K.L.N. College of Engineering

Pottapalayam – 630612.(11 km From Madurai City)
Tamil Nadu, India.

MECASO/MECH/VOLUME 1/ISSUE 2

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DEPARTMENT OF MECHANICAL ENGINEERING

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VISION

To become a Centre of excellence for Education and Research in Mechanical Engineering.

MISSION

- Attaining academic excellence through effective teaching learning process and state of the art infrastructure.
- Providing research culture through academic and applied research.
- Inculcating social consciousness and ethical values through co-curricular and extra-curricular activities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO I	Graduates will have successful career in Mechanical Engineering and service industries.
PEO II	Graduates will contribute towards technological development through academic research and industrial practices.
PEO III	Graduates will practice their profession with good communication, leadership, ethics and social responsibility.
PEO IV	Graduates will adapt to evolving technologies through lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Mechanical Engineering Graduates will be able to:

PSO 1	Derive technical knowledge and skills in the design, develop, analyze and manufacture of mechanical systems with sustainable energy, by the use of modern tools and techniques and applying research based knowledge.
PSO 2	Acquire technical competency to face continuous technological changes in the field of mechanical engineering and provide creative, innovative and sustainable solutions to complex engineering problems.
PSO 3	Attain academic and professional skills for successful career and to serve the society needs in local and global environment.

MECASO

MECHANICAL ENGINEERING NEWSLETTER

Principal Message

A major shift has come in the Technical education of Tamilnadu in recent years. These developments have brought new hopes and aspirations to the minds of stakeholders in an engineering education. The reflections of this change, I hope, it is visible in the academic atmosphere of KLN College of Engineering also. The management, faculty and students, I am sure, will be able to rise up to the expectations of the new System, and I wish our engineering college will be regarded as the best in Anna university affiliated Colleges also; I would like to congratulate the entire KLN family for obtaining the ISO certification for yet another time. In the past semester, with a lot of academic and nonacademic activities, has added yet another colorful chapter to the history of KLN College of Engineering. The magazine which documents the faithful activities of the Mechanical department for the past three months stands as a model of the quality, KLN College maintains in all its activities. I take this opportunity to place on record, my appreciation for the sincere efforts taken by the Mechanical Engineering Department for maintaining its position at the apex. I offer my best wishes to the college and Mechanical Department and pray God Almighty that he Guides KLN College of Engineering in its right path. My blessings for the forward march of the institution towards Excellence.

Principal

Dr. A.V. RAMPRASAD

Message from the Head of the Department

Creating technology through science is the ultimate stratum of all engineering endeavours. To establish parity with reality, one must appreciate the fact that engineering genuinely encompasses almost all specializations, be it in mechanical, electrical, electronics, information technology, robotics, biotechnology and so on. As we lift our hearts in gratitude for our past accomplishments, in faith and in trust, we also raise our hearts in asking the spirit to guide us as we get along the journey of life. The work and achievements of the students and faculty are duly encouraged, recognised and appreciated in our institution. I am happy to say that this time all so the department of Mechanical engineering of KLN College of Engineering is still continuing its legacy of meritorious and co-curricular achievements of its staff and students. As I look ahead, I can visualize that the department will grow in pursuit of higher standards of teaching, research, and play a significant role in shaping the future of the country. My blessings and good wishes will always be with the students and staff.

HOD / Mech

Dr. M.R. Thansekhar

Finite Element Method

By Dinesh R (121054) II Year A section

The **finite element method** (**FEM**) is a numerical technique for finding approximate solutions to boundary value problems for partial differential equations. It is also referred to as **finite element analysis** (FEA). FEM subdivides a large problem into smaller, & simpler parts called finite elements. The simple equations that model these finite elements are then assembled into a larger system of equations that models the entire problem. FEM then uses variational methods from the calculus of variations to approximate a solution by minimizing an associated error function

Basic concepts

The subdivision of a whole domain into simpler parts has several advantages:

- Accurate representation of complex geometry
- Inclusion of dissimilar material properties
- Easy representation of the total solution
- Capture of local effects.

