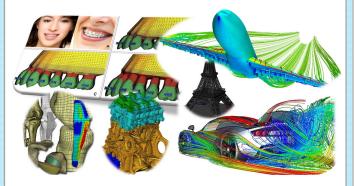**Short term course on**

Product Design and Innovation using CFD and FEM

27 - 31 December 2016

Coordinator

Dr. Om Prakash Singh
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Organized by

Department of Mechanical Engineering
Indian Institute of Technology (IIT) (BHU)
Varanasi-221005

COURSE OBJECTIVE/SCOPE

Engineers, graduate students including masters and PhD students study lots of theory on Computer Aided Engineering (CAE), specially on Finite Element Method (FEM) and Computational Fluid Dynamics (CFD) but when comes to the application of theory in solving real world problems, they either lack the skill and/or don't know how to approach the problem. Keeping this in mind, this course has been designed to provide SKILL to the students/faculty/industry engineers on industry standard tools and practices using CFD and FEM. This short course would help Industry Engineers and Designers, Academic Institutions Faculty, Post Graduate and Research students in designs based on 21st Century Approach "Simulation Based Engineering Approach".

COURSE CONTENT

This is one-of-its-kind industry oriented short term course that offers unique experience of both the field of Product design and Innovation, FEM and CFD:

Product innovation: Intellectual property rights (IPR), Patents, trademarks, designs, copyright, trade secrets, domain names, patent issues, patent writing techniques, patent case studies, Product design, 2D and 3D CAD systems, Use of CAE tools, 3D CAD generation techniques using reverse engineering,

Introduction and application: Use of CAE (CFD and FEM) in various engineering fields, design and failure analysis using CAE etc.

Basic theory of CFD and FEM: Governing differential equations, discretisation techniques- Finite volume method, Finite difference methods, Explicit, Implicit and Crank-Nicolson's algorithm; weak form, Rayleigh Ritz method, concept of boundary layer.

Complex geometry handling: feature curves, surface organization, free edges, boundary surfaces, other pre-processing techniques.

1-D Meshing: Introduction to meshing, when to use 1-D meshing, element section, beam element, problems based on 1-D FEM and comparison with exact theory.

2-D Meshing: When to use 2D simulations, techniques for 2D FEM, CFD simulation, Family of 2-D elements: effect of mesh density, effect of biasing in critical region, how not to mesh, shrink wrap meshing

3-D Meshing: When to use 3D FEM and CFD simulations, boundary layer mesh generation, elements types, DoF for solid elements, brick meshing, prism layer

Mesh Quality and Checks: Compatibility and mechanisms, shells to solids, beam to solids etc, General element quality checks: skewness, aspect ratio, warpage, jacobian; 2-D quality checks, grid independence study

Linear Static and Dynamic Analysis: FEM model for linear analysis, design problems based on linear analysis, Theory of dynamic analysis: forced and free vibration, mode shapes, harmonic analysis, design techniques for avoiding resonance, modeling stress concentration.

Thermal Analysis: Conjugate heat transfer, meshing techniques, Fluid and solid volume extraction techniques, Boundary layer mesh generation techniques, CFD results with and without boundary layer mesh.

Design Optimization: Fundamental theory, NVH, structure design and optimization based on vibration analysis - dynamic and frequency response function (FRF), mode shape extraction, design for avoiding resonance etc., Optimization based on stiffness, mass etc.

Real to Virtual: Reverse engineering techniques, creating 3D CAD designs from 2D still images of real objects, Image processing techniques: building cloud points, mesh and texturing,

FVM vs. FEM: Which gives better result: Finite volume method or Finite element method?

Special topics: to be included if requested by the participants in advance.

WHO CAN ATTEND

- This course is taught in such a way that 90% of the CFD/FEM techniques are same irrespective of branch. Hence, **students/faculty/engineers** from **Civil, Mechanical, Structural, Automotive, Electrical, Construction, Aerospace, Biomedical** etc can attend.
- This course is not just a course, it is a skill building program. Anyone interested to enhance their skill in the CAE domain, are welcome to participate.

