SARDAR PATEL COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

ORGANIZES

ONE WEEK TRAINING CUM WORKSHOP
UNDER TEQIP ON

PRODUCT DESIGN VALIDATION
USING
FINITE ELEMENT ANALYSIS
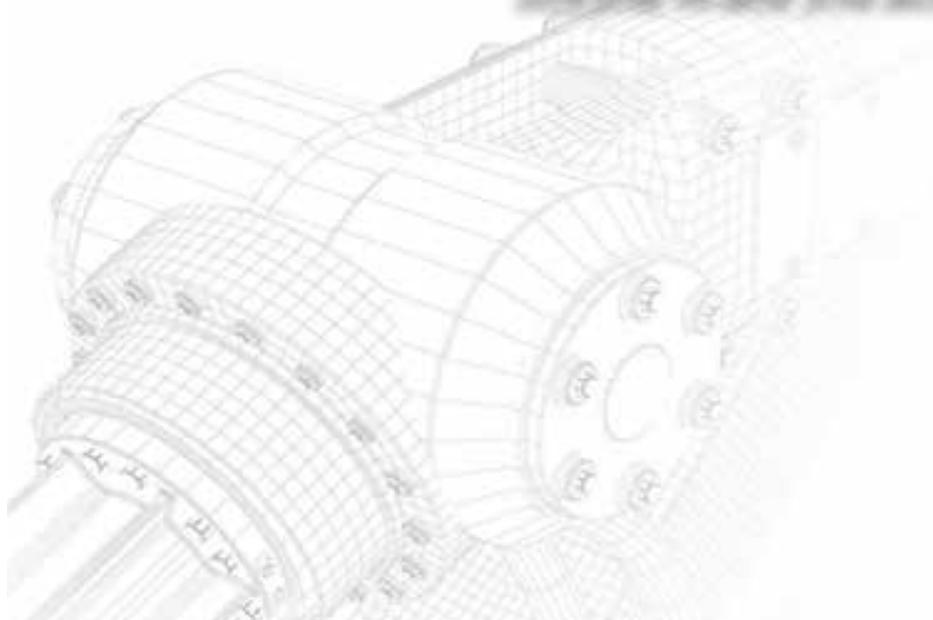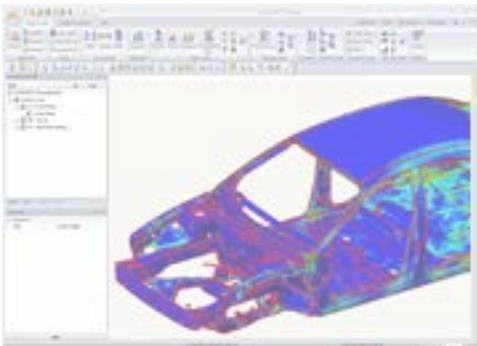
24TH JUNE TO 28TH JUNE 2013

One Week Workshop

A Workshop dedicated to Product design validation (PDV) using Finite Element Analysis.

Hands-On Training

Live industrial examples solved in workshop by participants .

Industrial Interaction

To understand current industrial processes, we made our participants to interact with known figures from industry .
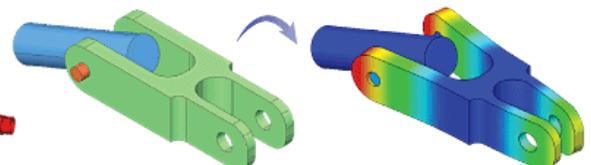
BHARTIYA VIDYA BHAVAN'S
SARDAR PATEL COLLEGE OF ENGINEERING
(An autonomous institution affiliated to University of Mumbai)
BHAVAN'S CAMPUS, MUNSHI NAGAR, J.P.ROAD
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NEWSLETTER

Modal analysis of an automobile axle
(7th mode, Free-Free condition)

Modal analysis of an assembly using sliding contact

SARDAR PATEL COLLEGE OF ENGINEERING.

Sardar Patel College of Engineering (SPCE) under the management of the Bhartiya Vidya Bhavan,was founded by Kulapati Dr.K.M.Munshi. It was established to meet the growing demand for engineering talent.