A typical work out of the method involves (1) dividing the domain of the problem into a collection of subdomains, with each subdomain represented by a set of element equations to the original problem, followed by (2) systematically recombining all sets of element equations into a global system of equations for the final calculation. The global system of equations has known solution techniques, and can be calculated from the initial values of the original problem to obtain a numerical answer.

In the first step above, the element equations are simple equations that locally approximate the original complex equations to be studied, where the original equations are often partial differential equations (PDE). To explain the approximation in this process, FEM is commonly introduced as a special case of Galerkin method.

The process, in mathematical language, is to construct an integral of the inner product of the residual and the weight functions and set the integral to zero. In simple terms, it is a procedure that minimizes the error of approximation by fitting trial functions into the PDE. The residual is the error caused by the trial functions, and the weight functions are polynomial approximation functions that project the residual. The process eliminates all the spatial derivatives from the PDE, thus approximating the PDE locally with

- a set of algebraic equations for steady state problems,
- a set of ordinary differential equations for transient problems.

These equation sets are the element equations. They are linear if the underlying PDE is linear, and vice versa. Algebraic equation sets that arise in the steady state problems are solved using numerical linear algebra methods, while ordinary differential equation sets that arise in the transient problems are solved by numerical integration using standard techniques such as Euler's method or the Runge-Kutta method.

In step (2) above, a global system of equations is generated from the element equations through a transformation of coordinates from the subdomains' local nodes to the domain's global nodes. This spatial transformation includes appropriate orientation adjustments as applied in relation to the reference coordinate system. The process is often carried out by FEM software using coordinate data generated from the subdomains.

FEM is best understood from its practical application, known as **finite element analysis (FEA)**. FEA as applied in engineering is a computational tool for performing engineering analysis. It includes the use of mesh generation techniques for dividing a complex problem into small elements, as well as the use of software program coded with FEM algorithm. In applying FEA, the complex problem is usually a physical system with the underlying physics such as the Euler-Bernoulli beam equation, the heat equation, or the Navier-Stokes equations expressed in either PDE or integral equations, while the divided small elements of the complex problem represent different areas in the physical system.

FEA is a good choice for analyzing problems over complicated domains (like cars and oil pipelines), when the domain changes (as during a solid state reaction with a moving boundary), when the desired precision varies over the entire domain, or when the solution lacks smoothness. For instance, in a frontal crash simulation it is possible to increase prediction accuracy in "important" areas like the front of the car and reduce it in its rear (thus reducing cost of the simulation). Another example would be in numerical weather prediction, where it is more important to have accurate predictions over developing highly nonlinear phenomena (such as tropical cyclones in the atmosphere, or eddies in the ocean) rather than relatively calm areas.

Application

A variety of specializations under the umbrella of the mechanical engineering discipline (such as aeronautical, biomechanical, and automotive industries) commonly use integrated FEM in design and development of their products. Several modern FEM packages include specific components such as thermal, electromagnetic, fluid, and structural working environments. In a structural simulation, FEM helps tremendously in producing stiffness and strength visualizations and also in minimizing weight, materials, and costs.

FEM allows detailed visualization of where structures bend or twist, and indicates the distribution of stresses and displacements. FEM software provides a wide range of simulation options for controlling the complexity of both modeling and analysis of a system. Similarly, the desired level of accuracy required and associated computational time requirements can be managed simultaneously to address most engineering applications. FEM allows entire designs to be constructed, refined, and optimized before the design is manufactured.

This powerful design tool has significantly improved both the standard of engineering designs and the methodology of the design process in many industrial applications. The introduction of FEM has substantially decreased the time to take products from concept to the production line. It is primarily through improved initial prototype designs using FEM that testing and development have been accelerated. In summary, benefits of FEM include increased accuracy, enhanced design and better insight into critical design parameters, virtual prototyping, fewer hardware prototypes, a faster and less expensive design cycle, increased productivity, and increased revenue.

