

MEEN5900.707: Computational Fluids and Heat Transfer

Spring 2008

Instructor

Dr. Zhi-Gang Feng
Office: F101M, Research Park, UNT
Phone: 940-565-2078
Email: feng@egw.unt.edu

Time and Place

T and Thu: 2:00-3:20pm

Office Hours

M: 12:00 pm-5:00pm; Thu: 3:30 am-5:30 pm; and by appointment if you cannot make use of the office hours.

Textbook

You can choose any one of the following books:

1. *Computational Methods for Fluid Dynamics*, Joel H. Ferziger and Milovan Peric, Springer-Verlag.
2. *J.C. Tannehil, D.A. Anderson, and R.H. Pletcher, Computational Fluid Mechanics and Heat Transfer*, Taylor and Francis.
3. *Computational Fluid Dynamics (Vol.1)* by Klaus A. Hoffmann and Steve T. Chiang, *Engineering Education System*:
<http://www.eesbooks.com/booklist.html>

Computing environment

It is highly recommended that you program, test and run your code using a Unix or Linux environment. You can install a Linux-like environment for your Window; it is freely available from <http://www.cygwin.com>. For those of you who are new to Unix/Linux, you might want to check a nice Unix tutorial:

<http://www.ee.surrey.ac.uk/Teaching/Unix/index.html> .

I recommend *emacs* as the text editor for development and *gnuplot* as the tool for post-processing (plotting) your results.

Course Objectives

This course offers an introduction to CFD with an emphasis on finite-difference method. It starts with classification of PDEs and basic representation of derivatives via finite-difference approximations and proceeds to consider discretizations of various PDEs. It offers fundamental concepts and detailed techniques on solving heat transfer equations and Navier-Stokes equations for incompressible flow; it also provides exposures to scientific computing environment and open-source packages.

Course Topics:

Introduction to CFD and computing environment
Introduction to programming language
Governing equations of fluid dynamics and heat transfer
Classification of PDEs
Finite-difference approximation of derivatives
Numerical analysis of PDE: implicit, versus explicit, stability.
Numerical methods for linear hyperbolic PDEs
Numerical Methods for Parabolic PDEs
Numerical Methods for Elliptic PDEs
Numerical methods for incompressible Navier-Stokes equations.
Advanced topics

Attendance Policy

Class attendance will contribute significantly to the success in this course. All students are required to attend all classes and examination sessions.

Homework and Computer Projects (60%)

You will be given reading and homework assignments each week. Computer projects will also be assigned. They will involve writing your own programs and graphing the results. To complete a computer project, you need write a short technical report describing the problem being solved, the numerical method being used, your code and a discussion of your results.

In-class Midterm Test (20%)

There will be one midterm in-class test.

Final Exam (20%)

Comprehensive, covering all the materials taught in the whole semester.

Grading scale

85 and above: A; 75-84 B; 60-74: C; below 60: D.

Other Policies

1. It is the responsibility of students with certified disabilities to provide the instructor with the appropriate documentations;
2. Dishonesty will be handled as per the school policy;
3. Any questions regarding the grading discrepancy should be brought up a week after receiving returning work.