

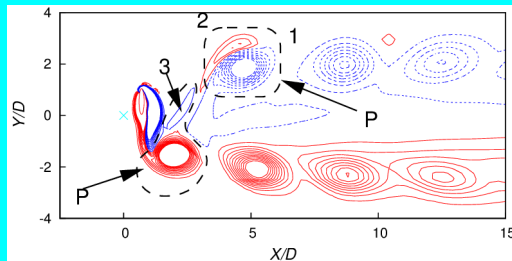
A

Five day Short Term Course

on

CFD Analysis of Heat Transfer and Fluid Flow Problems Using FEM and FVM

3rd July-7th July 2017



Organized by



Department of Mechanical Engineering
IIT(ISM) Dhanbad
Dhanbad - 826 004, Jharkhand
India

About IIT(ISM) Dhanbad

The **Indian Institute of Technology (Indian School of Mines)** is a fully residential and co-educational premier institute located in the mineral-rich belt of India in the city of Dhanbad, Jharkhand. It is one of the oldest technical institute of the country, serving the nation since 1926. What started as an institution to impart mining education, has graduated into a full-fledged technical institution of international acclaim offering a host of programmes, such as, B. Tech., M. Tech., M. Sc. Tech., integrated M.Sc., integrated M.Sc. Tech. and MBA. In addition, the Institute offers M. Phil. and full as well as part time Ph.D. programmes, while also awarding D.Sc. as the highest degree of academic achievement. The Institute has eighteen departments and six centers. Formerly known as Indian School of Mines Dhanbad, the Institute was upgraded to a full-fledged IIT on 6th September, 2016.



About the Department

The Department of Mechanical Engineering is an indispensable constituent of IIT(ISM) Dhanbad, since its inception. In recognition of the expanding activities of the Department, it was renamed as 'Department of Engineering and Mining Machinery' in 1973. With the development of substantial infrastructure and expertise, the Institute felt and recognized the necessity to start the B. Tech. course in Mechanical Engineering in 1999. Consequently, the Department was renamed in 2002, to 'Department of Mechanical Engineering and Mining Machinery Engineering'. In a few years, the B. Tech. in Mechanical Engineering acclaimed much popularity and increased its intake substantially. Thus, the Institute declared the 'Department of Mechanical Engineering' to work independently since 26th June, 2013.

Aim of the Course

To provide detailed theoretical background with examples on applications of finite-element and finite-volume methods to solve heat transfer as well as fluid flow problems.

About the Course

The CFD techniques for approximately solving the flow and heat transfer problems rely on three major discretization methods, i.e. finite difference (FDM), finite volume

(FVM) and finite element (FEM). The later two constitute the theme of this course.

FEM is a powerful numerical technique employed for approximately solving continuum differential equations with a very high accuracy. This discretization method, though has been used extensively in the context of solid mechanics problems, is becoming increasingly more attractive to the heat and fluid flow community. The ease in handling simple to extremely complex geometries without coordinate transformation, ease in handling flux boundary conditions, flexibility in choosing elements types/interpolation functions, compact structure of FEM algorithms and finally, compact coding has made FEM an indispensable numerical tool for present and future day computations.

FVM is a special case of FEM and widely used for computations of heat transfer and fluid flow problems. This method relies on balance of fluxes at cell faces and integration of governing differential equations written in conservative form.

Topics to be covered

- ✓ Introduction to Finite Volume Method: review of continuum equations and illustrations of heat conduction and convection-diffusion problems

- ✓ Introduction to Finite Element Method: method of weighted residuals, gradient, divergence and Green-Gauss theorems, strong and weak or variational forms
- ✓ Shape and weight functions, connectivity array, implementation of specified, natural, convective boundary conditions
- ✓ Concepts of Galerkin and Petrov-Galerkin formulations
- ✓ Numerical integration to find the entries of element matrices, vectors
- ✓ Assembled matrix formation for single and multiple degrees-of-freedom
- ✓ Solution of assembled matrix equation system, Comparison of FDM, FVM and FEM results for 1-D heat conduction problem
- ✓ Illustration with complete FEM solution of Poisson equation for heat conduction in 2-D, convection-diffusion equation in one-dimension using linear and quadratic elements
- ✓ Discretization of two-dimensional Navier-Stokes equations using coupled formulation, LBB condition,

staggered and collocated arrangement, stabilization against velocity and pressure oscillations

- ✓ Step by step illustration of global matrix-vector formation using stabilized FEM on collocated mesh for two-dimensional lid-driven cavity
- ✓ Structured mesh generation using Fortran coding, illustration of solved problems on flow and heat transfer

Who can attend

This course focuses on FEM and FVM treatment of CFD problems. Thus, students, research scholars, faculties and industry personnel working in CFD can attend it.

Speakers

1. Professor Sanjay Mittal, Department of Aerospace Engineering, IIT Kanpur
2. Professor Tanmay Basak, Department of Chemical Engineering, IIT Madras
3. Associate Professor K. Arul Prakash, Department of Applied Mechanics, IIT Madras
4. Assistant Professor Subhankar Sen, Department of Mechanical Engineering, IIT(ISM) Dhanbad

Registration Fee

| Participants | IIT(ISM) | External |
|---|-----------|------------|
| B.E./B.Tech./M.E./M.Tech. students | Rs. 500/- | Rs. 4000/- |
| Ph.D. students | Rs. 500/- | Rs. 5000/- |
| Faculty | -- | Rs. 6500/- |
| Others (Industry/Project fellow/research fellow) | -- | Rs. 6500/- |

The registration fee includes the charges for accommodation, food, course material, participation certificate. Fooding and accommodation will be provided only to external participants.

How to apply

The participants may download the registration form available under the 'Short Courses' tab in the Institute website (www.iitism.ac.in). The registration fee may be paid via (1) demand draft or (2) online transfer.

(1) Payment via demand draft

The registration form filled in all respects along with a DD in favour of '**Registrar, Indian School of Mines**' payable at

Dhanbad should reach the Course Coordinator latest by **20th June, 2017**.

(2) Payment via electronic transfer

The filled in registration form along with the hard copy of the transaction slip should reach the Course Coordinator latest by **20th June, 2017**.

Name of Bank: Canara Bank
Branch Name: Saraidhela, Dhanbad
Email: cb0986@canarabank.com
A/C No.: 0986101009746 (Savings)
Account Holder Name: Registrar, IIT(ISM), Dhanbad
IFSC Code: CNRB0000986
MICR Code: 826015003

How to reach IIT(ISM) Dhanbad

Dhanbad city is well connected via railway and roadway to all the major cities of the country. IIT(ISM) Dhanbad is located about three kilometers away from Dhanbad railway station.

Course Coordinator:

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Registration form

Name (in block letters): _____

Gender: Male/Female _____

Designation: _____

(B.Tech./M.Tech./Ph.D./Faculty, etc)

Organization: _____

Mailing address: _____

Telephone: _____

E-mail: _____

Educational qualification: _____

Accommodation required: Yes / No

Details of demand draft: _____

or Transaction ID: _____

Signature of applicant: _____