SYST 611 **Instructor: Dr. Frederick Wieland**
Spring 2012 **Tuesdays, 7:20—10 PM IH 206**

Overview

This course is about the mathematics of dynamic systems. A "dynamic system" is a system that evolves in time—one of more of the system "state variables" change as a function of time. We will study both discrete and continuous dynamic systems, with an emphasis on how to set up those systems (i.e., model the systems) given examples from social science, finance, economics, physics, electrical engineering, and other engineering disciplines. We will not only set up the differential or difference equations that describe the systems, but we will solve those equations and gain insight into the understanding of the system. By the end of the course you will gain a greater insight into the nature of dynamic systems, how to model them, and how to control them.

Required Text:

David G. Luenberger, "Introduction to Dynamic Systems: Theory, Models, and Applications."

Although MATLAB is not required for this course, it will make solving the homework problems easier.

Prerequisite Knowledge

Course SYST 500. You should have a thorough knowledge of algebra, as well as some understanding of differential equations. You should also know something about matrix theory; if you need a refresher, study chapter 3 of the required text (Luenberger) before the 2nd class.

Course Outline

Date	Topic	Readings (L = Luenberger)
8/28	Polynomial fractions—poles, zeros, and PFEs	L 263-266
9/4	Difference equations and Z-transforms	L section 2.1-2.7, and sections 8.2-8.3, and L chapter 3 (please know chapter 3 before this class)
9/11	State variable representation, differential equations, LaPlace transforms	L sections 4.1-4.5
9/18	Applications of difference and differential equations	L 2.8-2.10 and L 4.6-4.7 and pages 139-141, and L section 8.5
9/25	Equlibrium and stability ; oscillating solutions	L 5.9-5.12
10/2	Introduction to feedback control	Class handout
10/9	COLUMBUS DAY HOLIDAY—NO CLASS	
10/16	Midterm Exam, In-class	
10/23	Control of dynamic systems and PID controllers	Class handout
10/30	Discrete probability models	L chapter 7 (entire)
11/6	Continuous probability models	L chapter 9
11/13	System linearization	L Chapter 9
11/20	Nonlinear systems	L chapter 9
11/27	Models of linear and nonlinear systems	L chapter 10

12/4	Final exam review	
12/11	Reading week (no class)	
12/18	Final Exam (in-class)	

Course policies

- Homework will be issued weekly, and should be submitted on-line through the "blackboard" system. No printed-out homeworks will be accepted.
- Please write your homework legibly, using a dark pen or pencil on a blank white background. After printing out your assignment, if I cannot read it, you will be given a 'zero' for that assignment.
- Collaboration is encouraged for the homework—please consult fellow students or web sites.
- For the mid-term and final exams, you will be working alone. So please understand all questions that have been assigned in the homework.
- If GMU is closed, for example for inclement weather or a national emergency, then the homework due that day is automatically due the next time class meets.
- Class attendance is optional
- Grading policy is as follows:
    - Homework: 30% of your grade. Your lowest homework score is dropped before the homework grade is averaged.
    - Midterm: 30% of your grade.
    - Final: 40% of your grade. The final is comprehensive, although it will emphasize what has been learned since the midterm.
- Although the instructor does not keep regular office hours, extra help can be arranged in advance if needed.
- Contacting instructor: Please email fredwieland@hotmail.com, and include SYST 611 in the subject line of your email.