadband wireless access (BWA). IEEE 802.16 standard also known as worldwide interoperability for microwave access (WiMAX) defines two modes to share wireless medium: point-to-multipoint (PMP) mode and mesh mode. In the PMP mode, a base station (BS) serves several subscriber stations (SSs) registered to the BS. In IEEE 802.16, data are transmitted on the fixed frame based. The frame is partitioned into the downlink subframe and the uplink subframe. Frame duration and the ratio between the downlink subframe and the uplink subframe are determined by the BS. In the PMP mode, the BS allocates bandwidth for uplink and downlink. The BS selects connections to be served on each frame duration[2]. the IEEE 802.16 standard [3] defines four types of service flows, each with its own QoS needs. Each connection between the SS and the BS is coupled with one service flow. The Unsolicited Grant Service (UGS) transmit constant bit rate (CBR) flows of CBR like applications such as Voice over IP. The real-time Polling Service (rtPS) is considered for applications with real time needs which produce variable size data packets regularly, such as MPEG video streams. In this class, QoS guarantees are given in the form of restricted delay with minimum bandwidth guarantees. The non real-time Polling Service (nrtPS) is adequate for better than- best-effort services such as FTP services. Similar to rtPS, minimum bandwidth guarantees are also given to nrtPS connections. The Best Effort service (BE) is used for best-effort traffic such as HTTP[4]. For years, the IEEE has devoted continuous efforts to develop the wireless metropolitan area network (MAN) 802.16 standard, streamlined as the Worldwide Interoperability for Microwave Access (WiMAX) by the WiMAX Forum. This standard has since attracted a great deal of attention in both the research and industry communities, and is touted as the next killer technology that promises to offer multiplay services in the future wireless multimedia marketplace. The main advantages of WiMAX lie in its cost-competitive deployment and comprehensive quality of service (QoS) support for large numbers of heterogeneous mobile devices with high-datarate wireless access. Since 2004, WiMAX has established its relevance as a wireless extension (or alternative) to conventional wired access technologies, such as T1/E1 lines, cable modems, and digital subscriber line (xDSL), extending the reach to remote areas. Mobile WiMAX, based on the IEEE 802.16-2004 and IEEE 802.16e amendment [5], fills the gap between the wireless local area network (WLAN) and third-generation (3G) cellular systems with respect to their data rate and coverage trade-offs, and acts as a strong competitor to the current 3G Partnership Project (3GPP) long-term evolution (LTE) on the road to 4G wireless broadband markets[6]. there are huge and different kinds of videos streaming from different users which may influence each other and thus, it is essential to enforce a scheduling policy designed for suitable video metrics and efficient network utilization, preferably in a distributed manner[7].

II. History of Scheduling Environment

Many papers has been proposed new packet scheduler environment for 802.16 network, in order to provide different levels of QoS guarantees for various applications. This is driven by the lack of standardisation for the Admission Control and Uplink Scheduling

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algorithm for rtPS, nrtPS and BE service flows in the 802.16 standard. [8] Proposes an architecture that introduces a framework for the scheduling algorithm and admission control policy for 802.16. They also suggest system parameters that may be used, and define traffic characteristics for which the network can provide QoS .[9] provides a detailed description of the proposed architecture and more background on the 802.16 standard. Authors in [10] Presents a scheduler where the priority is based on the channel and service quality. Huei-Wen Ferng and Han-Yu Liau[11] has proposed how to simultaneously achieve fairness and quality-of-service (QoS) guarantee in QoS-oriented wireless local area networks (LANs) is an important and challenging issue. Targeting at this goal and jointly taking priority setting, fairness, and cross-layer design into account, four scheduling schemes designed for the QoS-oriented wireless LAN mainly based on concepts of deficit count and allowance are proposed in this paper to provide better QoS and fairness. Bader Al-Manthari, et al.[12] has proposed a novel downlink packet scheduling scheme for QoS provisioning in BWASs. The proposed scheme employs practical economic models through the use of novel utility and opportunity cost functions to simultaneously satisfy the diverse QoS requirements of mobile users and maximize the revenues of network operators. Liang Zhou, et al.[7] has proposed important issue of supporting multi-user video streaming over wireless networks is how to optimize the systematic scheduling by intelligently utilizing the available network resources while, at the same time, to meet each video's Quality of Service (QoS) requirement. In this work, they proposed the problem of video streaming over multi-channel multi-radio multihop wireless networks, and developed fully distributed scheduling schemes with the goals of minimizing the video distortion and achieved certain fairness. HONGFEI DU, et al.[6] has proposed the design issues and the state of the art of multimedia downlink scheduling in the multicast/broadcast-based WiMAX system. This proposed a viable end-to-end framework, connection-oriented multistate adaptation, by considering cross-layer adaptations in source coding, queue prioritization, flow queuing, and scheduling. Its performance is confirmed by simulations on important metrics, showing that the framework can effectively accommodate heterogeneity in link variations, queue fluctuations, and reception diversities.

III. WiMAX Architecture

Broadband wireless architecture is being standardized by the IEEE 802.16 Working Group (WG) and the Worldwide Interoperability for Microwave Access (WiMAX) forum [9]. The basic IEEE 802.16 architecture consists of one Base Station (BS) and one or more Subscriber Stations (SSs) [7]. Figure (1) shows a typical IEEE 802.16 network in PMP mode comprising a Base Station (BS) that communicates with one or more Subscriber Stations (SS) known as Customer Premises Equipment (CPE) [4][10]. IEEE 802.16 specifies the following modes of deployment architectures [11]:

- **Point-To-Point (PTP):** A connection between one BS and one SS. The PTP mode extends the range over the PMP mode.
- **Point-to-MultiPoint (PMP):** A connection between one BS and multiple SS nodes. The BS always coordinates the uplink and downlink transmission. This mode supports multicast communication.
- **Point-To-Consecutive Point (PTCM):** It involves the creation of a closed loop through multiple PTP connections.
- **Mesh:** SSs can communicate with each other without the coordination of a BS. Both BS and SS are stationary while clients connected to SS can be mobile. BS acts as a central entity to transfer all the data from SSs in PMP architecture. Two or more SSs are not allowed to communicate directly. Transmissions take place through two independent channels downlink channels (from BS to SS) and uplink channel (from SS to BS). The uplink channel is shared among all the SSs while the downlink channel is used only by BS.

