ME 282 (JAN) 3:0 Computational Heat Transfer and Fluid Flow

Mathematical description of fluid flow and heat transfer, conservation equations for mass, momentum, energy and chemical species, classification of partial differential equations, coordinate systems. Discretization techniques using finite difference methods: Taylor series and control volume formulations. Irregular geometries and body-fitted coordinate system. Applications to practical problems.

Instructor: R. K. Shukla

References

1. Patankar, S.V., Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, 1980.
2. Anderson, D.A., Tannehill J.C., and Pletcher, R.H., Computational Fluid Mechanics and Heat Transfer, Hemisphere Publishing Corporation, 1984.
3. Instructor's notes.

Pre-requisites

Familiarity with Navier-Stokes equations is preferred. Prior experience with a standard programming language (e.g. C/C++) and basic numerical analysis are recommended.

Additional information

This course is open to doctoral and master's students interested in computational fluid dynamics and numerical analysis. Undergraduate students with sufficient background can approach the instructor for permission.

Course objectives

After taking this course, the students will be able to:

1. Understand and appreciate the discretization methodologies and approximation techniques that are commonly used to simulate fluid flows.
2. Analyze the discrete algebraic system for flow computation and assess its accuracy, stability and convergence.
3. Develop and implement numerical solvers for simulating fluid flows in standard geometries.

Course website: To be announced.