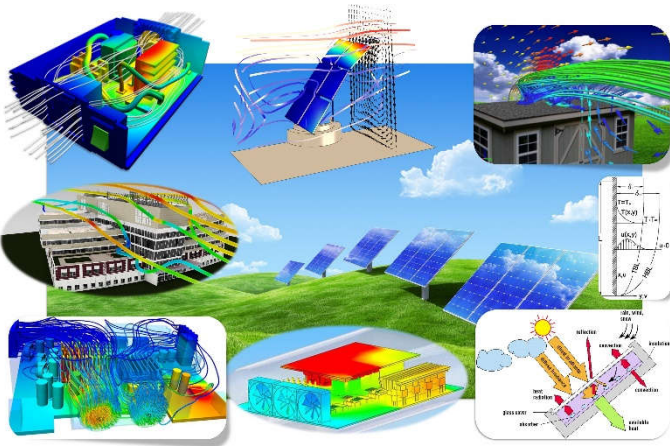


Short term course on  
**Energy System Modeling using  
CFD: Theory and Practice**

1 - 7 July 2017



**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**

This course aims at bridging the skill gap between what industry needs today and what is taught in the academic environment on a theme of energy systems. The accelerated pace with which product design and development is taking place using Computer Aided Engineering (CAE), it is the need of the hour to enhance the skills of students, faculty and industry engineers in designs based on 21st Century Approach "Simulation Based Engineering Approach". "One cannot learn driving just by watching videos online, one has to take the driving seat and practice". Many CFD videos are available online but it will not make anyone expert. Keeping this in mind, this course has been designed to impart much needed knowledge and skills in Computational Fluid Dynamics (CFD) in designing and modeling various energy systems. After attending this course, participants will be able to model any problems using CFD.

**COURSE CONTENT**

**Introduction and application:** Energy systems: Recent technologies: solar energy for solar heater, collector etc, energy efficient building design, use for CFD and FEM in various engineering fields, CFD results validation techniques etc.

**CFD theory:** Governing differential equations, discretisation techniques, concept of boundary layer, scaling laws, turbulent models, Y+ estimation etc.

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

**Surface and Volume Meshing:** When to use 2D simulations, effect of mesh density, effect of biasing in critical region, boundary conditions, how not to mesh, shrink wrap meshing, boundary layer mesh generation, effect of mesh size on results, control volumes for mesh refinement etc.

**Mesh Quality and Checks:** Quality checks for CFD mesh, grid independence study.

**CFD Boundary Conditions for internal/external flows:** How to model steady and transient phenomena: how to decide time steps, heat flux, convection, adiabatic, radiation, moving reference frame etc., wind tunnel design techniques, lift/drag prediction.

**Solar Energy Systems:** Characteristics of solar radiation, CFD modeling of flat plate solar energy collector, modeling thin glass behavior using multiband radiation model, gray radiation spectrum model, solar load, wind pressure load calculations over PV solar panels at different orientations, concentrating solar power (CSP) applications: CFD simulations for collectors, thermal receivers, and thermal storage technologies, Integrating Phase Change Materials (PCM) on solar collectors and modeling techniques, VoF method, conjugate heat transfer modeling techniques, concept of thermal resistance, multi-phase flow modeling.

**Cooling of Electronics Equipment:** CFD modeling techniques for various modes of cooling, conduction cooling

**Building Ventilation:** CFD modeling techniques for natural ventilation, steady/transient thermal analysis, flow over buildings, wind tunnel creation techniques for tall/small buildings, thermal comfort, radiant heating/cooling, thermal stratification, thermal bridging, use of PCM etc., Accessing building ventilation before construction from CFD results, scaling laws derivation for heat transfer as a function of Rayleigh number, Prandtl number etc.,

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

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

Visit [www.omprakashsingh.com/stc17](http://www.omprakashsingh.com/stc17) for updated information

## WHO CAN ATTEND

- This course is taught in such a way that 90% of the CFD 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 completion of the course 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) : June 15, 2017

*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](mailto:opsingh.mec@iitbhu.ac.in) ,  
[stccdfem@gmail.com](mailto:stccdfem@gmail.com)

## ACCOMMODATION

Shared accommodation in the IIT guest house will be provided on payment basis. 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

## REGISTRATION PROCESS

- Send an email to [stccdfem@gmail.com](mailto:stccdfem@gmail.com) and CC to [opsingh.mec@iitbhu.ac.in](mailto:opsingh.mec@iitbhu.ac.in) with the subject line STC17. Mention 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 pay online **OR** speed post the registration fee (Cheque/DD in favour of **[to be updated]** payable at Varanasi, U.P) to the address given 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. 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. Kindly mention participant's name in the remark section during the bank transaction.

## Address

Write "STC 17 CFD" on the top of the envelope and send Cheque/DD to the following address:

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

## ONLINE REGISTRATION FEE PAYMENT

Account holder name: Bank name: **To be updated**  
Branch:

Account No.:

Account type: IFS Code:

## 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. Swati Sunder Mondal  
Dr. Jahar Sarkar  
Dr. Rakesh Kumar Gautam