The foundation stone of the college was laid on 17th September 1961 by Shri.Y.B.Chavan (the then Chief Minister of Maharashtra who later became the Defence Minister of India.The college was inagurated by the first Prime Minister of Independent India,Pandit Jawaharlal Nehru in 1962.The college is dedicated to Sardar Vallabhbhai Patel,an eminent nation builder of independent India.

The college is autonomous and affiliated to the University of Mumbai for the full-time degree and post graduate degree courses. The institute has set high standards for aspiring engineering students and also meets the need of quality education in the challenging world of business. Over the last 50 years the college has gained an excellent reputation in the field of Technical Education.

SPCE is one of the few colleges that have received Grade 'A+' rating for its aided courses from the Govt. of Maharashtra which certifies the spirit of excellence that the institute has symbolized and always practiced.

OUR INSPIRATIONS

Dr.P.H. Sawant
Professor & Principal - Sardar Patel College of Engineering
Area of Interest - Construction Management, Water resources for surveying.

" *It gives me immense pleasure to announce that Department of Mechanical Engineering is organizing it's first one week workshop under TEQIP on Finite Element Analysis (FEA). This Workshop is unique amongst the other because of its coverage of theory with combination of practical session. In this workshop MED has invited eminent experts from renowned industries like L&T, Tata Motors & General Electric (GE) etc as well as Indian Institute of Technology (IIT-B). I congratulate the coordinator & Head MED for organizing this type of workshop which will enhance the knowledge of participants in the area of FEA".*

Dr.M.M.Murudi
Professor & Vice-Principal - Sardar Patel College of Engineering | TEQIP Coordinator
Area of Interest- Earthquake Engineering.

" *As a Vice-principal and TEQIP coordinator I feel overwhelmed by the fact that Mechanical Engineering Department is taking a leading role by arranging this type of workshop after the success of their previous two workshops. I congratulate the organizers for conducting such important and practical oriented workshops in series for the benefit of academic fraternity.* "

MESSAGE FROM CO-ORDINATOR

"Modern Finite Element Analysis (FEA) programs simulate static, dynamic, linear, nonlinear, thermal, modal, and random vibrations, and much more. But in today's scenario there are very limited resources who can teach us to apply these tools for solving daily engineering problems faced during design process.

The objective of these training is to provide the attendee with the skills to interpret the engineering problem, identify the required analysis process clearly to use Finite Element Analysis tools such as NFX, NASTRAN, ANSYS, ABAQUS etc. to carry detailed analysis and review the results. Our training program will enable engineers to perform linear, nonlinear, fatigue, buckling, modal, dynamic (Implicit and Explicit) and heat transfer analysis in the most efficient manner to speed the product development cycle and to obtain the most accurate results for product design validation.

This training cum workshop are presented with the emphasis towards maximizing the hands on experience with many sample model set up, analysis and results processing examples, presented live by the faculty. In addition examples are provided to the students for practice and gain confidence in the methods."

Prof.R.B.Buktar

WORKSHOP SNAPSHOT

The workshop started with participants registration followed by inauguration by Dr.Gajanan Sadekar from Larsen & Toubro (L&T) immediately after inauguration Prof.A.A Bage's expert session on historical development and Introduction to FEA was conducted. This session was followed by Dr.R.S.Maurya's expert session on Modeling and Simulation in Computer Aided Engineering was taken wherein participants learned on requirements for conducting successful analysis using FEA and CFD techniques. The session was followed by lunch and thereafter a practical session conducted by Mr.Amit Nirmal of Shirsh Design Solutions Pvt. Ltd. In this session practicals were conducted on NFX FE code based on NASTRAN solver. The first day participants were introduced to the FE work flow, material parameters, elemental properties, Static structural analysis and follwed by hand calulation to make participants understand FE solving procedures. Day two was very important from FE learning point of view where we discussed on Meshing techniques and important futuristic topic - "Meshless Method" by Mr.Nelson of IIT-Mumbai. Participants learned different meshing methods like automatic, interactive and also manual method. Participants were made aware of different mesh checks. Day three was started with Process equipment design and role of FEA. Dr.Nilesh Raykar (Ex-Head of Design L&T, Heavy engineering division)

