UNIVERSITY OF CALIFORNIA, SANTA CRUZ
BOARD OF STUDIES IN COMPUTER ENGINEERING

EE-154/CMPE-241:
INTRODUCTION TO FEEDBACK CONTROL SYSTEMS

WINTER 2008
T-Th 12:00 – 1:45 PM
CLASS: Merrill College, 130

INTRODUCTION

Design of linear feedback control systems for command-following error, disturbance rejection, stability, and dynamic response specifications. Root-locus and frequency response design (Bode) techniques. Nyquist stability criterion. Design of dynamic compensators. Examples are drawn from electrical, mechanical, and aeronautical applications. Computer aided design with MATLAB.

INSTRUCTOR:

GABRIEL HUGH ELKAIM
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TEXTBOOKS (ALSO IN THE LIBRARY ON RESERVE):

"Feedback Control of Dynamic Systems (5th Edition)" by Gene Franklin, J.D. Powell, Abbas Emami-Naeini, Prentice Hall; 5 edition (October 31, 2005), ISBN: 0131499300

PREREQUISITES:

EE103, AMS27 or equivalent (Basic Circuit Analysis, Basic Dynamics, Differential Equations, Complex Numbers)

HOMEWORK

Attendance is highly recommended for the lectures as the material builds up quickly. Lecture material will be made available on the website, usually before covered in class. Annotated lecture notes and videos of the lecture will be posted after class in a timely fashion (see note on video below).

There will be weekly homework assignments that are both required and graded. They are worth 20% of your overall grade, they are essential to mastering the material. There will one midterm exam and one final exam. The midterm and exam material will be based on homework and lecture material.

Homeworks are due in my office, E2-337B, on Thursday's at 6:45 PM.

GRADING

This course is based on a combination of the homeworks and exams. For undergrad's enrolled in EE-154, the breakdown is as follows:

HOMEWORKS,	20%
MIDTERM EXAMS	30%
FINAL EXAM	50%

For graduate students enrolled in CMPE/EE-241, there is an additional final project that will involved developing the equations of motion, a control design, and a write-up in LaTEX, such that the grading breakdown is as follows:

HOMEWORKS,	20%
MIDTERM EXAMS	20%
FINAL EXAM	40%
FINAL PROJECT	20%

WWW SITE, VIDEOS, AND WEBFORUM

Website: www.soe.ucsc.edu/classes/ee154/Winter08

Check this site often as this is where the homework assignments, lecture notes, homework and test solutions, and lecture videos are posted. You are expected to read the material on the website.

Videos: As an experiment in teaching technology, the instructor will be capturing both the audio and screen from the course in real-time. This will later be posted to the website. While every attempt will be made to capture the classes, as this is a new technology, there are no guarantees. Also, while watching the video should be a great way to review course material, if you are not in class you cannot ask questions and/or clarifications. Further, if too few students show up for lectures, the instructor may restrict access to class videos.

WebForum: TBA, look for it on the class website shortly.

Use the webforum to post questions about and class work. Use it to ask questions of other students. Do not expect quick replies from the instructor, use e-mail for that. Do NOT post code onto the webforum.

ACADEMIC HONESTY

Academic honesty is a requirement for the course. All assignments must be your own independent work; this includes homework, exams, and project.

What is cheating? It is presenting work that is not yours as your own. You can, and are encouraged to, discuss and strategize with your colleagues on homeworks and on the project, but your work should be your own. Copying is NEVER acceptable.

If a student is caught cheating in either the class or the lab this will result in an immediate failure in the class. It will be reported to your college and your department. DO NOT CHEAT; it is not worth it.

SYLLABUS

The class is based fairly closely on the progress of the book (the new edition), we will be covering the first six chapters (possible hitting Chapter 7 if we have time). You should be reading the chapters ahead of the class, as it will really help your understanding of the material.

CHAPTER 1,	Intro and History
CHAPTER 2,	Dynamic Models
CHAPTER 3,	Dynamic Response
	Convolution
	Laplace Transforms
	Block Diagrams
	Control Specifications
CHAPTER 4,	Basic Properties of Feedback
CHAPTER 5,	Root Locus Design
CHAPTER 6,	Frequency Response Design
	Frequency Response
	Nyquist
	Bode
	Compensation
CHAPTER 7,	State Space Design

MATLAB

This course will rely heavily on the use of MATLAB for homework, and as a tool to understanding control system behavior. MATLAB is available on the cluster computers in Baskin Engineering, as well as on the Solaris machines. You can also purchase a copy of the student version of MATLAB directly from the Mathworks (and also from the bookstore). The control system toolbox is also available from the Mathworks. Note that there are open source versions of equivalent programs, such as OCTAVE, which are perfectly acceptable.

ACKNOWLEDGEMENTS

I would like to acknowledge the tremendous help of Prof. Ed Carryer of Stanford University for pioneering this video capture technology, and helping me to get this technology working. I would also like to acknowledge Prof. Steve Rock of Stanford University, who teaches this material and has generously helped with the syllabus, the course material, and general inspiration. Prof. Rock combines the theory with real world stories in a way that makes controls engineering fun and completely enjoyable.