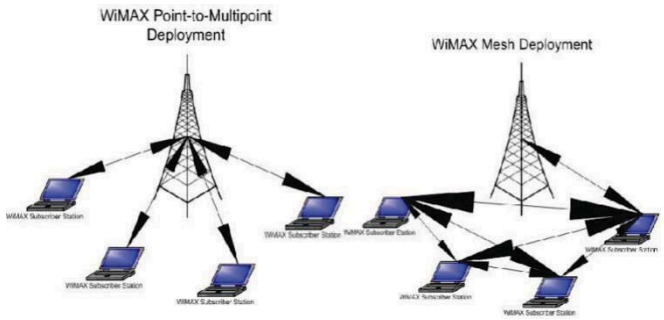


Figure 1: Mesh and Point-to-Multipoint (PMP) mode [7].

IV. Why use OPNET

A good modeling tool should closely reflect the true behavior of a network or computer system. It should support a wide range of network protocols and applications. It must be easy to use and master, especially for beginners. On the other hand, a good modeling tool should provide comprehensive technical support and maintenance assistance. In summary, we believe that a good modeling tool should have the following properties:

- **Versatile:** able to simulate various network protocols/applications under a wide range of operating conditions.

- **Robust:** provide users with powerful modelling, simulation and data analysis facilities.
- **User Friendly:** easy to use and master.
- **Traceable:** easy to identify modeling problems and simulation faults. OPNET is hailed by network professionals because it has all these properties. OPNET is a software package that has been designed with an extensive set of features. It can be tailored to suit almost every need of network protocol designers, network service providers, as well as network equipment manufacturers. OPNET supports most network protocols in existence, both wire line and wireless. It can be used to model and analyse a complex system by performing discrete event simulations.

V. Sheduling Queuing Algorithem

The research of packet scheduling algorithms in wireless channel has been taken for a long time[9,10,11]. In the physical world, the purpose of a real-time system is to have a physical effect within a chosen time-frame. Typically, a real-time system consists of a controlling system (computer) and a controlled system (environment). The controlling system interacts with its environment based on information available about the environment. On a real-time computer, which controls a device or process, sensors will provide readings at periodic intervals and the computer must respond by sending signals to actuators. It is imperative that the state of the environment, as received by the controlling system, be consistent with the actual state of the environment. Otherwise, the effects of the controlling systems' activities may be disastrous. Therefore, periodic monitoring of the environment as well as timely processing of the sensed information is necessary . In a real-time system, there may be unexpected or irregular events and these must also receive a response. On the other hand, having a sufficient number of processors, one is able to schedule the tasks without missing any deadlines. In this dissertation, various type of scheduling algorithm, like FIFO,PQ,WFQ, for comparison of four type of service, with its own QoS needs, as explained as under.

a) Fifo Queuing Algorithem

First-in-first-out (FIFO) is the simplest type of queuing. The incoming packets are placed in a single queue and are served in the order as they were received. This queuing policy requires very little computation and its behavior is very predictable, i.e. packet delay is a direct function of the queue size. There are many undesirable properties related to this queuing policy, due to the simplistic nature.

- It is impossible to offer different services for different packet classes since all packets are inserted into the same queue.
- If an incoming flow suddenly becomes bursty, then it is possible for the entire buffer space to be filled by this single flow and other flows will not be serviced until the buffer is emptied.

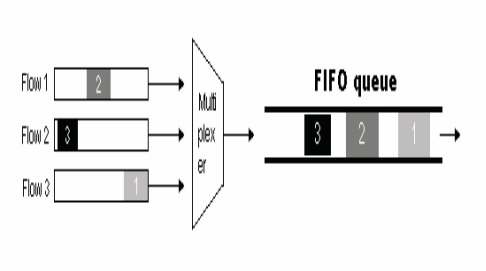


Figure 2: FIFO queuing[14]

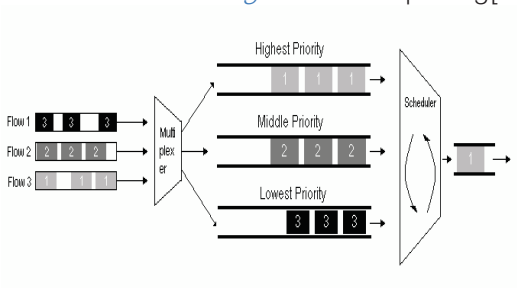


Figure 3: Priority queuing[14]

b) Priority Queuing

A simple way of offering different services to different classes of packets is Priority Queuing. Its operation involves classifying each incoming packet into different priorities and placing them into separate queues accordingly. The packets that have the highest priority are transmitted on the output port before the packets with lower priority. Even though this queuing policy is a good way of providing differentiated service, it also has some shortcomings, like large continuous flow of high priority traffic into the queue, equals excessive delay, and perhaps even service starvation for lower priority packets. Further, in our case we make use of both a non-preemptive priority network and a preemptive priority network. The difference between a so-called non-preemptive priority queuing discipline and a preemptive priority queuing discipline is that the transmission of a packet in a non-preemptive queuing discipline is not interrupted once it has begun.

c) Weighted Fair Queuing

Processor Sharing (PS) is a class of queueing mechanism with the purpose of allowing fair access for each incoming flow and to prevent a bursty flow from consuming all of the output bandwidth. PS contains a queue for each distinct flow and packets from each flow are inserted into its respective queue. The system then services each queue one packet at a time in a round–robin fashion.

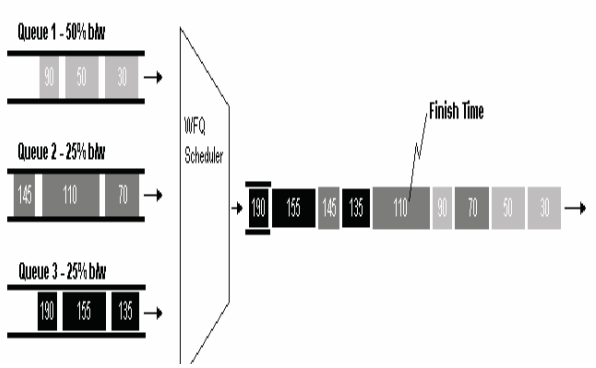


Figure 4 : WFQ Scheduling[14]

Weighted Fair Queuing (WFQ) is a variation of Processor Sharing (PS) in that it supports flows with different bandwidth requirements. It does this by assigning each queue with different weights that corresponds to the proportion of the allocated output bandwidth. In WFQ, each incoming packet is time stamped with a finish time in addition to being placed into its corresponding flow queue. Unlike Processor Sharing, selection of which packet to be serviced is now based on this time stamp on each packet. Further packets are serviced by examining their finish times. The ones with earlier finish times are transmitted before the ones with later finish times. It is possible for a later packet to have a finish time stamp that is smaller than an earlier packet.