Ms.Deepika Singh Singhraur (Workshop Event Coordinator) getting the participants registered at Lighton Conference hall

explained clearly about design process in heavy engineering and procedures for conducting FE analysis on Process Equipment design followed by fatigue analysis using FEA expert session by Dr.Raykar as his topic for Phd is also same. The day four was full of enthusiasm with Dr.Tansen Chaudhari's session of Finite Element Analysis and Design of Experiments which showcased the projects done by Dr.Tansen himself as a part of patent processing. (*Dr.Tansen have five patents to his name*). We had also covered Computational Fluid Dynamics session by Mr.Sachin Shendge from TATA Motors Ltd, Pune which also enlightened processes from industry and live examples on how CFD is conducted for automobile applications. On this day we also covered Implicit and Explicit Dynamic analysis by working on various examples such as impact analysis on car body, drop test, Steel rolling process, bird strike etc. On fifth day we started with Prof.D.N Jadhav's session on crack analysis using FEA which highlighted on theory and worked out example. We concluded with practical session on fatigue analysis and have optimized the structure by topology methodology. Through out the session we have taken care that participant should not loose the track and should understand the gist of computer aided engineering. The feedback form was collected at the end of workshop to understand any shortfalls, but to our expectations participants were extremely confident about the practical aspect of finite element analysis and have shown keen interest to take this learning to next level.

" The Workshop was conducted in a very professional manner and presented with minute information on FEA which would be helpful for all participants in future and material provided is very good" - Prof.S.R.Raukar (SPCE).

" Lectures from visiting faculties from IIT-Bombay and experts from industries were very good and enlightening. We enjoyed the practice sessions as it was very good to have hands-on session on NFX software". - Dabir Shahb Ahmed Hanif. (P.G. Student).

INSTITUTE & INDUSTRY SPEAKERS

Prof. D.N.Jadhav – Pursuing Phd. IIT-Mumbai
Associate Professor | SPCE
Area of Interest - Finite Element Analysis in Fatigue & Fracture Mechanics.

Dr.R.S. Maurya – Phd. IIT-Chennai
Associate Professor | SPCE- Procurement Coordinator
Area of Interest - Computational Fluid Dynamics (CFD).

Dr.A.A.Bage – Phd. IIT-Mumbai
Associate Professor | SPCE
Area of Interest - Damage Detection in Structures using Ultrasonic guided waves & ANM.

Dr.Tansen Chaudhari– Phd. IIT-Mumbai
Chief Operating Officer | Fluid Controls Pvt. Ltd.
Area of Interest - Design for Six Sigma (DFSS) & Design of Experiments (DOE).

Dr. Nilesh Raykar – Phd. IIT-Mumbai
Ex- Head Process Equipment Design Group | Larsen & Toubro Ltd.
Area of Interest - Hydrogen Assisted Stress Corrosion Cracking.

Sachin Shendge – M.E. Government College of Engineering, Pune
Manager (Development) | Engineering Research Centre (ERC) | Tata Motors Ltd.
Area of Interest - Aero Thermal analysis using Computer Aided Engineering in Automotive Domain.

Nelson M. – Pursuing Phd. IIT-Mumbai
Under the able guidance of Dr.S.K.Maiti.
Area of Interest - Meshless Methods.

Amit Nirmal
Director | Shirsh Design Solutions Pvt. Ltd.
Area of Interest - Finite Element Analysis (Dynamic) & Computational Fluid Dynamics (Fluid-Thermal).

INAUGURAL FUNCTION

Mr.Gajanan Sadekar, Vice-President - Product & Technology Development Centre, L&T, Mumbai, inaugurating one week workshop on FEA.

Dr.M.M. Murudi, TEQIP Coordinator & Vice Principal, SPCE lighting the lamp during the inaugural ceremony.

Mr.Amit Nirmal, Director of Shirsh Design Solutions, lighting the lamp during the inaugural ceremony.

