AME 404 – Computational Solutions to Engineering Problems

Lecture: MW 8:00-9:20 am (class # 28754R) SLH 102
MW 11:00-12:20 pm (class #28755R) OHE 132
MW 11:00-12:20 pm (class # 29005D) DEN
Instructor: Dr. Takahiro Sakai
Office: RRB 213
Contact Info: tsakai@usc.edu ; (213) 740-5367
Office Hours: Mon 2-3:30 pm; Tue 10:30-12pm

Textbook: Not required.

Teaching Assistant / Office hours:
Bo Jin (bochengj@usc.edu): Mondays 9:30am-11:30am & 12:30am-4:30pm @VHE402 (no phone)
Shibing Liu (shibingl@usc.edu): Tuesdays 9am-12pm & 1pm-4pm @VHE202 (213-740-8253)

Course Objective: The goal of this course is to introduce numerical methods and effective numerical tools in simulating and analyzing typical problems that arise in aerospace and mechanical engineering. At the end of semester students will have skills to: formulate a simple problem, implement numerical methods to a computer program, simulate the problem and evaluate the corresponding results.

Selected Topics (some topics may change):

Part 1. Numerical Simulations of Dynamical Systems
- Simulation methods of Ordinary Differential Equations (ODEs)
- The 1st order, the 2nd or higher order ODEs and the 1st order systems
- Fourier spectral analysis, Signal processing

Part 2. Numerical Solutions to Two-point Boundary Value Problems (BVP)
- Iterative method (the shooting method)
- Eigenvalues and Eigenfunctions

Part 3. Numerical Solutions to Partial Differential Equations (PDEs)
- Finite differences
- 1D steady state heat conduction problems
- Solution methods to linear system equations
- Direct method for two-point BVP
- 2D steady state heat conduction problems
- 1D unsteady heat conduction problems

Grading: Homework 30%; Project-1 35%; Project-2 35%

Computer Programming Language: MATLAB programming language is required for this course. Students are expected to have basic MATLAB programing skill (e.g., AME150L or equivalent).

Homework Policy (IMPORTANT): In general students are expected to work on homework independently. Discussion with peer students is not discouraged. However, students must write computer programs and the other part of the work independently. Your work will be carefully

monitored for academic integrity throughout the semester. If graders determined that academic plagiarism is highly likely, then the work will receive a score of zero. If plagiarism persists, then such a case will be filed to Student Judicial Affairs & Community Standards (http://www.usc.edu/student-affairs/SJACS) with a recommended course grade of F. This is the worst scenario and, should be avoided at all times. If you worked on a problem in a group, it would be likely that your work looks similar to others'. In order to avoid your work miscounted as a plagiarism, therefore, please list all the group members' names on your work. This does not harm your score.

Your questions on grading will be accepted for one-week counting from the day the homework is returned, and the homework grade will be frozen thereafter and no appeal or excuse will be accepted.

Partial credit will be given even the program does not output correct results. Late homework is not accepted.

In general, submitted work must include written formulation, printout of computer program and corresponding results other than that required by the assignment.

Project Policy (IMPORTANT): Project policy basically follows the homework policy except that students are required to work on projects all independently. No collaborating work is permitted. This means that all the students must submit their original work. TAs and instructor will assist you only in clarifying the problems but not in solving. Late submittal is never accepted.

DEN Blackboard: All course documents (lecture notes, homework, project, etc.) will be posted to DEN Blackboard (https://www.uscden.net/) and available for all the students. However, online lectures and video archives are available for DEN students only (section 29005).

Academic Integrity: The Department of Aerospace and Mechanical Engineering adheres to the University's policies concerning Academic Integrity as described in SCampus. All faculty, staff and students share the responsibility for maintaining an environment of integrity. Students are expected to be aware of, and to observe, the academic integrity standards set forth in SCampus. We will collectively follow these standards in this section of AME 404.

Note: This syllabus is tentative and subject to change as needed during the semester. Any changes will be announced in class in advance.