VI. Simulation Methodology with Opnet Modeler

OPNET Modeler 14.0 is a powerful discrete-event simulation tool with an easy and convenient development environment and GUI I used an OPNET modeler 14.0 with WiMAX Wireless Advanced Module to develop a simulation for this paper. The key parameters that are provided here are: delay, network load, through put and application response time. A snap shot of the system simulation model is captured in figure (5).The proposed scenario consists of a wireless Network implemented as a WiMAX network, which was modeled within an area of10km x 10km.

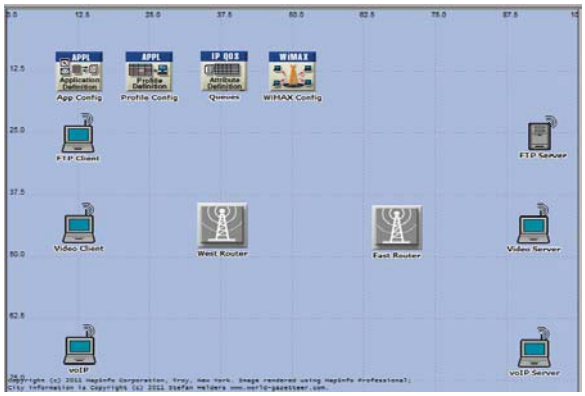


Figure 5: WiMAX network scenario with QoS

A WiMAX Configuration Node (WiMAX_config) is used to store profiles of PHY and Service Class which can be referenced by all WiMAX nodes in the network.

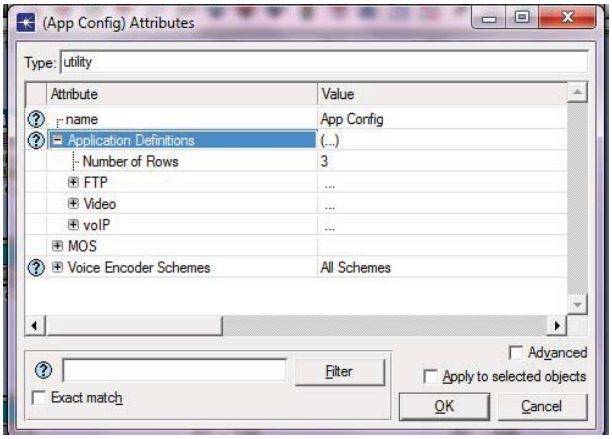


Figure 6: Application configuration

To support the VoIP ftp and video application, the application definition has to be configured.

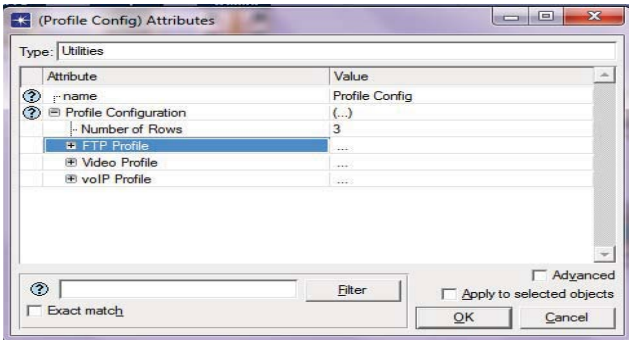


Figure 7: Profile configuration

Once the application configuration has been set, the profile would be ready to be configured since the profile definition was built upon the VoIP, ftp and Video application.

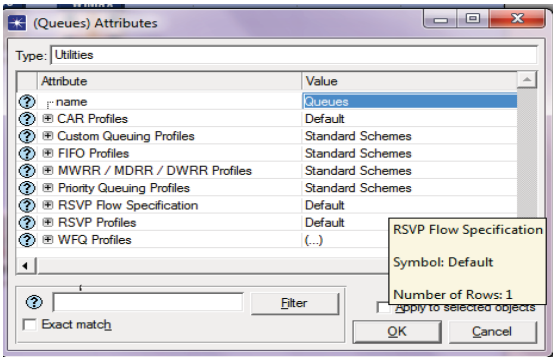


Figure 8: Queue Attribute

Queue attribute show the different parameter of FIFO, PQ and WFQ algorithms.

VII. Simulation Results

WiMAX is often compared with Wi-Fi and existing 3G technologies, such as UMTS and CDMA2000. With Wi-Fi's advantage in speed and 3G's advantage in mobility, WiMAX sits between the two in data transfer rate and coverage range. The duration of the simulation for all four scenarios was 200 seconds. In all simulated results, dark blue line indicates the FIFO scenario, red line represents the PQ scenario, and green line indicates the WFQ scenario.

In case video traffic, Average bytes per second forwarded to all video conferencing applications by the transport layers in the network.

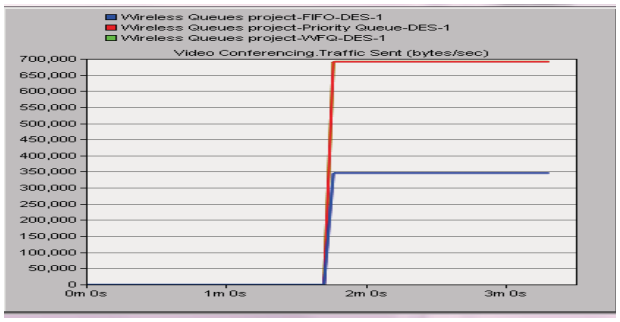


Figure 9: Video conference traffic (sent byte/sec)

In case FIFO (for the video traffic) number of transmitted byte is less (350,000 byte/sec) but in case of PQ and WFQ In which green lines are underneath the dark red line, number of transmitted byte is 700,000 byte/sec as shown in figure 9.Thus for the Video conference traffic FIFO traffic is less as compared to the PQ and WFQ traffic.

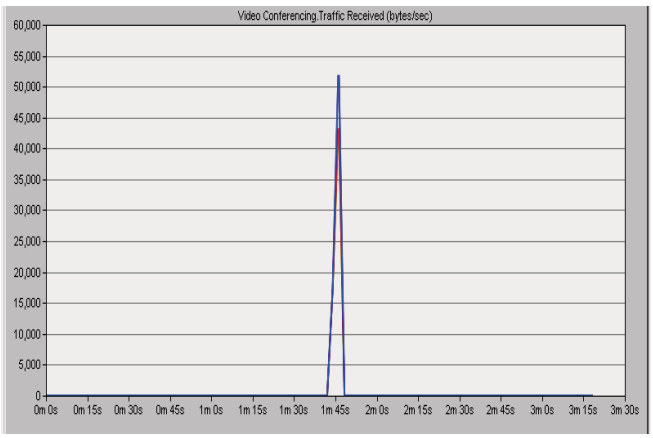


Figure 10: Video conference received (sent byte/sec)

In FIFO number of received byte is 53,000 byte/sec but in case of PQ and WFQ In which green lines are underneath the dark red line, number of received byte is 43,000 byte/sec as shown in figure 10. Thus in this scenario result of FIFO is better than result of PQ and WFQ.