Dr.M.M.Murudi felicitating Mr.Gajanan Sadekar

Mr.Gajanan Sadekar addressing the participants

Mr.Gajanan Sadekar after inaugurating the workshop shared his experiences at Larsen & Toubro highlighting on how they are successfully using Finite Element Analysis to make best process equipment in the country. Mr.Sadekar also cautioned on the underestimating of this technology by quoting Dr.Robert D.Cooks statement which says :

" Finite Element Analysis makes good engineer best and bad engineer dangerous"

Mr. Gajanan Sadekar was very happy to visit his alma mater (SPCE).

Mr.Gajanan shared on how in his days they were finding difficult to conduct FEA and have to rely on government institutes like TIFR. He also explained the generic process on conducting the industrial problem and asked participants not to take results given by codes blindly.

Mr. Gajanan Sadekar is an ex-alumni of Sardar Patel College of Engineering 1975 batch. He has experiences in working in various departments such as oil and gas, process equipment , Technology Development.

Mr.Gajanan Sadekar sharing his knowledge expertise on finite element analysis (FEA)

INTRODUCTION TO THE TOPIC

Well equipped State-of-the-art lighton seminar hall

The workshop was conducted in the state-of-art seminar hall. After Dr.Gajanan's enlightening speech we started with Dr.A.A.Bage's lecture on Topic of " History and Introduction to Finite Element Analysis". where he covered some important discussion on the historical development of finite element analysis starting from classical period starting way back from Archimedes time and discussed Mathematical foundation of FEA wherein Richard Courant proposed breaking a continuous system into triangular segments then development of matrix structural analysis methods using energy principles by Argyris & Kelsey & mathematical formalism of the FEM by Zienkiewicz in 1947.

Dr.A.A.Bage also highlighted on the development history of commercial software as a part of history of Modern Finite Methods. He also took one theoretical example to explain the concept in much detail. Dr.Bage made lecture very interactive by asking participants to solve the example and concluded the session by brief review of the technology, how the different type of analysis can help to solve different engineering problem such as Static Analysis,Modal Analysis, Linear Buckling Analysis, Transient / Frequency / Response Spectrum Analysis, Material / Geometry Nonlinearity Analysis, Interface Nonlinearity Analysis, Reinforcement Analysis, Cracking Analysis, Heat Transfer Analysis, Fatigue Analysis, Fluid Dynamics Analysis.

Dr.A.A.Bage Presenting expert lecture on Development of FE method

Dr.R.S.Maurya enlightening participants on Modeling and Simulation

The next session was continued by Dr.R.S.Maurya after Dr.A.A. Bage's session, this was filled with valuable information on modelling and simulation for CAE. Dr.Maurya highlighted the designing and development of complex engineering system from conceptual stage to fabrication stage. Dr. Maurya have also taken one industrial problem of designing a refrigeration system and have walked participants through concept, modeling and simulation techniques. Dr.Maurya spoke on complete numerical investigation wherein mechanical analysis and heat and fluid flow analysis including fluid structure interaction (FSI) was discussed. Based on his experience highlighted on common pitfalls in numerical simulation and also as to how we can avoid it. Overall the session was very informative and was well received by participants.

"Qualified theoretical inputs with practical assignments proved very productive" - Prof. D.S.S.Sudhakar (H.O.D- Production Department, Fr.Agnel College of Engineering - Bandra(W), Mumbai).

"The arrangements were excellent. The experts shared very valuable information based on their experiences, This workshop proved to be very practical oriented and will help me in my project work" -Narvel Yahya Abdul Majid. (P.G. Student).

"The session was well received by me. As a beginner in FEA this workshop have given the required boost in my learning" -Prof Shilpa Bhambure. (K.J.Somaiya College of Engineering).

SESSION HIGHLIGHTS

Dr.Tansen Chaudhari presenting expert lecture on FEA & Design of Experiment

Dr Tansen Chaudhari, presently working as Chief Operating Officer at Fluid Controls Pvt. Ltd, Lonavala shared his valuable experiences on use of finite element analysis (FEA) for industrial products.

- During his lecture he stressed on the fact that instead of using the ready-made packages available in the market for FEA, one should focus on writing a simple FE code using any programming language which will help them to interpret engineering problem in-depth.

- He also highlighted on how Design for six sigma and design of experiments (DOE) can be leveraged for FEA, he exemplified this concept by sharing classy example of bumper optimization using DOE. He further explained that how by leveraging the other tools and techniques like Six Sigma and DOE with FEA.

