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Syllabus
MAE561/471 Computational Fluid Dynamics - Fall 2013
Tuesday/Thursday 1:30-2:45 PM GWC535

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Instructor: Huei-Ping Huang, ERC 359, Email: hp.huang@asu.edu
Office Hours: Tuesday/Thursday 3:00-5:00, or by appointment
Textbook: *Computational Fluid Dynamics, vol. 1, 4th Edition*, Hoffmann & Chiang, **Required**
Course website: **http://www.public.asu.edu/~hhuang38/MAE561.html**

## Course Outline

Part I  Overview
- Overview of equations in fluid dynamics & applications (instructor's note)
- Review of basic partial differential equations (PDEs) (1.2–1.7, 1.10, 1.11)
- Review of numerical differentiation & related concepts (2.2, 2.4–2.6)

Part II  Numerical solutions of prototypical PDEs
- One-dimensional linear advection/diffusion/wave equations
  - Construction of finite difference schemes: advection equation (6.2, 6.4, 6.5)
  - Construction of finite difference schemes: diffusion equation (3.2–3.5)
  - Numerical convergence (instructor's note)
  - Numerical stability (4.3, instructor's note)
  - Boundary conditions (instructor's note)
- One-dimensional Nonlinear PDE
  - Numerical treatment of nonlinear terms (6.6)
  - Conservation law (instructor's note)
- Elliptic PDE (5.1–5.4)
- Higher-dimensional PDEs
  - Grid arrangement and grid generation (3.7, 3.13, 8.7, 9.1–9.5)
  - Boundary conditions (instructor's note)

Part III  Numerical solutions of Navier-Stokes equations
- Overview of 3-D N-S equations (instructor's note)
- Boundary conditions (instructor's note, 8.6, 8.9)
- Simplified versions of N-S equations (1-D idealized, etc.) (instructor's note, 7.5)
- Numerical models of 2-D incompressible flow (8.1–8.12: **topic for final project**)
- CFD solvers (Lab work using ANSYS-Fluent - Computer lab at GWC 481)

**Grade:** **Nominally 65% homework, 35% final project.**
**Attendance is important. The lectures will only loosely follow the textbook.**

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Useful links

ASU policy on academic integrity:  https://provost.asu.edu/academicintegrity
Campus safety and security:        https://provost.asu.edu/University-Safety-Security
Grade and grading policies:        https://students.asu.edu/grades
Counseling and consultation:       https://students.asu.edu/counseling
SEMTE advising:                    http://engineering.asu.edu/semte/Advising.html
ASU common software/applications portal: https://apps.asu.edu  (login required)
MATLAB searchable online documentation: http://www.mathworks.com/help/techdoc/?s_iid=ML2012_bb_doc
MATLAB online examples:            http://www.mathworks.com/products/matlab/examples.html