THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Computational Fluid Dynamics

MECHENG 7511

Credit Hours:
3.00 - 3.00

Course Levels:
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
Advanced numerical methods for solving the Navier-Stokes equations using pressure-based techniques.

Prerequisites and Co-requisites:
Prereq: 6507 (707) or AeroEng 5615 (615), or permission of instructor.

Course Goals / Objectives:
- Learn to apply the finite-volume method to solution of conservation equations encountered in thermo-fluid analysis
- Learn various techniques for discretization of an advection-diffusion equation
- Learn to perform stability and error analysis
- Develop standalone codes from ground up to solve the Navier Stokes equations using both staggered and co-located meshes
- Learn to solve advection-diffusion equations using the finite-volume method on an unstructured mesh

Course Topics:

- Review of finite-volume method
- Governing equations for fluid flow
- Finite-volume integration of general scalar advection-diffusion equation
- Various schemes for treatment of advective flux
- Finite-volume integration of the Navier-Stokes Equation on a structured staggered mesh
- The SIMPLE algorithm, pressure-velocity coupling, variations of SIMPLE
- Finite-volume integration of the Navier-Stokes Equation on a structured co-located mesh, pressure-weighted interpolation (Rhie-Chow interpolation)
- Stability and convergence analysis
- Extension to energy (enthalpy) equation and compressible flow
- Irregular geometries: coordinate transformations, cylindrical coordinates
- Solution of the Navier-Stokes Equation on an unstructured co-located mesh

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Designation:

Elective