Dr. Tansen Chaudhari session was concluded by Q&A session.

Dr.Nilesh Raykar presenting expert lecture on Process equipment design

Dr. Nilesh Raykar on third day have taken dual topic on Role of FEA in process equipment design and Importance of Fatigue analysis.

- Dr.Raykar spoke about industrial process equipment design where normal working pressure is between 250- 350 bar. The design of shell, flanges, nozzles & gaskets in accordance with Pressure vessel design codes under section VIII was explained.

- This session participants linked their learned pressure vessel design in BE. Syllabus with actual validation using Finite Element Codes. Dr.Raykar then explained the techniques for modeling gaskets in the pressure vessels.

- The session was then continued with fatigue analysis, wherein Dr.Raykar explained on how we can solve fatigue problems using FEA.

- He discussed on all three approaches viz. Stress-Life (S-N), Strain-Life (E-N) & Crack growth. The stress-life approach was explained in more detail about the process and application of S-N approach.

On fourth day we conducted session from TATA Motors taken by Mr.Sachin Shendge.

- Mr.Sachin explained in detail on using CFD solution for conducting aero-thermal problems on vehicle.

- He explained one HVAC problem from passenger vehicle and how after analyzing different design options they finalized the current design.

- This session we also learned about conducting external flow analysis on vehicle aero-dynamics.

Mr.Sachin Shengde presenting expert lecture on CFD in automotive domain, Sachin is currently working at TATA MOTORS LTD

"Workshop was very good and practical sessions were also good" - Shruti Dileep Murumkar. (P.G. Student).

"The lectures by guest speakers was good. if possible the expert from industry must give whole day session in their field. Overall the practical session made us understand the theory in most precise way." - Shoaib Shaik (P.G. Student).

INDUSTRIAL EXPOSURE

On Fifth day we had a session from Prof D.N Jadhav on Finite Element Analysis in Fracture mechanics which is used to formulate

- The degree of Safety of a structure against brittle fracture.
- The conditions necessary for crack initiation, propagation and arrest
- The residual life in a component subjected to dynamic/fatigue loading

This session clearly outlined the procedure required for performing crack growth analysis on FEA codes like Abaqus and ANSYS.
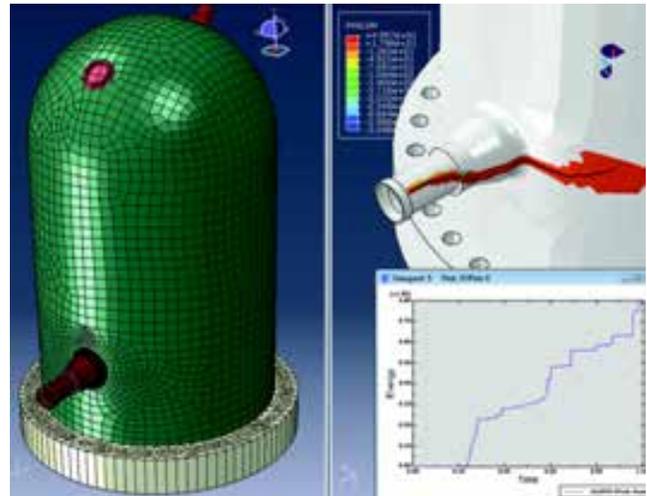
Prof.D.N.Jadhav explained the crack growth phenomenon by using above example from process equipment using Finite Element Analysis.

The practical sessions marked a significant learning for participants . Each day participants learned and practiced important procedures and tips for conducting successful Finite Element Analysis. Overall participants enjoyed and yet learned a very important technology in engineering analysis.

"A very good balance of theory, practical case studies from different industries and hands-on training was maintained throughout the workshop. The strengths and shortcomings of this important analysis tool were aptly highlighted by various speakers. I especially appreciate the excellent exposure provided by the program to multiple analysis types within a short time span. In fact, the breadth of course contents demand future courses focusing on individual topics." - Dr.Nilesh Raykar

" Excellent arrangement, topics & hospitality. I feel this session should be conducted more often in future" - Prof .A.A Bage (SPCE)

"Lectures from visiting faculties were very useful, case studies explained by experts helped in getting the feel of practical usage of FEA in industries. Hands-on experience on NFX software was good learning"- Siddiqui Rehan Muniruddin (P.G. Student).

