MAE 250D (online)
Computational Aerodynamics
Summer 2012

Instructor: Xiaolin Zhong, Professor of MAE

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Office Hours: Because of the nature of online instruction, I do not hold regular office hours. Instead, your questions are handled through e-mails. Please send me and/or the TA e-mails regarding your questions. For general questions, the questions and answers will both be e-mailed to all students of the class, and be posted as class announcements in courseweb.

TA: Mr. Kin Wai Leung.

Starting from the second week, Kin Wai will hold two-hour weekly web-based TA sessions to help you with homework problems and to answer questions, etc. The details and time of the TA sessions will be announced to the class by Kin Wai.

Lecture: We will release two lectures each week, with an exception that only one lecture is given in the week of the midterm exam. Lectures are to be posted the weekend before the lectures are to be viewed. The power-point slides I used for the lectures will also be posted on the courseweb.

Class Web Site: http://courseweb.seas.ucla.edu. All handouts, assignments, and solutions will be posted on this website only.


References: In addition to the online lectures, I will post copies of my powerpoint slides used in the video in courseweb for your reference.

Grading:

1. **Homework:** 25%. Weekly homework will be assigned and collected through courseweb. HW solutions will also be posted on the same class web site.
2. **Midterm Exam:** 20% (Saturday, July 28, 2012, 1–2 pm, closed book except your own notes of two one-sided pages)
3. **A Course Project:** 25%. The TA will post project
instructions after the midterm exam.

4. **Final Exam:** 30% (Saturday, September 1, 2012, 1-3 pm, closed book except your own notes of six one-sided pages.)

**Computer Use:** You need to write your own computer programs using a computer programming language you know for homework assignments and the final project. Examples of the programming languages are: Matlab, Fortran, c/c++, Java, etc. I have requested UCLA Seasnet to activate Matlab for the class.

**Prerequisites:** Familiar with computer programming, and basic knowledge of numerical analysis (MAE 182C) and compressible flows (MAE 250C).

**Course Topics**

1. **Overview and Basic Equations**
   - Model partial differential equations (PDE)
   - Classification of PDE's

2. **Basic Numerical Methods and Application to Model Partial Differential Equations**
   - Numerical methods for PDE's
   - Finite difference and finite volume methods
   - Truncation error, consistency of a numerical method
   - Von Neumann stability analysis and asymptotic stability analysis
   - Modified equations, numerical dissipation and dispersion
   - Method of lines, Runge-Kutta schemes for PDE.
   - High-order explicit and compact linear schemes
   - High-resolution nonlinear schemes: TVD, ENO, WENO schemes.
   - Multi-dimensional problems

3. **Computational Mesh and Coordinate Transformation**
   - Computational mesh
   - Coordinate transformation relations
   - Grid generation methods

4. **Numerical Methods for Inviscid Flow Equations (Euler Equations)**
   - Governing equations of fluid mechanics
   - Conservation laws, 1-D Euler equations
   - Riemann solver, upwind schemes, and MacCormack scheme
   - Second-order upwind and high-resolution schemes
   - Multi-dimensional problems, implicit methods