In the scenario of voice traffic(shown in figure 11) number of transmitted byte is 32,000 byte/sec in FIFO,PQ and WFQ algorithms in which green lines line are underneath the dark blue line.

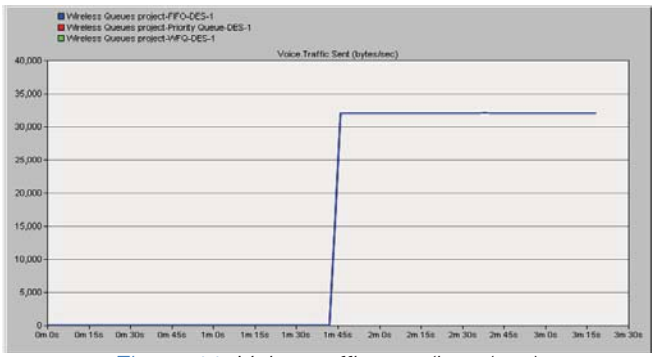


Figure 11: Voice traffic sent(byte/sec)

After the transmission of voice traffic, number of received byte/sec is varried with time,as shown in figure 12.In this scenerio, in the case of WFQ, at the time 1m 45s,number of received byte is 41,000 and in the case of FIFO, at the time 2m 0s,number of received byte is 64,000 and and in the case of PQ, at the time 2m 8s,number of received byte is 64,000.Thus traffic is varied at every instant of time at all.

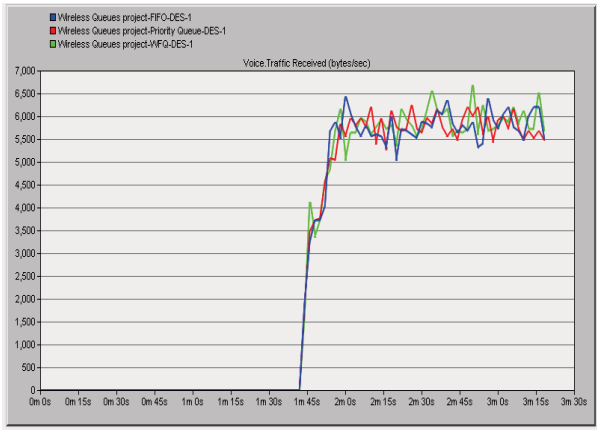
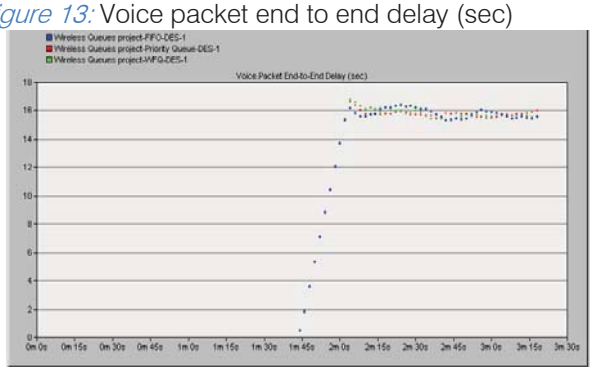


Figure 12: voice traffic received (byte/sec)

The total voice packet delay, called "analog-to-analog" or "mouth-to-ear" delay = network_delay + encoding_delaydecoding_delay+compression_delay+ decompression_dela. In the scenario of voice traffic (shown in figure 13) packet end to end delay

Figure 13 Voice packet end to end delay(sec)

Figure 13: Voice packet end to end delay (sec)



varied every instant of time at all in FIFO,PQ & WFQ algorithms.

VIII. Conclusion

The purpose of the paper is to demonstrate the comparative study of different queuing algorithms, implementation in WiMAX network with OPNET modeler . The factors that were studied in the simulation are the end to end delay traffic sent and traffic received. The introduction of an queue will not add more hardware since its elements will be deleted once it is extracted from the original queue. If there are connections with different service levels in the network, the scheduler allocates enough slots for each connection, so that the QoS requirements are supported.

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Pc Controlled Multichannel Timer Schedular

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Abstract - Looking at today's scenario throughout the world we get to see how fast paced our life has become and time is the most valuable thing. Communication media have played an important role in bringing theworld closer.The system deals with customized industrial process manager at the vicinity of personal computer. For this we are using one of the most widely available technologies namely wireless communication.In any manufacturing process there are lots of valves & different types of Relay controlled which has to be continuously ON-OFF at regular intervals depending upon requirement of production.

This paper aims to acknowledge the importance of the multichannel timer scheduler in the coming years andalso proposes a novel method of to develop such a system which will be able to program the respective process-switching sequence.Thus this paper not only aims to contribute to the "PC based Wireless controlling of multichannel timer scheduler but also utilizes Embedded technology and wireless communication to minimize the complications of multichannel controlling through manual methods".

GJRE-F Classification : FOR Code: 861603

Strictly as per the compliance and regulations of:

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Madhurya Mudiar

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I. Introduction

Phenomenal growth of Wireless technology has led to the suggestions that PC will find its way into the industries. The above mentioned technologies have played an important role in making world closure in this scenario since they permit easy and power saving deployment. The latest application of these technologies is to enable humans to control multichannel processes in industries to our own comfort. In any manufacturing process there are lots of valves & different types of Relay controlled which has to be continuously ON-OFF depending upon requirement of production. We are going to develop such a system which will be able to program the respective process-switching sequence. User will be able to reprogram the time sequence of each valve operation. We will be implementing SCADA Supervisory control & data acquisition.A computer system for gathering & analyzing real time data. SCADA systems are used to monitor and control equipment in industries. Imagine the convenience, if we could control different devices at home/industry by using a single PC. Our project aims at the same and could be used to control the printer power, loads & other household electrical appliances

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Our project is wireless technology based low cost, compact module which will basically have two units:-

- One Transmitter unit for sending control code.
- And one receiver for accepting the code.

Thus the complete system becomes customized industrial process manager.

II. Problem Defination

In industries and factories we see that machines with controllers and control panel have to be under the supervision of a technical personnel and its mandatory for him to be present at the site of the machine all the time so that he can manually has access to control panel (in order to modify the parameters). This leads to his unavailability for some other work and also unnecessary loss of valuable time for him. Even controlling home appliances like heaters, security systems etc. From remote would add a greater degree of convenience to the user. For this we came up with this project so that the above stated problems can be successfully overcome as the machines and appliances can be controlled while being on a terminal.

