14.557 Structural Dynamics (3-0-3)

– Dynamic Analysis and Control of Civil Infrastructure Systems –

Syllabus
Fall 2013

Instructor:
 Tzuyang Yu, Ph.D. (Falmouth 107C, ext.2288, tzuyang_yu@uml.edu)
 Thurs. 4:30 p.m.∼5:30 p.m. (or by appointment)

Teaching Assistant:
 N/A

Time and Venue:
 Thurs., 6:30 p.m.∼9:20 p.m., KI305

Webpage: http://tyu.eng.uml.edu/14.557_2013/

Prerequisites: 14.205 *Dynamics*; 14.350 *Structural Analysis*; 92.236 *Engineering Differential Equations*

Course Description

The first part of this course aims to provide an understanding of the dynamic behavior of civil engineering structures with an emphasis on buildings and bridges. Free vibration and forced vibration (harmonic, periodic, arbitrary, impulse) of structures (single- and multi-degree-of-freedom) are investigated. Seismic response and resistant design of structures are introduced using design codes. The second part presents a rational basis for the preliminary design of motion-sensitive structures. Modelling and analysis of structures equipped with modern control and energy dissipation devices are introduced. Topics including the role of damping in controlling motion, and optimal distribution of stiffness and damping in structural control are covered. Passive damping systems including tuned mass dampers and base isolation systems are discussed. An introduction to blast resistant design of buildings is also provided. Matlab (Matrix Laboratory ®, MathWork, Inc.) codes are provided and used in solving numerical examples.

Grading Policy

There will be four homework assignments (10% each) and two exams (30% mid-term and 30% final). All homework assignments must be turned in on time. The late policy is stated as follows: (1) 25% reduction for "less than one day" late; (2) 50% reduction for "one to two days" late; and (3) 100% reduction for "more than two days" late.

Textbook and References

Textbook:

A.K. Chopra, *Dynamics of Structures – Theory and Applications to Earthquake Engineering*, 4th ed., Prentice Hall, Upper Saddle River, NJ; 2012.

References:

J.J. Connor, *Introduction to Structural Motion Control*, Prentice Hall, Upper Saddle River, NJ; 2003.

J.W. Clough and J. Penzien, *Dynamics of Structures*, McGraw-Hill, New York, NY; 1993.

G.V. Berg, *Elements of Structural Dynamics*, Prentice-Hall, Englewood Cliffs, NJ; 1989.

N.M. Newmark, E. Rosenblueth, *Fundamentals of Earthquake Engineering*, Prentice-Hall, Englewood, NJ; 1971.

Schedule

Week	Date	Topics
1	09/05	Introduction; Free vibration of single-degree-of-freedom (SDOF) systems
2	09/12	Forced vibration of SDOF systems
3	09/19	Free vibration of multi-degree-of-freedom (MDOF) systems
4	09/26	Forced vibration of MDOF systems
5	10/03	Seismic response of SDOF and MDOF systems
6	10/10	(Mid-term review)
7	10/17	**Mid-term Exam**
8	10/24	Earthquake engineering and seismic resistant design
9	10/31	Structural damping
10	11/07	Passive and active structural motion control
11	11/14	Optimal stiffness distribution
12	11/21	Optimal passive damping distribution
13	11/28	*Thanksgiving recession*
14	12/05	Tuned mass damper (TMD) and based isolation systems; Blast resistant design
15	12/19	**Final Exam**