Overview

Finite Element Method (FEM) is one of the the most extensively used numerical tool by engineers and scientists to address several real-life problems by solving the partial differential equations. These differential equations arise during the analysis of structural integrity of civil and mechanical components subjected to various kinds of loading, heat transfer, and fluid flow. Few examples of these are plates and shells, bullet penetrating an armour plate, crash events of automotive components, thermal cycling of IC ships during their service life. Several complex engineering problems such as those involving coupled-field interactions, contact stress analysis, fluid-structure interaction and soil structure interaction for which obtaining closed form solutions are very difficult and can be solved with modest effort using FEM. The advent of modern experimental techniques have led to the validation of the FEM predictions there by increasing the reliability of FEM. This has further led to the development of several commercial finite element software's which are widely used in the nuclear, defense, marine, and space applications .

Who Should Attend the Course

This course is designed to the faculty involved in teaching the course on finite element method and for the students who intend to make a career in finite element applications in near future. The course also aims at solving representative engineering problems using commercial FE software's which will be extremely useful for the industry, research professionals and senior PhD students Overall, this course is intended to provide an excellent exposure on theory and concepts of FEM along with hands on experience on several example problems using commercial software's such as ABAQUS/ANSYS.

Benefit to the Participants

Upon successful completion of the course and securing min. 40% marks in the quiz on last day, participants will be provided with the participation certificates.

About IIT Indore

Indian Institute of Technology Indore, also known as IIT Indore, is located in Madhya Pradesh, India. Started in 2009 with an aim of Inventions and Innovations in research, IIT Indore is an institute of National Importance with a vision to become World Leader in Science and Technology. Recently, IIT Indore was ranked 76 in by the Young University Rankings.

At IIT Indore, the thematic balance of research culture among faculties and students is based on the fact of "Ideas for life". This is visible through the ongoing national and international collaborative industry sponsored projects. Besides this, IIT Indore also strives to build and deliver the indigenous technology to Defense and Space sector of India as an initiative of Government 's *"Aatm nirbhar Bharat "* program.

https://www.iiti.ac.in/

For more details, please contact:

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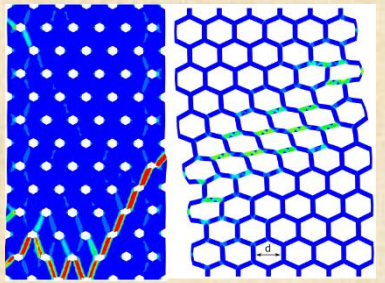
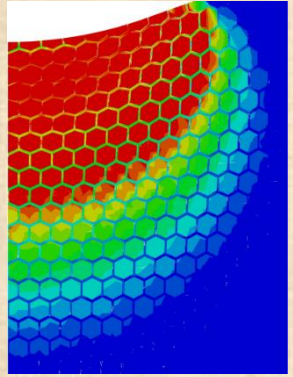
Important Dates:

Registration Deadline:	**December 17--, 2021**
Intimation to the participants:	**December 18--, 2021**
Link Sharing:	**December 19---, 2021**





A certificate course on finite element methods and hand on experience

(with basic introduction to theory of elasticity, 1-D and 2-D FE formulation)

5 week online Certificate Course

Course Duration: 20th Dec 2021 to 23rd Jan 2022

Organized by

Department of Mechanical Engineering,
Department of Civil Engineering,
and
Center of Futuristic Defence and Space Technology
Indian Institute of Technology Indore,
Khandwa Road, Simrol,
Indore 453552 (Madhya Pradesh)

