MECH 550T: Advanced Computational Fluid Dynamics (3 credits)

Lectures: Tues, Thurs 9:30–11:00; CEME 1210

Instructor: **Prof. W. K. Bushe**
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Grading:

Quizzes:	30%
Project:	20%
Final:	50%

Course Synopsis

This course is an introduction to the computational methods used to predict temperature, pressure, velocity and fluid flow rates in an engineering context. The course will provide coverage of major topics such as numerical methods, gridding, stability, convergence and turbulence modelling; here the intent is to provide a background in these methods to enable students to make better use of commercial software packages through an improved understanding of the methods used in such packages. Students will be expected to propose a project in which they will simulate a flow that is related to their thesis work; this could be a flow for which they plan to do experiments or a flow similar to that they which they plan to research in their thesis work. Ideally, the project should involve simulation of a flow for which there is experimental data available in the literature. The research proposal will be worth 10% of the Project grade and is due at the second quiz. The final report should be written in the form of a paper in the style of the Journal of Fluid Mechanics. It should include proper citations and direct comparisons to exerimental data in the literature where appropriate.

First class: Thursday September 10, 2009

Course Outline by Lecture Period

Date	**Topic**
Sept. 10	Introduction to CFD
Sept. 15	"Review" of Differential Equations
Sept. 17	Finite Difference/Volume/Element methods
Sept. 22	Time integration/iteration
Sept. 24	Boundary and initial conditions
Sept. 29	Meshing, stability and convergence
Oct. 1	Case study: simulating a laminar flow
Oct. 6	**Quiz 1**
Oct. 8	"Review" of statistics
Oct. 13	Review of statistics (cont.)
Oct. 15	Turbulence
Oct. 20	Statistics for turbulent flows
Oct. 22	Direct Numerical Simulation
Oct. 27	Mean governing equations
Oct. 29	Turbulent viscosity models
Nov. 3	Reynolds stress models
Nov. 5	Large Eddy Simulation
Nov. 10	**Quiz 2**
Nov. 12	Case study: simulating a turbulent flow
Nov. 17	Case study (cont.)
Nov. 19 – Dec. 1	Use of Commercial CFD
Dec. 3	Review