SYST 320: Dynamic Systems II
Course Overview, Fall 2016

It is often important to predict the behavior of systems that change in time. Such systems are called *dynamic systems*. Examples include mechanical systems (for example, the suspension system of a car), electrical systems (an audio amplifier), fluid systems (an estuary and the rivers that flow into it), biological systems (populations of interacting species), and so forth.

The objective of this course is to model and analyze a variety of systems using a common mathematical framework of linear differential equations. This course follows SYST 220, Dynamic Systems I. The first course covered mechanical systems and fundamental aspects of obtaining solutions using Laplace transforms and block diagrams. This course expands the set of application areas to include electrical systems, fluid systems, and other applications; and it continues the analysis of how systems respond to different external inputs and controls. Key questions addressed in this course are:

- Is a system stable?
- What are fundamental characteristics of the system behavior as a function of time?
- How does the system respond to oscillatory inputs?
- How can external controls be applied to ensure adequate system performance in the presence of uncertain disturbances?
- How should the system be designed to meet specified engineering requirements?

Class Hours: Tuesday, Thursday, 10:30 – 11:45 am.
Location: Lecture Hall 2

Pre-requisites: SYST 220 (dynamic systems I)
MATH 203 (matrix algebra)
MATH 214 (differential equations)
PHYS 260 (university physics II)

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Textbook: Palm, W. J. 2014. *System Dynamics*. McGraw-Hill, 3rd edition.

Student Evaluation Criteria

Homework and quizzes	15%
Professionalism	3%
Group project	10%
Midterm 1	20%
Midterm 2	20%
Final exam	32%

Syllabus and Course Schedule
Last Updated: 8/12/16

Date	Topic	Reading	Assignment
Tue. Aug. 30	Fluid Systems, pressure, force	7.1	
Thu. Sep. 1	Fluid Systems, dynamic models	7.4	Hmwk #1 due
Tue. Sep. 6	Fluid Systems, conservation of mass, capacitance	7.2	
Thu. Sep. 8	Fluid Systems, resistance	7.3	Hmwk #2 due
Tue. Sep. 13	Electrical Systems, circuit elements	6.1	
Thu. Sep. 15	Electrical Systems, solving circuits	6.2	Hmwk #3 due
Tue. Sep. 20	Electrical Systems, impedance	6.3	
Thu. Sep. 22	Electrical Systems, resistive heating		Hmwk #4 due
Tue. Sep. 27	Electrical Systems, filters		
Thu. Sep. 29	Time Domain Analysis, 1st order systems	8.1	Hmwk #5 due
Tue. Oct. 4	Midterm #1		
Thu. Oct. 6	Time Domain Analysis, 2nd order systems	8.2	
Tue. Oct. 11	No Class (Columbus Day on Monday)		
Thu. Oct. 13	Time Domain Analysis, roots, stability	8.2	Hmwk #6 due
Tue. Oct. 18	Time Domain Analysis, step response	8.3	
Thu. Oct. 20	Intro. to Control Systems	10.1, 10.2	Hmwk #7 due
Tue. Oct. 25	Intro. to Control Systems, types of control laws	10.3	
Thu. Oct. 27	Intro. to Control Systems, examples	10.4	Hmwk #8 due
Tue. Nov. 1	Intro. to Control Systems, root-locus		
Thu. Nov. 3	Freq. Domain Analysis, complex #'s	9.1	Hmwk #9 due
Tue. Nov. 8	Freq. Domain Analysis, freq. response function	9.1	
Thu. Nov. 10	Freq. Domain Analysis, Bode plot	9.1	Hmwk #10 due
Tue. Nov. 15	Midterm #2		
Thu. Nov. 17	Freq. Domain Analysis, resonance	9.2	
Tue. Nov. 22	Freq. Domain Analysis, further examples	9.3	Hmwk #11 due
Thu. Nov. 24	No Class (Thanksgiving)		
Tue. Nov. 29	Dynamic Systems: Other Applications		
Thu. Dec. 1	Dynamic Systems: Other Applications		Project due
Tue. Dec. 6	Dynamic Systems: Other Applications		
Thu. Dec. 8	Review		Hmwk #12 due
Tue. Dec. 13	Final Exam, **10:30 am – 1:15 pm**, Chap. 6-10		