Course Contents

S.l.	Chapter	Topics to be covered	Duration
1	Revision of basics concepts theory of elasticity	Stress and strain tensors, Generalized Hook's Law, strain displacement relation equilibrium equation. Plane stress, plane strain and axis symmetric conditions.	6 hours
2	Calculus of variations	Functional, Extremization of a functional, Principal of minimum potential energy Weighted residual method, Determination of weak form (Principal of virtual work) of equilibrium equation, Galerkin method, Ritz method	8 hours
3	One dimensional FE formulations	General form of finite element equation for 1-d structural problem, Linear bar element: Determination of shape function, stiffness matrix and force vectors, Natural coordinate, iso-parametric mapping. Stiffness and force vectors in terms of natural coordinates. Quadratic bar element Beam and frame elements	16 hours
6	2D finite element formulation	General FE equation for 2D structural problems: Stiffness matrix and force vectors Three-noded triangular elements, six-noded triangular elements Four-, eight- and nine-noded rectangular elements. Natural coordinates, stiffness matrix and force vectors in terms of natural coordinates.	16 hours
7	Numerical integration	Trapezoidal Rule, Simson's Rule, Newton-Cotes Formula, Gauss-Quadrature (GQ) Method	2 hours
8	Accuracy and Convergence	Convergence of finite element solutions to exact solution Criteria for monotonic convergence Rate of convergence Convergence of Isoparametric elements	2 hours

Time distribution for various topics

Week 10 Hours	Monday 5-7 PM	Tuesday 5-7 PM	Wednesday 5-7 PM	Thursday 5-7 PM	Friday 5-7 PM
1	Revision of basics concepts theory of elasticity	Revision of basics concepts theory of elasticity	Assignment #1 on Elasticity	Calculus of variations-I	Calculus of variations-II
2	Calculus of variations-III	Assignment #2 on Calculus of variation	Assignment #3 (basic training on Abaqus)	1D FE formulation -I	1D FE Formulation -II
3	1D FEM Bar Stiffness, force vectors in terms of natural coordinates	1D FEM iso-parametric mapping.	1D FEM quadratic bar element	1D FEM Beam Element	Assignment # 4 on 1D FEM
4	2D FEM General FE equation for 2D	2D FEM: Stiffness Matrix and Force Vector	2D FEM: 3 node Triangular Elements	2D FEM: 6 node Triangular Elements	4node rectangular elements
5	2D FEM: eight- and nine-noded elements	2D FEM: Mapped Elements	Assignments on 2D FEM	Numerical integration	Accuracy and Convergence

About Instructors

Dr. Indrasen Singh received B.Tech degree in mechanical engineering in 2004 from MNNIT, Allahabad, India. Subsequently, he joined the position of scientist at ARDE, Pune, a premier laboratory of DRDO. In 2007, he moved to PTC software (India) Pvt. Ltd., Pune and work there for 3 years as a software developer. He joined Ph.D. in the department of mechanical engineering at IISc, Bangalore in Aug 2010. His PhD work focused on understanding the fracture and deformation response of metallic glasses and nanoglasses through finite element simulations. In October 2016, He joined post-doctoral position at NUS, Singapore. He received gold medal for best Ph.D. Thesis from IISc in 2017. Since April 2017, he is working as assistant professor at IIT, Indore. His research interest lies in the area of mechanical behavior of materials. Some specific research areas are: Finite element methods, Crystal plasticity, Computational Fracture Mechanics, Piezoelectric materials, metallic glass, nanoglasses and composite materials.

Prof. Sandeep Chaudhary is currently working as a Professor in the Department of Civil Engineering, Indian Institute of Technology Indore. Before joining IIT Indore, he served as a faculty member in different capacities at MNIT Jaipur. His areas of specialization are Structural Analysis and Design; and Building Materials. His group carries out both analytical and experimental studies. The experimental studies range from microstructure to full-scale.

How to Register

Participants needs to register for the course via online Google form by clicking the below link;

https://forms.gle/ydZb9jc5aAymCmzo8

After filling the G-form, participants are requested to send the confirmation email to indrasen@iiti.ac.in and schaudhary@iiti.ac.in with cc to phd1901103008@iiti.ac.in

Registration Fees

Course fee: INR 11,000/- plus 18% GST
Mode of Payment: Bank Transfer
Account Name: Registrar, IIT Indore
Account Number: 1476101027440
Bank Name: Canara Bank
Branch: IIT Simrol, Indore
IFSC: CNRB0006223

Upon successful completion of payment, participants are requested to send a copy of transaction receipt to indrasen@iiti.ac.in and schaudhary@iiti.ac.in with cc to phd1901103008@iiti.ac.in

Volunteers

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