AME 302: Dynamic Systems

Lecture: M, W 1-10:50  
Discussion: F 10-11:50  
Instructor: H. Flashner  
Office: Olin Hall 430E  
Phone: (213) 740-0489  
Office hours: Monday, 12pm-2pm  
email: hflashne@usc.edu

Teaching Assistant: Sichen Yuan  
email: ysichen@usc.edu  
Office: VHE 202  
Office hours: TBD

Homework: Will be assigned every Wednesday and will be due the following Wednesday

Grading: The final grade will be according to the following formula:

- Homework: 20%  
- Project: 10%  
- Midterm 1 (October 2): 15%  
- Midterm 2 (November 6): 15%  
- Final (Friday, December 8): 40%


References:

Course Outline

1. Introduction (Chapter 1)
   (a) Input-output relations
   (b) Dynamic systems
   (c) Classes of dynamic systems
      i. Mechanical systems
      ii. Electrical systems
      iii. Electro-mechanical systems
      iv. Fluid and hydraulic systems
      v. Heat transfer systems

2. Review of Mathematical Methods (Chapter 2)
   (a) Solution of Ordinary Differential Equations in Time
      i. Homogeneous and particular solution
      ii. Variation of parameters
   (b) Laplace Transform
      i. Complex numbers
      ii. Laplace transform of elementary functions
      iii. Characteristics of Laplace transform
      iv. Inverse Laplace transform
         A. Partial fractions
      v. Solution of ODE’s using Laplace transform
   (c) Transfer function representation of dynamical systems
   (d) System response using MATLAB

3. Mechanical Systems (Chapters 3 and 4)
   (a) Newton’s laws
      i. Newton’s laws for translational motion
      ii. Newton’s second law for rotation about a fixed axis
   (b) General planar motion
   (c) Spring elements
   (d) Damping elements
   (e) Modeling Flexible systems

4. Representation and Simulation of Dynamic System (Chapter 5)
(a) Block diagram representation
(b) State-variable representation
(c) Simulation using MATLAB
   i. Linear models
   ii. Nonlinear models
(d) Simulation using SIMULINK
   i. Linear models
   ii. Nonlinear models

5. Electrical and Electromechanical Systems (Chapter 6)

   (a) Electrical elements
   (b) Kirchoff’s laws
   (c) Operational amplifiers
   (d) Electrical motors

6. Fluid and Thermal Systems (Chapter 7)

   (a) Fluid level systems
   (b) Hydraulic systems
   (c) Thermal systems

7. System Analysis in Time Domain (Chapter 8)

   (a) Response of first-order system
   (b) Response of second-order system
   (c) Specifications of step response
   (d) Parameter estimation in time-domain

8. System Analysis in Frequency Domain (Chapter 9)

   (a) Response of linear system to harmonic input
   (b) Interpretation of frequency response
   (c) Asymptotic approximation of frequency response
   (d) System identification if frequency response