PRACTICAL EXPOSURE

Mr.Amit Nirmal of Shirsh Design Solutions (www.shirsh.com) conducting practical sessions, to have indepth practical exposure this session was conducted for all the five days on NFX (NASTRAN) version of Finite Element Code.

The session was concluded by Mr.Amit Nirmal highlighting the role & responsibilities of an engineer in design process. Participants understood that design validation phase as one of the most important and indispensable of all tasks in engineering design. As it ensures the workability of the finished product, as well as for cost effectiveness.

In the era of global competition, the demands on the use of Computer Aided Engineering (CAE) are growing faster than ever in the process of product design simulations to validate and optimize designs.

The job of design engineers is to take the product design and development through the process set to have better products in market. Having understood the process, let dig into the history of engineering development that relate growth of CAE to fully appreciate the complexity and capabilities of the design validation tools available today. This workshop was an attempt to bridge the gap between theoretical learning and practical exposure for participants.

We will be arranging many more sessions like this in near future on different topics of interest, Till then keep learning !

NOTE: Please keep visiting **www.spce.ac.in** for more future workshops

"It was really excellent to have attended such a workshop. It was really good to hear lectures delivered by people from corporate world. The shared knowledge gives us good scope for our future" - Shaikh Saad Abdul Latif (P.G. Student).

"The Workshop is conducted as per schedule. Visiting faculties taught us the actual field applications. Dr.Tansen Gave us excellent information"- Dange Maheshkumar V. (P.G. Student).

VALEDICTORY FUNCTION

Dr.R.S.Maurya felicitating Dr.P.H.Sawant

Dr.P.H.Sawant distributing certificates to the participants

Dr.M.MMurudi distributing certificates to the participants

Dr.M.MMurudi addressing and concluding the one week FEA workshop

List of Participants

Bhambure Shilpa Sadanand	Khan Yusuf Mohammed
Mrs.Sangeeta Kasbe	Shoaib Shaik
Mrs.Ramita S.Pandey	More Hemant
Dr. A. A. Bage	Shaikh Saad Abdul Latif
Anupa Sabnis	Dange Maheshkumar
Pravinkumar Sadashiv Jagtap	Narvel Yahya Abdul Majid
Sachin Rajaram Vankar	Siddiqui Rehan Muniruddin
D.S. S. Sudhakar	Dabir Shahab Ahmed Hanif
Nawaz Irshad Motiwala	Negarullah Naseebullah Khan
Khan Nafees Ahmed	Shruti D.Murumkar & Khan Abdullah K.

GROUP PHOTOGRAPH

VOTE OF THANKS

Prof.R.B.Buktar

- I thank our Principal Dr. P.H.Sawant & Vice-Principal Dr. M.M. Murudi for encouraging & motivating Mechanical Engineering Department to conduct this one week workshop.

- I take this opportunity to thank Mr. Gajanan Sadekar for squeezing out his valuable time from busy schedule & grace this occasion with his timely presence.

- I take this opportunity to thank our eminent speakers from industries who delivered the required & helped in promoting industry-institute interaction.

- I especially thank Dr.Nilesh Raykar for connecting the dots and helping us to invite our prestigious chief guest Dr.Gajanan Sadekar.

- At the end I also thank all the participants for sincerely attending all the theory and practical sessions conducted during the workshop.

- I thank Mr.Amit Nirmal for smoothly conducting the practical sessions.

- Last but not the least I thank our supporting staff Mr.Luis Dias, Ganpat Jadhav, Vasantkumar and event coordinator Mrs. Deepika Singh Singhraur for smooth conduct of this workshop.

SWEET MEMORIES

Dr.Nilesh Raykar and Dr.R.S.Maurya attentively involved in the session by Dr.A.A.Bage

Dr.M.M.Murudi addressing the participants at an inauguration function.

Participants enjoying the lunch during the day.

Mr.Amit Nirmal clearing the doubts of participant.

Mrs Deepika and Mr.Luis at registration desk

Participants applauding the conclusion of the session.