FEA has also been proposed to use in stochastic modelling for numerically solving probability models.

Reverse Engineering

By Subash Gandhi K S(121124) II year B Section

Reverse Engineering, also called **back engineering**, is the processes of extracting knowledge or design information from anything man-made and re-producing it or reproducing anything based on the extracted information. The process often involves disassembling something (a mechanical device, electronic component, computer program, or biological, chemical, or organic matter) and analyzing its components and workings in detail.

The reasons and goals for obtaining such information vary widely from everyday or socially beneficial actions, to criminal actions, depending upon the situation. Often no intellectual property rights are breached, such as when a person or business cannot recollect how something was done, or what something does, and needs to reverse engineer it to work it out for themselves. Reverse engineering is also beneficial in crime prevention, where suspected malware is reverse engineered to understand what it does, and how to detect and remove it, and to allow computers and devices to work together ("interoperate") and to allow saved files on obsolete systems to be used in newer systems. By contrast, reverse engineering can also be used to "crack" software and media to remove their copy protection,[1]:5 or to create a (possibly improved) copy or even a knockoff; this is usually the goal of a competitor.[1]:4

Reverse engineering has its origins in the analysis of hardware for commercial or military advantage. However, the reverse engineering process in itself is not concerned with creating a copy or changing the artifact in some way; it is only an analysis in order to deduce design features from products with little or no additional knowledge about the procedures involved in their original production. In some cases, the goal of the reverse engineering process can simply be a redocumentation of legacy systems.Even when the product reverse engineered is that of a competitor, the goal may not be to copy them, but to perform competitor analysis. Reverse engineering may also be used to create interoperable products; despite some narrowly tailored US and EU legislation, the legality of using specific reverse engineering techniques for this purpose has been hotly contested in courts worldwide for more than two decades

Reasons for Reverse Engineering:

- **Interfacing**. Reverse engineering can be used when a system is required to interface to another system and how both systems would negotiate is to be established. Such requirements typically exist for interoperability.
- **Military or commercial espionage**. Learning about an enemy's or competitor's latest research by stealing or capturing a prototype and dismantling it. It may result in development of similar product, or better countermeasures for it.
- **Improve documentation shortcomings**. Reverse engineering can be done when documentation of a system for its design, production, operation or maintenance have shortcomings and original designers are not available to improve it. Reverse engineering of software can provide the most current documentation necessary for understanding the most current state of a software system
- **Obsolescence**. Integrated circuits often seem to have been designed on obsolete, proprietary systems, which means that when those systems can no longer be maintained (lack of spare parts, inefficiency, etc.), the only way to incorporate the functionality into new technology is to reverse-engineer the existing chip and then re-design it using newer tools, and using the understanding gained, as a guide. Another obsolescence originated problem which can be solved by reverse engineering is the need to support (maintenance and supply for continuous operation) existing, legacy devices which are no longer supported by their OEM. This problem is particularly critical in military operations.
- **Software modernization** - often knowledge is lost over time, which can prevent updates and improvements. Reverse engineering is generally needed in order to understand the 'as is' state of existing or legacy software in order to properly estimate the effort required to migrate system knowledge into a 'to be' state. Much of this may be driven by changing functional, compliance or security requirements.
- **Product security analysis**. To examine how a product works, what are specifications of its components, estimate costs and identify potential patent infringement. Acquiring sensitive data by disassembling and analysing the design of a system component. Another intent may be to remove copy protection, circumvention of access restrictions.
- **Bug fixing**. To fix (or sometimes to enhance) legacy software which is no longer supported by its creators (e.g. abandon ware).

- **Creation of unlicensed/unapproved duplicates**, such duplicates are called sometimes clones in the computing domain.
- **Academic/learning purposes**. Reverse engineering for learning purposes may be understand the key issues of an unsuccessful design and subsequently improve the design.
- **Competitive technical intelligence**. Understand what one's competitor is actually doing, versus what they say they are doing.
- **Saving money**, when one finds out what a piece of electronics is capable of, it can spare a user from purchase of a separate product.
- **Repurposing**, in which opportunities to repurpose stuff that is otherwise obsolete can be incorporated into a bigger body of utility.