III. Literature Survey

The solution to above-mentioned problem can be achieved in following ways:-

- The device which has to be controlled is connected to the relays which can be set ON/OFF by just clicking on a PC. On this the computer will generate a code through the serial port and is available at the transmitter system.
- For controlling multiple devices wireless Rf transmitters & receiver can be circuited Due to this wireless technology the user can control the multiple devices by using a controller and personal computer to control an appliance by sending a control word using transmitter placed in the remote location and a receiver to enable receiving action.
- Due to the micro controller technology based system, we can program a timer to ON/OFF any devices for a particular amount of time.
- One more method exits in which we can use a remote control to control the device by just pressing the remote for ON/OFF via PC.

- One more efficient way of controlling is by using a micro controller and personal computer to control an appliance by sending a control word using transmitter placed in the remote location and a receiver to enable receiving action.
- The main advantage of the system is that it will be compact, portable, and reliable and efficient. Thus due to above advantages we have chosen this method for our project.

IV. Proposed System

a) System design

The module consists of a micro controller and Personal Computer. They are interface by wireless communication .The PIC is interfaced with the relay unit through its ports which can later be connected to multichannel process to be controlled

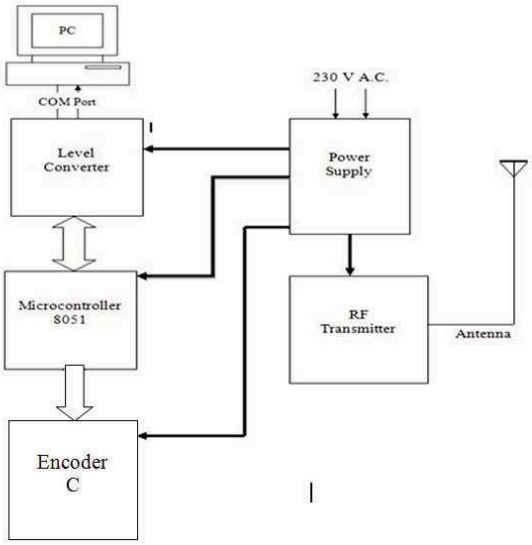

Figure- I: Block Diagram of transmitter section

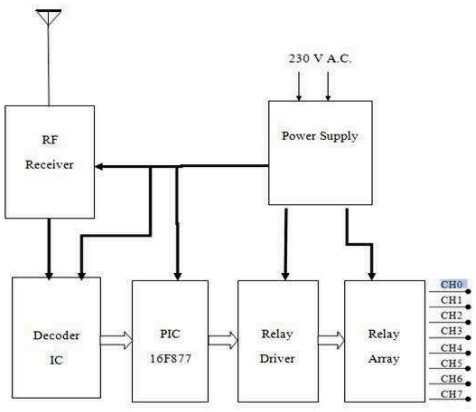

Figure-II : Block Diagram of receiver section

The proposed block diagram of our project consisting of the transmitter board (for sending) and receiver board is as shown above The following are the brief explanation of the working principle of the various major block or sections used in the system:

Power Supply

This unit will supply the various voltage requirements of each unit. This will be consisting of transformer, rectifier, filter & regulator. The rectifier used here is bridge rectifier. It will convert 230VAC into desired 5V/12V DC.

MAX 232

This section will be used to convert TTL logic into RS232 logic and vice-versa. IN TTL---logic 1 is +5V and logic 0 is 0V. In RS232---logic 1 is -10V & logic 0 is +10V. This unit will provide interface that is required to communicate microcontroller with RS232 based devices using serial communication link. The MAX232 IC is dedicated for the logic conversion. This unit is also called as a logic converter or a level converter. This unit requires +_5V DC for its proper operation.

Microcontroller

This unit is controlling the actions of the transmitter side of the transmitter module. It is responsible for. It receives the serial data from the RS 232 unit and converts it into parallel data. This software code is responsible for ON-OFF action of appliances which has been selected by the user. The controller here will be 8051 family. The code will written in C language and will burn the program into the code memory using a programmer. This unit requires +5V dc supply.

Encoder

The 212 encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/ data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the 212 series of encoders.

Decoder

The 212 decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek_s 212 series of encoders (refer to the encoder/decoder cross reference table). For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and

data from a programmed 212 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The 212 series of decoders are capable of decoding information's that consist of N bits of address and 12_N bits of data. of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

PIC

PIC decodes the code Microcontroller has a set of ready codes, which are there at the transmitter side also. For a particular received code, microcontroller sets a particular port's pin or resets it if device is to be switched off. Relay driver drives the relay. It functions as a switch. Relay works on electromagnetic principle. Thus whenever a '1' comes from the microcontroller, relay driver connects VCC across the relay and the device which has been connected across the relay turns on

Decoder

The 212 decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek_s 212 series of encoders (refer to the encoder/decoder cross reference table). For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 212 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT

Relays

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field, which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. These relays are used since they are small in size and are capable of handling highvoltages. Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.

V. Development Tools

Keil (µVision 2)

The Keil C51 Cross Compiler is an ANSI C Compiler that is written specifically to generate fast, compact code for the 8051 microcontroller family. The C51 Compiler generates object code that matches the efficiency and speed of assembly programming.

Introduction to Visual Basic

Welcome to Microsoft Visual Basic, the fastest and easiest way to create applications for Microsoft Windows® .Whether you are an experienced professional or brand new to Windows programming, Visual Basic provides you with a complete set of tools to simplify rapid application development.

The Visual Basic programming language is not unique to Visual Basic. The Visual Basic programming system, Applications Edition included in Microsoft Excel, Microsoft Access, and many other Windows applications uses the same language. The Visual Basic Scripting Edition (VBScript) is a widely used scripting language and a subset of the Visual Basic language. The investment you make in learning Visual Basic will carry over to these other areas. Whether your goal is to create a small utility for yourself or your work group, a large enterprise-wide system, or even distributed applications spanning the globe via the Internet, Visual Basic has the tools you need.

Eagle(Easily Applicable Graphical Layout Editor)

The EAGLE is an editor, which is easy-to-use, yet powerful tool for designing printed circuit boards (PCBs). It is a complete platform for the development of any type of complicated & sophisticated multilayered PCBs.

Mikrol CCS PIC programming
Customer Computer Services (CCS) compiler ports the Microchip PIC12x, PIC16x, PIC18x, and dsPIC superset of ANSI C to work with embedded micros, such as fuse and interrupt level support. CCSLOAD features a Windows user interface with extensive diagnostics, serialization, and security options as well as a command line interface that will run on Linux and Window's platforms

VI. Future Scope

The latest application of these technologies is to enable humans to control multichannel process to their own comfort. Uses the latest technology of wireless communication. It can be used basically as a timer scheduler to schedule the sequence of various processes through automation easing manual operation.