CERTIFICATE

A certificate of participation would be issued to all the participants.

LOCATION

Varanasi Railway Station is well connected to almost all parts of the India. Also it is well connected via Air to Delhi, Mumbai, Kolkata, Hyderabad, and Bengaluru. There are frequent flight services from New Delhi. The Institute is located in the extreme south of the Varanasi city and about 7 km away from Varanasi Railway Station and 30 km from the Babatpur (Varanasi) airport. Taxis, Auto-rickshaws, are available as transport.

IMPORTANT DATES

Last date of registration (if seats available) : December 20, 2016
Enquires should be addressed to:
Dr. Om Prakash Singh, Associate Professor,
Department of Mechanical Engineering, IIT (BHU), Varanasi – 221 005
E-mail : opsingh.mec@iitbhu.ac.in

ACCOMMODATION

Shared accommodation in the IIT guest house will be provided. Depending upon the need, accommodation may also be provided in institute hostels. Participants interested to stay outside the campus in hotels can make their own arrangement.

REGISTRATION FEE

Indian Nationals:
- IIT BHU student: Rs. 4000/-
- Non-IIT BHU student : Rs. 10,000/-(ten thousand)
- Faculty member : Rs, 15,000/- (fifteen thousand)
- Industry professional: Rs. 20,000/- (twenty thousand)

International candidate
- Student: USD 220
- Faculty member: USD 320
- Industry professionals: USD 420

Note: Registration fee includes (for non-IIT BHU members) course material, breakfast, lunch, dinner, refreshments, accommodation, certificate of participation and prizes during the entire course duration.

REGISTRATION PROCESS

- Send an email to opsingh.mec@iitbhu.ac.in with the list of participants interested to attend the course.
- Depending upon the seat availability, a provisional confirmations though email will be sent within 2 hour.
- After receiving email confirmation, kindly speed post the registration fee (Cheque/DD in favour of **IIT(BHU)- Main Account (Special Fund)** payable at Varanasi, U.P) to the address given below OR online transfer as per the online payment details mentioned below.
- Mention your name, designation (student, faculty or industry professional) address, mobile number and email id on the back of the DD/Check. The same information should also be sent as email to opsingh.mec@iitbhu.ac.in. In case of many participants with a single DD/Cheque, use a separate sheet of paper to mention participants details. **There is no separate registration form**.
- If registration fee is paid via online transfer, the participant should inform the transaction details/proof of money transfer via email to opsingh.mec@iitbhu.ac.in. Kindly mention participant's name in the remark section during the bank transaction.

Address

Write "STC 16 CFD FEM" on the top of the envelope and send Cheque/DD to the following address:

Prof. Pradyumna Ghosh/Dr. Om Prakash Singh
Department of Mechanical Engineering,
IIT (BHU), Varanasi, U.P, India-221005

ONLINE REGISTRATION FEE PAYMENT

Account holder name: **IIT(BHU)- Main Account (Special Fund),** Bank name: **State Bank of India**
Branch: **IT-BHU,** Branch code: **11445**
Account No.: **32778803937**
Account type: **Current,** IFS Code: **SBIN0011445**

EVALUATION AND GRADING

There is will be continuous evaluation of each participants during the course on the understanding of the concepts and skills.
- A overnight assignment will be given to the participants whose evaluation will be done next day morning.
- Based on the participants performance, winners will be announced.

COMMITTEES

Patron:
Honorable Professor Rajeev Sangal, Director, IIT (BHU)

Organizing/Advisory committee, IIT (BHU)
Dr. Om Prakash Singh
Prof. Prashant Shukla
Prof. Pradyumna Ghosh
Dr. Jeevan Vachan Tirkey
Dr. Swati Sunder Mondal
Dr. Arnab Sarkar
Dr. Jahar Sarkar
Dr. Rakesh Kumar Gautam