Reverse engineering of machines

As computer-aided design (CAD) has become more popular, reverse engineering has become a viable method to create a 3D virtual model of an existing physical part for use in 3D CAD, CAM, CAE or other software.The reverse-engineering process involves measuring an object and then reconstructing it as a 3D model. The physical object can be measured using 3D scanning technologies like CMMs, laser scanners, structured light digitizers, or Industrial CT Scanning (computed tomography). The measured data alone, usually represented as a point cloud, lacks topological information and is therefore often processed and modeled into a more usable format such as a triangular-faced mesh, a set of NURBS surfaces, or a CAD model.[8]

Reverse engineering is also used by businesses to bring existing physical geometry into digital product development environments, to make a digital 3D record of their own products, or to assess competitors' products. It is used to analyse, for instance, how a product works, what it does, and what components it consists of, estimate costs, and identify potential patent infringement, etc.

Value engineering is a related activity also used by businesses. It involves de-constructing and analysing products, but the objective is to find opportunities for cost cutting.

Robotic aspects

Here are many types of robots; they are used in many different environments and for many different uses, although being very diverse in application and form they all share three basic similarities when it comes to their construction:

1. Robots all have some kind of mechanical construction, a frame, form or shape designed to achieve a particular task. For example, a robot designed to travel across heavy dirt or mud, might use caterpillar tracks. The mechanical aspect is mostly the creator's solution to completing the assigned task and dealing with the physics of the environment around it. Form follows function.
2. Robots have electrical components which power and control the machinery. For example, the robot with caterpillar tracks would need some kind of power to move the tracker treads. That power comes in the form of electricity, which will have to travel through a wire and originate from a battery, a basic electrical circuit. Even petrol powered machines that get their power mainly from petrol still require an electric current to start the combustion process which is why most petrol powered machines like cars, have batteries. The electrical aspect of robots is used for movement (through motors), sensing (where electrical signals are used to measure things like heat, sound, position, and energy status) and operation (robots need some level of electrical energy supplied to their motors and sensors in order to activate and perform basic operations)
3. All robots contain some level of computer programming code. A program is how a robot decides when or how to do something. In the caterpillar track example, a robot that needs to move across a muddy road may have the correct mechanical construction, and receive the correct amount of power from its battery, but would not go anywhere without a program telling it to move. Programs are the core essence of a robot, it could have excellent mechanical and electrical construction, but if its program is poorly constructed its performance will be very poor or it may not perform at all. There are three different types of robotic programs: remote control, artificial intelligence and hybrid. A robot with remote control programing has a preexisting set of commands that it will only perform if and when it receives a signal from a control source, typically a human being with a remote control. It is perhaps more appropriate to view devices controlled primarily by human commands as falling in the discipline of automation rather than robotics. Robots that use artificial intelligence interact with their environment on their own without a control source, and can determine reactions to objects and problems they encounter using their preexisting programming. Hybrid is a form of programming that incorporates both AI and RC functions.

Guest Lecture

During the month of June to September following guest lecture are given to the students in order to improve the knowledge of students and also to fill the gap identified in the curriculum.

Date	Topic of Lecture	Name of Industry / Scholar	Year	No. of Students
24.7.2014	Lean Manufacturing	Mr.N. SundaraSubramanian. Chief consultant, Tehnozen Business Consultants, Madurai.	IV	104
17.7.2014	Power Plant Technology	Mr.V. Marimuthu, Assistant Engineer, Tuticorin Thermal Power Station, Tuticorin.	IV	105

