EME 172: Automatic Control of Engineering Systems

Summer Session 1, 2007

Instructor	Dr. Bo Chen Phone: 752-1028 E-mail: bochen@ucdavis.edu Office hours: TW 10:00 – 11:00am, Bainer 1067
Teaching Assistant	Yucheng Chou, cycchou@ucdavis.edu Office Hours: WR 2:00 – 3:00pm, 2121A Bainer Hall CAE Lab
Lecture Hours	MTW 8:00 – 9:40am OLSON 146
Discussion Hours	T 2:10 – 3:50 Bainer 1134 The discussion sessions will be devoted to problem solving and clarification of material covered in the lectures, homework, and exams.
Course Website	http://iel.ucdavis.edu/course/EME172/
Synopsis	In this course, we study basic principles governing the design and performance analysis of control systems. Topics include the use of Laplace transforms and state space representations to model the behavior of linear dynamic systems; analysis of system transient and steady-state behavior; system stability; and compensator/controller design through root locus or frequency response methods to guarantee desired system performance characteristics.
Prerequisites	ENG 102 You need a good working knowledge of engineering mathematics – especially basic algebra, ordinary differential equations, and complex numbers.
Textbook	*Control Systems Engineering*, 4th Edition, by Norman S. Nise, Wiley (2004).
Reference	*Feedback Control of Dynamic Systems*, 5th Edition, by Gene F. Franklin, J. Davis Powell, and Abbas Emami-Naeini, Pearson Education, Inc. (2006).

Course outline

The textbook contains too much material for a one-quarter course. The following is an outline of the topics that we shall address:

Introduction to Control Systems
- Control systems
- Open-loop control systems
- Closed-loop (feedback) control systems
- Basic control problems
- General design objectives
- Basic approach to control system design

Mathematical Modeling of Dynamic Systems
- Laplace transform
- System transfer functions
- Dynamic models
- State space model
- Converting a transfer function to state space
- Converting from state space to a transfer function

Time Response of Dynamic Systems
- Poles and zeros
- Second order systems
- Underdamped second order systems
- Effect of zeros on time response
- Response of higher order systems
- Reduction of block diagrams
- Stability

Steady-State Errors
- Analysis of steady-state errors
- Error constants and system types
- Steady-state error specifications

The Root Locus Design Method
- Root locus of a basic feedback system
- Rules for sketching the root locus
- Compensator/controller design via root locus

Frequency Response
- Basic properties of linear systems
- Bode plots (stability, gain margin, phase margin, and steady-state errors)
- Stability analysis using Nyquist diagram
- Design by frequency response methods

Homework

Homework will be assigned periodically through the email in PDF file and is due on the date stated on the homework assignment. The homework will be collected at lecture time. No late homework will be accepted. Solutions for the homework will be posted after the due date.

Homework should be completed on your own. You may consult with classmate, instructor, and teaching assistant about conceptual aspects of a problem, but all written work must be your own.

Examinations

There will be two exams: a midterm and a comprehensive final. The date of midterm will be announced one week before the examination date. The final is on August 1, 2007.

No make-up exams will be given. If you have a legitimate reason (medical condition, etc.), *corroborated by written documentation*, arrangements may be made in **exceptional circumstances** for you to take the exam somewhat earlier or for a missed exam to not count towards your grade. You **must** contact the instructor before the regularly scheduled examination to request approval of such an exception.

Grading Policy

Homework and exams contribute to your overall grade as follows:

Homework	25%
Midterm exam	30%
Final exam	45%