

Computational Fluid Dynamics - Video course

COURSE OUTLINE

Illustration of the CFD approach; CFD as an engineering analysis tool.

Derivation of flow governing equations; turbulence modeling; modeling approaches for multiphase flow; initial and boundary conditions; wellposedness.

Discretization of the governing equations using finite difference/volume/element methods; concepts of consistency, stability and convergence; template for the discretization of a generic unsteady transport equation.

Solution of discretized equations; direct methods; classical iterative methods; advanced methods for structured matrices; conjugate gradient techniques; multigrid methods.

Solution of coupled equations: methods for compressible flows; evaluation of pressure in incompressible flows; pressure-velocity coupling algorithms.

Structured and unstructured grids; structured grid generation; unstructured grid generation.

Benchmarking; calibration.

COURSE DETAIL

S No	Topic	No. of Lectures
1	Illustration of the CFD approach; CFD as an engineering analysis tool.	2
2	Derivation of flow governing equations.	5
3	Initial and boundary conditions; wellposedness.	2
4	Turbulence modeling.	4
5	Discretization of the governing equations using finite difference / volume methods.	2
6	Concepts of consistency, stability and convergence.	2
7	Template for the discretization of a generic unsteady transport equation.	2



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Chemical Engineering

Pre-requisites:

UG-level courses in fluid mechanics and computational techniques + basic programming skills.

Additional Reading:

Relevant literature.

Coordinators:

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8	Spectral analysis of errors and TVD schemes.	2
9	Solution of discretized linear algebraic equations: direct methods; classical iterative methods; convergence analysis.	4
10	Advanced methods for the solution of discretized equations.	4
11	Solution of coupled equations: methods for compressible flows.	2
12	On evaluation of pressure in incompressible flows.	2
13	Pressure-velocity coupling algorithms.	2
14	Template for the solution of governing equations.	1
15	Structured and unstructured grids.	1
16	Structured grid generation methods.	2
17	Unstructured grid generation methods.	2
18	Benchmarking and calibration.	1
	Total	42

References:

1. C Hirsch, Numerical Computation of Internal and External Flows, Vol. 1 and 2, John Wiley, 1990.
2. J H Ferziger and M Peric, Computational Methods for Fluid Dynamics, Springer, 2002.