AME 302: Dynamic Systems

Lecture:	*Tue, Th 9:30-10:50*
Discussion	*F 10-11:50*
Instructor:	*H. Flashner*
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Homework: Will be assigned *every* Thursday and will be due *the following* Thursday

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

Homework:	20%
Project	10%
Midterm 1	15%
Midterm 2	15%
Final (December 7):	40%

Required textbook: William J. Palm III, *System Dynamics*, 3rd ed. McGraw-Hill, 2014

References:

1. C.M. Close, D.K. Frederick, and J.C. Newell, Modeling and Analysis of Dynamic Systems", Wiley, 3rd ed., 2002

2. R. S. Esfandiari and B. Lu, "Modeling and Analysis of Dynamic Systems", 2nd ed. ,CRC Press, 2014

3. E. Doebelin, System Dynamics, modelin, analysis, simulation, design, 2nd ed., Marcel Dekker, 1998

Course Outline

1. *Introduction (Chapter 1)*
   (a) Input-output relations
   (b) Dynamic systems
   (c) Classes of dynamic systems
      i. Mechanical systems
      ii. Elecrical 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 secon-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 frquency response
    (c) Asymptotic approximation of frequency response
    (d) System identification if frequency response