Enables humans to control multichannel process to their own comfort. Uses the latest technology of wireless communication. To control a plant or equipment in industries such as:

- Telecommunications, water and waste control, energy, oil, gas refining & transportation.
- Computer systems that control industrial processes.
- Gas refining & transportation.
- Manufacturing.
- Production, power generation, fabrication & refining.
- Infrastructures processes and include water treatment and distribution, waste water collection.
- Oil and gas pipelines
- Electrical power transmission and distribution, Wind Farms
- Large communication systems.
- Facility processes occur both in public facilities and private ones, including buildings, airports, ships, and space stations.

VII. Result

The PC serial port is a powerful platform for implementing projects dealing with the control of real-world peripherals. This port can be used to control the printer as also household and other electrical appliances.The computer program through the interface circuit controls the relays, which, in turn, switch the appliances on or off.

- By clicking on the available options on the control screen of the personal computer to on or off a particular device, a code is generated. The time interval and the modes are selected by the user.
- Initially we have to select the port.
- As soon as we select the right port following message is displayed.
- The reset all options resets all the options selected by the user

There are three modes

Manual mode

In manual mode the user can control the ON/OFF action of channels by simply clicking on the option available. When OFF action is selected green signal is indicated on the channel. When ON action is selected red signal is indicated on the channel

Automatic Mode

In this mode the user can set the time in the hr: min: sec format the clock must be 12 hr format. At the selected time the particular channel selected will be automatically ON or OFF as desired. For example: At 6:10 AM channel 0 will be ON and at 6:20:10 AM it will become OFF

Timer mode

In this mode the particular channel will be ON or OFF for the particular time interval specified by the buser. For example as selected by the user every 10 sec the channel 0 will be ON and for every 20 sec it will remain OFF. This entire ON/OFF action will keep on repeating.

- This code then generates through the serial port and is then available at the input of level shifter.
- Level shifter converts the code, which is in RS-232 logic in to TTL logic because the rest of the circuit works on TTL logic. The code is then given to microcontroller.
- The code is then given of microcontroller 89C51 which converts serial data to parallel data. The code is then given Rf transmitter.
- RF transmitter where the code is digitally modulated using ASK with the carrier frequency of 434MHZ.The ASK modulated signal is then transmitted using a whip antenna. The ASK modulated code then arrives at the receiving whip antenna. It is then given to RF receiver, receiver then demodulates the ASK modulated code so that the original binary code is available at the input of PIC.

PIC decodes the code Microcontroller has a set of ready codes, which are there at the transmitter side also. For a particular received code, microcontroller sets a particular port's pin or resets it if device is to be switched off. Relay driver drives the relay. It functions as a switch. Relay works on electromagnetic principle. Thus whenever a '1' comes from the microcontroller, relay driver connects VCC across the relay and the device which has been connected across the relay turns on.

VIII. Conclusion

After analyzing all the aspects covered in PIC, SCADA & wireless technology we have intensions of making a working module. The project will control the various multichannel processes in industry. This will help to reduce manpower. The wireless technology will make the controlling process with ease. Hence it will be a great advantage for the industries.

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Design and Comparison of U - Slot Micro Strip Antennas with Different Slot Widths

By Lakhan Singh, Rajesh Kumar Verma
Deptt. of Electronics & Comm. Engg

Abstract - This paper presents design and comparison of two U slot microstrip antennas of different dimensions fed by a coaxial probe. A coaxial feed microstrip antenna is proposed for linear polarization. These antennas are implemented on glass epoxy dielectric substrate with İr =4.4, h=1.6mm and resonant at 2 GHz. The simulations are carried out using Zeland IE3D software.

Keywords: *U slot MSA,Micro strip,patch antenna, VSWR, IE3D.*

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Design and Comparison of U - Slot Micro Strip Antennas with Different Slot Widths

Lakhan Singh,[α] Rajesh Kumar Verma[Ω]

Abstract -This paper presents design and comparison of two U slot microstrip antennas of different dimensions fed by a coaxial probe. A coaxial feed microstrip antenna is proposed for linear polarization. These antennas are implemented on glass epoxy dielectric substrate with ε_r =4.4, h=1.6mm and resonant at 2 GHz. The simulations are carried out using Zeland IE3D software.

Keywords: U slot MSA,Micro strip,patch antenna, VSWR, IE3D.

I. Introduction

A MSA in its simplest form consists of a radiating patch on one side of a dielectric substrate and a ground plane on the other side. Most commonly rectangular shape is used, however, other shapes, such as the corner truncated square, circular, triangular, semicircular, and annular ring shapes are also used. Radiation from MSA can occur from the fringing fields between the periphery of the patch and the ground plane. To enhance the fringing fields from the patch, which accounts for the radiation, the width W of the patch is increased. The fringing fields are also enhanced by decreasing the εr or by increasing the substrate thickness h. Due to its advantages such as low weight, low profile, low fabrication cost and capability to integrate with microwave integrated circuits technology, the microstrip patch antenna is very well suited for applications such as wireless communication systems, cellular phones, pagers, radar systems and satellite communication system [1, 2].

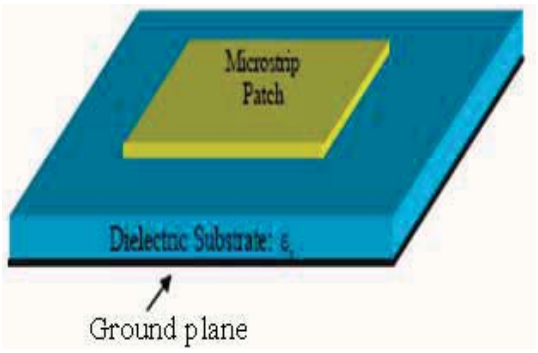

Figure 1: Rectangular Micro strip Patch Antenna

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E-mail:rajesh_jhansi@rediffmail.com