Guest Lectures delivered by Institutional Experts

S. No.	Date & Hour	Topic of the Guest Lecture	Year/Sec	No of students benefitted	Resource Person
1.	19.08.14	AutoCAD and Mechanical Packages	II Year/ A,B&C	129	Ms. A.D. Idaya, GADS Software, Madurai.
2.	05.08.14	Mech CADD Softwares	II Year/ A,B&C	134	Mr.K.Vijayan Sr.CADDEngineer, Practical Technologies, Madurai
3.	24.07.14	Lean Manufacturing	IV Year/ A&B	104	Mr.Sundarasubramanian, Chief Consultant,Technozen, Madurai
4.	14.07.14	The Latest Mechanical Engineering Softwares	II Year/ A,B&C	131	Mr.Ramachandran & Mr.Karthick, CADDEngineers, CADDCenter, Madurai

In-Plant Training

S. No	Name of the Industry	Name of the students	Duration
1.	Thermal Power Plant, Tuticorin.	M.Prabhakaran S.P.Surya M.Velpandian N.Sathish Kumar	23.06.2014 to 27.06.2014
2.	Fenner (India) Ltd., 3, Madurai Melakkal Road, Kochadai. Madurai – 625106	L.U.Umachander R.S.Vinoth Kumar	21.06.2014 to 25.06.2014
3.	Sundaram Industry, Rubber Factory, Madurai16.	Vinoth Kumar K.G Dhakshnamoorthy. T.M	16.06.2014 to 25.06.2014

Industrial Visits

The following industrial visits are arranged for the students in the month of July in order to facilitate students about the idea of industries and provide innovative learning experience

S. No	Name of the Industry	Date of visit	Year & sec	No. of Students	Period
1.	R.L. Institute of Nautical Science, Madurai	18.07.14	IV Year A	55	½ day
2.	R.L. Institute of Nautical Science, Madurai	21.07.14	IV Year B	54	½ day
3.	Madras Cements Ltd., Virudhunagar.	25.07.14	II Year A	45	1 day
4.	Madras Cements Ltd., Virudhunagar.	25.07.14	II Year B	47	1 day
5.	Madras Cements Ltd., Virudhunagar.	25.07.14	II Year C	45	1 day
6.	Flow Link System Pvt. Ltd., & Lakshmi Machine Works (Machine Tool Division) Coimbatore.	26.07.14	III Year A,B&C	48	1 day

Organized Events in Association with The Institution of Engineers (India)

S. No.	Date	Events	Topic	Resource Person	No. of students benefitted
1.	31.8.14	Placement Training	NAC –Tech Exam	APTECH, Chennai	104
2.	9.7.14 to 11.7.14	Placement Training	Skill Enhancement Programme– Analytic and VerbalReasoning	M/s Business Fundamentals, Bangalore	95
3.	30.6.14 to 3.7.14	Placement Training	Skill Enhancement programme– Aptitude Skills – AdvancedLevel	Focus Academy of Career Enhancement, Coimbatore.	92
4.	23.6.14 to 27.6.14	Placement Training	Skill Enhancement programme– Aptitude SkillsPreliminaryLevel	Ethnus Consultancy Pvt.Ltd., Bangalore	142
5.	23.6.14 to 27.6.14	Placement Training	Skill Enhancement programme– Verbal Skills and Soft skills	Six Phrase, Coimbatore	138

Organized Events in Association with SAE India – KLNCE – Collegiate Club

S. No.	Date	Event	Resource Person	No. of Students benefitted
1.	20.08.14	TIER 1	Dr. R.M. Satheeshkumar, Prof & Head/Automobile Engg.	80 (23 – Mech. Students)

PROGRAM OUTCOMES (POs)

Mechanical Engineering Graduates will be able to

1.	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to solution of complex engineering problems.
2.	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3.	Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6.	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7.	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8.	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9.	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11.	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.
12.	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

K.L.N. COLLEGE OF ENGINEERING

VISION

To become a Premier Institute of National Repute by Providing Quality Education, Successful Graduation, Potential Employability and Advanced Research & Development through Academic Excellence.

MISSION

To Develop and Make Students Competent Professional in the Dynamic Environment in the field of Engineering, Technology and Management by emphasizing Research, Social Concern and Ethical Values through Quality Education System.

Principal   President   Secretary & Correspondent