AME 545 Modeling and Control of Distributed Dynamic Systems

Spring 2016

Department of Mechanical Engineering
University of Southern California

==========

Meeting: Tuesday and Thursday, 05:00-06:20 pm, OHE 100C

Instructor: Professor Ben Yang
Office: OHE 430
Phone: (213) 740-7082; Email: bingen@usc.edu

Office Hour: Tuesday and Thursday, 3:00-4:30 pm

Grading:

Two midterm exams @20% each	40%
Homework (5 sets @7% each)	35%
Project	25%
Total	100%

Note: there is no final examination for this class.

Homework: About five sets homework will be assigned, with each due two weeks after its assignment. Late homework receives **NO** credits.

Text Book: B. Yang, "Stress, Strain, and Structural Dynamics: An Interactive Handbook of Formulas, Solutions, and MATLAB Toolboxes", Academic Press (March 11, 2005) ISBN-13: 978-0127877679

Also, class notes will be uploaded to the website https://courses.uscden.net/d2l/login

Reference Books:

1. F.B. Hildebrand, Methods of Applied Mathematics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1965.

2. L. Meirovitch, Computational Methods in Structural Dynamics, Sijthoff & Noordhoff, 1980.

3. J.N. Reddy, Applied Functional Analysis and Variational Methods in Engineering, McGraw-Hill Book Co., New York, 1986.

4. Research papers

Prerequisite: AME 521 and AME 541

Objective:

This course gives an exposition of analytical and numerical techniques for modeling and control of distributed dynamic systems in engineering, such as vibration of flexible mechanical systems and heat conduction in solids. Some of the course materials address state-of-the-art topics in technology and research.

Topics

- Review of theories for lumped parameter systems (AME420, AME 451, AME521 & AME541)
- Calculus of variations, Lagrange's equations and generalized Hamilton's principle
- Distributed transfer function method
- Discretization techniques for control system formulation
- Active, passive and semi-active controls, and delayed feedback control
- Applications: Large space structures, the Hyperloop, flexible rotor-bearing systems, automobile suspension systems, smart structures and materials, MEMS, nanostructures, and electronic musical instrument

Class Schedule with Dates of Homework, Project and Exams

See the following two pages.

AME 545 Modeling and Control of Distributed Dynamic Systems Spring 2016

Week	Date	Material	Homework	Quizzes	Project
1	1/12/2016	Introduction and Review			
	1/14/2016	Calculus of Variations			
2	1/19/2016	Lagrange's equations	HW 1		
	1/21/2016	Hamilton's Principle			
3	1/26/2016	Boundary Value Problems			
	1/28/2016	Eigenvalue Problems			
4	2/2/2016	Dynamic response by Green's function formulation	HW 2		
	2/4/2016	Distributed transfer function formulation			
5	2/9/2016	Distributed Tranfer function method			
	2/11/2016				
6	2/16/2016	Distributed Tranfer function method	HW 3		
	2/18/2016				
7	2/23/2016	Discretization - Assumed modes method		Quiz 1	
	2/25/2016				
8	3/1/2016	Discretization - Finite Element Method			Project description
	3/3/2016		HW 4		
9	3/8/2016	Flexible Mechanical Systems			
	3/10/2016	Applications			
10	3/15/2016	Spring recess - No class			
	3/17/2016	Spring recess - No class			
11	3/22/2016	Coulpled flexible rigid body systems			
	3/24/2016	Applications	HW 5		
12	3/29/2016	Heat conduction systems			
	3/31/2016	Applications			
13	4/5/2016	Control system formulation for distributed dynamic systems			

	4/7/2016	Sensor and actuator placement, controllability and observability	HW 6		
14	4/12/2016	Standard feedback control methods		Quiz 2	
	4/14/2016				
15	4/19/2016	Active, passive and semi-active control methodology			
	4/21/2016				
16	4/26/2016	Delayed feedback control method	HW 6 due		
	4/28/2016	Last class			
	5/5/2015	Project due by 5 pm on Thursday			Project report due