Lecturer: Dr. M.F. Lightstone  
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Purpose of Course:

Computational Fluid Dynamics (CFD) is increasingly being used to solve industrial problems involving heat transfer and fluid flow. To use commercial CFD codes intelligently, there must be a fundamental understanding of the equations being solved, the numerical techniques used, the performance of solvers, etc. This course focuses on the fundamentals of the conservation equations and their solution using a finite-volume approach. An understanding of those fundamentals is obtained by developing and experimenting with your own simple code. The assignments begin with simple one-dimensional problems (i.e., 1D conduction) and are eventually extended to model 2D fluid.

Recommended Textbook:


Marking Scheme:

Assignments (5): 50%  
Final Exam: 50%

The exam will be open book. Problem set solutions must be neatly written and well organized. Late assignments will not be accepted.  
Re-grading policy: Re-grading will only be done within two weeks of the return of the assignment. The student must include a written note detailing the reason for the re-grade request.

Course Content:

- 1D steady conduction  
- linearization of source terms  
- convergence, accuracy of schemes  
- iterative solvers (emphasis on multigrid)  
- 1D transient conduction  
- convection/diffusion of a scalar  
- false diffusion  
- 1D solution of mass and momentum equations  
- staggered vs. colocated grids  
- segregated methods for simultaneous solution of mass and momentum (pressure-correction techniques)  
- 2D solution of mass and momentum on Cartesian grids  
- modelling of turbulent flow (time-permitting)
Students are reminded that they should read and comply with the Statement on Academic Ethics and the Senate Resolutions on Academic Dishonesty as found in the Senate Policy Statements distributed at registration and available at the Senate Office. While interaction with your fellow students is expected in learning the course, assignments and projects submitted for academic credit must be your own work.

Policy Reminder:

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as the problem occurs.

McMaster University Statement on Academic Dishonesty

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/senate/academic/ac_integrity.htm

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. (Insert specific course information, e.g. style guide)
2. Improper collaboration in group work. (Insert specific course information)
3. Copying or using unauthorized aids in tests and examinations.