II. Antenna Geometry and Design

A typical design of rectangular micro strip antenna has been presented here and results are discussed at centre frequency of 2 GHz. The width and length of the patch are given by [3, 4]:--

$$W = \frac{C}{2f\left[\frac{\varepsilon_r + 1}{2}\right]^{1/2}} \quad (1)$$

$$L = Leff - 2\Delta L \quad (2)$$

$$\Delta L = \frac{0.412h\,[\varepsilon_{eff} + 0.300]\left[\left(\frac{w}{h}\right) + 0.264\right]}{[\varepsilon_{eff} - 0.258]\left[\left(\frac{w}{h}\right) + 0.8\right]} \quad (3)$$

$$\varepsilon_{eff} = (\varepsilon_r + 1)/2 + [(\varepsilon_r - 1)/2](1 + 12h/W)^{-1/2} \quad (4)$$

$$f = \frac{C}{2\sqrt{\varepsilon_{eff}}\,(L_{eff})} \quad (5)$$

Where,

C = velocity of light,

ε_r = dielectric constant of substrate,

f = operating frequency

ε_{eff} = effective dielectric constant,

L_{eff} = effective length,

ΔL = edge extension

III. Designed Parameters

For designing the proposed antennas the following parameters are used:--

Design frequency	= 2 GHz
Dielectric constant	= 4.4
Loss tangent	= 0.2
Thickness of substrate	= 1.6 mm
Length of the patch	= 36 mm
Width of the patch	= 46 mm
Location of feed point	= (15,15)
Slot width of MSA geometry 1	= 1.5 mm
Slot width of MSA geometry 2	= 2 mm

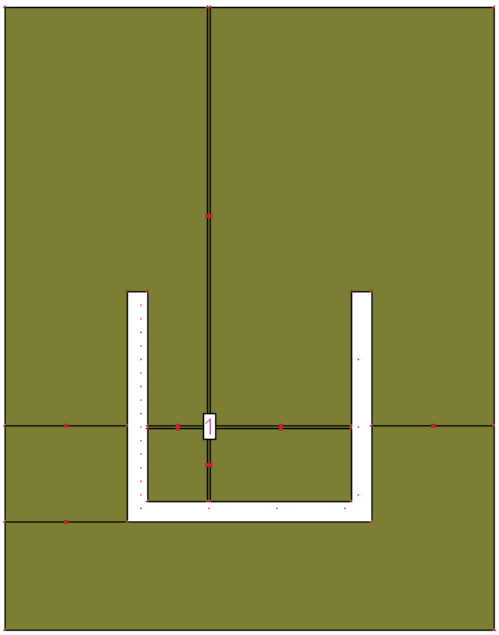

Figure 2: Geometry of U-slot MSA 1

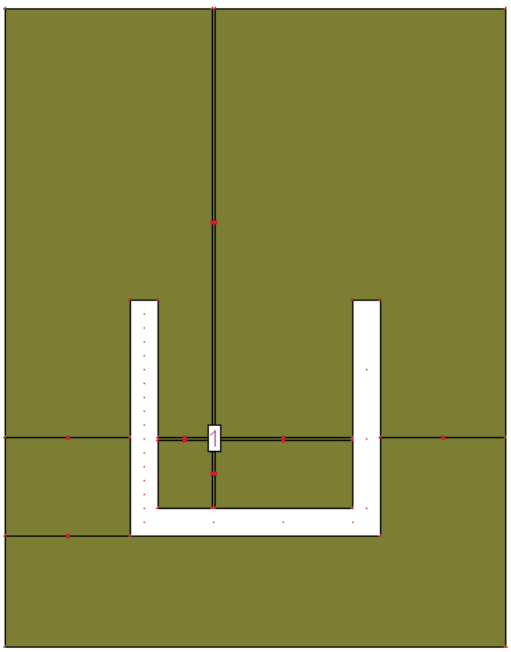

Figure 3: Geometry of U-slot MSA 2

IV. Antenna Fabrication and Results

After designing and simulation of U slot MSA with 1.5 mm slot, the return loss obtained is -39 db whereas U slot MSA with 2 mm slot gives a return loss of -28 db at the same designing parameters. Also, the VSWR for both the geometries is below 2 at the resonant frequency. The resulting data are presented in following figures

