University of California, Berkeley
Department of Electrical Engineering and Computer Science

EE128 **Feedback Control** **Fall 2004**

Course Description:

Three hours of lecture and three hours of laboratory per week. Analysis and synthesis of continuous and sampled-data linear feedback control systems. Advantages of feedback. Design by root locus, frequency response, and state space methods, with a comparison of techniques.

Prerequisite: EE120.

Textbook: Feedback Control of Dynamic System. 4th Edition. Franklin, Powell, and Emami-Naeini Addison Wesley.

Topics Covered:

- Introduction to Control Systems
- Mathematical Modeling of Electrical and Mechanical Systems
- Block Diagram Manipulation
- State Variable Representation
- Time Domain Analysis
- PID controller
- Stability analysis of Control Systems
- Routh's stability criterion
- Root Locus Techniques
- Nyquist criteria, Gain Margins; Phase Margins
- Lead and lag compensator design
- State Variable Theory
- Coordinate transformation
- Canonical realization
- Controllability and observablility
- State feedback and estimator design
- Discrete time system
- Discrete controller design by emulation
- Z-domain controller design

Course Instructor: Ping Hsu

Office: Cory 477

Phone and E-mail: (408) 924-3902, pinghsu@comcast.net

Grading: Homework: 10%, Lab: 25%, Midterm: 25%, Final: 40%

Syllabus (For reference only)

Chapter	Section
1 Overview	Overview
2. Dynamic Models (1st week)	2.1 Dynamics of Mechanical Systems
	2.2 Diff Equ. in State variable form
	2.6 Linearization
3. Dynamic Response (2nd week)	3.1 The Laplace transform
	3.2 Block diagram
	3.3 Response versus Pole locations
	3.4 Time-domain specification
	3.5 Effects of zeros and additional poles
4. Basic Properties of Feedback (3~4th week)	3.6 Stability, Routh stability criterion
	4.1 A case study of speed controller
	4.2 The classical three-term controller (PID)
	4.3 Steady-state Tracking and system type
5. The Root Locus Design Methods (5-6th week)	5.1Root locus of a basic feedback system
	5.2 Guidelines for sketching a root locus
	5.3 Selected illustrative root loci
	5.4 Selecting gain from the root locus
	5.5 Dynamic compensation
6. Frequency Response Design Method (7~8th week)	6.1 Frequency response
	6.2 Stability
	6.3 The Nyquist Stability Criterion
	6.4 Stability Margins
Midterm	6.7 Compensation (lead/lag compensator)
7. State Space Design (9~11th week)	7.1 Advantages of state space
	7.2 Analysis of the state equation
	7.3 Control law design for full state feedback
	7.5 Estimator Design
	7.6 Compensator Design
8. Digital Control (12~14th week)	8.1 Digitization
	8.2 Dynamic Analysis of discrete systems
	8.3 Design by Emulation
	8.4 Discrete Design
	8.5 State space design methods