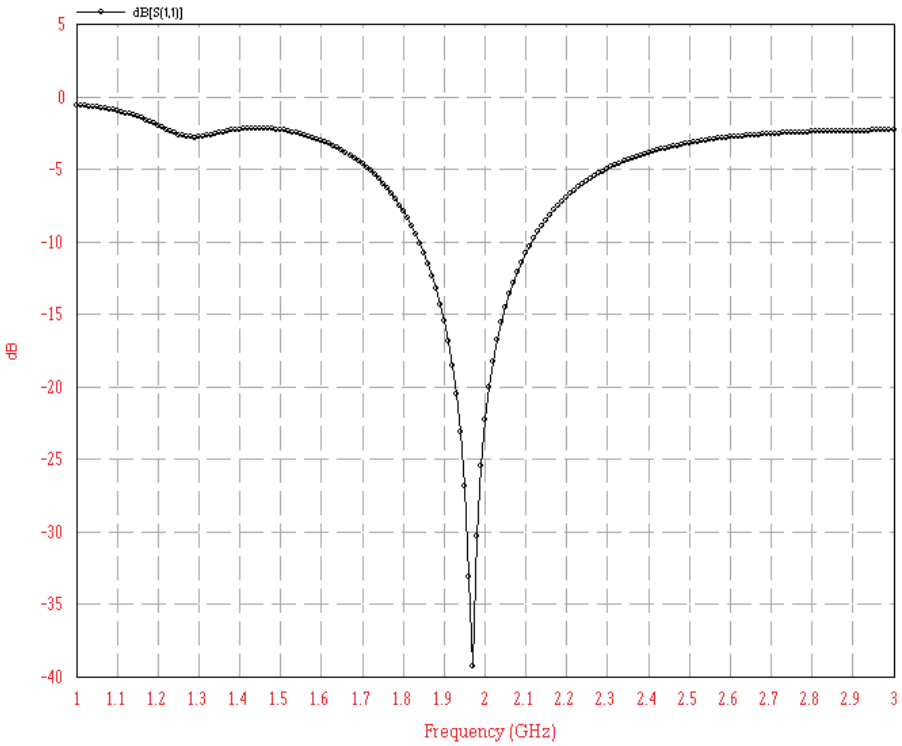

Figure 4: Return loss Vs frequency plot of U-slot MSA 1

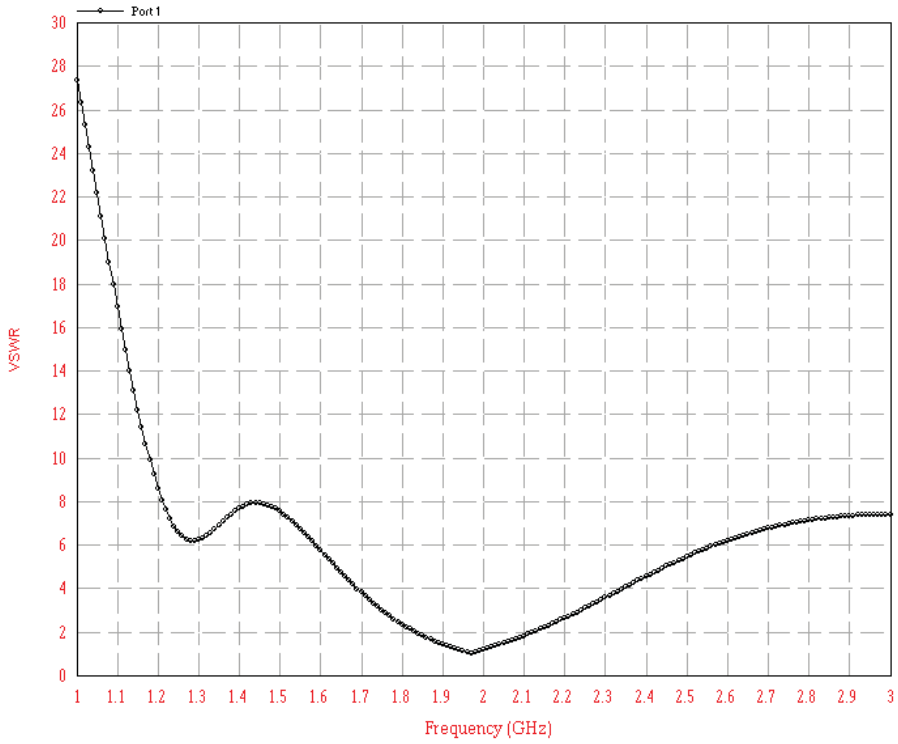

Figure 5: VSWR Vs frequency plot of U-slot MSA 1

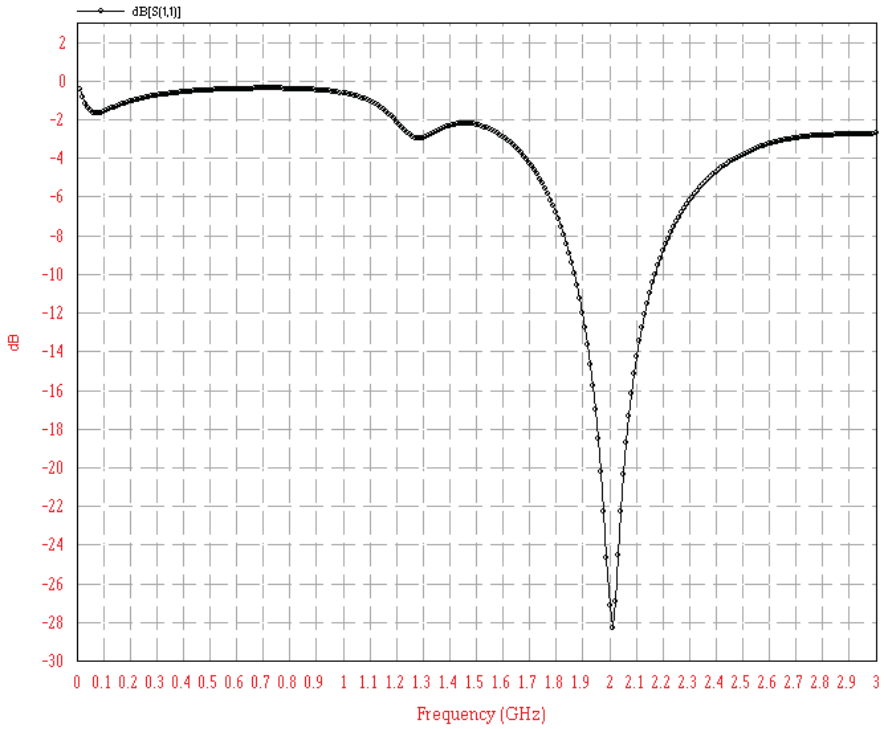

Figure 7: Return loss Vs frequency plot of U-slot MSA 2

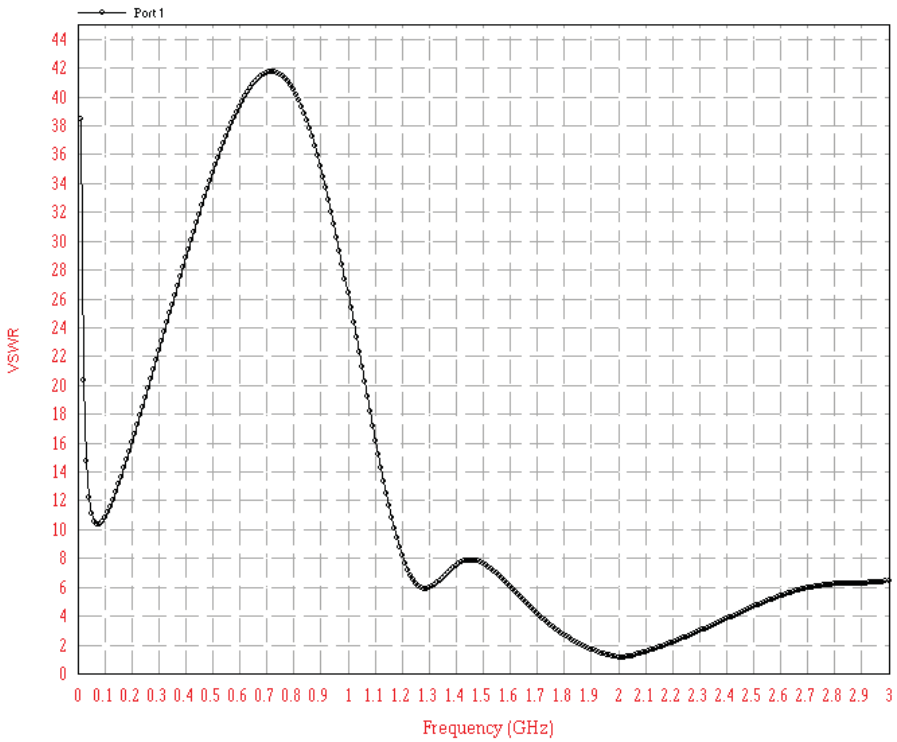

Figure 8: VSWR Vs frequency plot of U-slot MSA 2

V. Conclusion

It is observed that a coaxial feed, linearly polarized U slot MSA with different slot widths has been designed, simulated and compared. After comparison the U slot MSA with less slot width gives better results as compared to that of with more slot width. Both the antennas are suitable for implementing compact arrays, thus achieving even higher gain over specified bandwidth.

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Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

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6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

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the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

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9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

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18. **Pick a good study spot:** To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

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21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. **Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be

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32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page

- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to

shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

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This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic

principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

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- Explain materials individually only if the study is so complex that it saves liberty this way.
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- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.

- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
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- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

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The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

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- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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