EE575 Introduction to Control Theory (Spring 2009)

Catalog Description:

An introduction to classic and modern feedback control that does not presume an undergraduate background in control. Transfer function and state space modeling of linear dynamic systems, closed-loop response, root locus, proportional, integral, and derivative control, compensators, controllability, observability, pole placement, linear–quadratic cost controllers, and Lyapunov stability. MATLAB simulations in control system design.

Prerequisites:

EE 348 System Theory or equivalent.

Textbook:

G. F. Franklin, J. D. Powell and A. Emami-Naeini, *Feedback Control of Dynamic Systems*, Fifth Edition, Pearson Prentice-Hall, 2006.

Reference books:

N. S. Nise, Control Systems Engineering, 4e, John Wiley & Sons, 2004.
K. Ogata, Modern Control Engineering, 4e, Prentice-Hall, 2001.
B. C. Kuo, Automatic Control Systems, 7e, John Wiley & Sons, 1995.
C. T. Chen, Linear System Theory and Design, 3e, Oxford University Press, 1999.

Instructor:

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Grading:

Homework 20%
Mid-term Exam 30%
Final Exam (comprehensive) 50%

Homework will be assigned regularly. Possible revision of homework and test grades may be discussed immediately following the return of homework or the test papers (no later than a week from it). No make-up tests.

Any act of academic dishonesty will result in a failing grade.

Schedule of Topics (tentative):

Date	Academic Week	Topics	Textbook Readings
19-Jan	Week 2	Martin Luther King's Birthday. No class.	
26-Jan	Week 3	Introduction to control	1.1-1.3
29-Jan	Week 3	Dynamic models, transfer function, feedback, poles and zeros	2.1-2.3, 3.1-3.2
2-Feb	Week 4	Routh's stability criterion, dynamics response	3.3-3.5, 3.7, 4.1-4.2
9-Feb	Week 5	Root locus	5.1-5.4
16-Feb	Week 6	PID control, lead/lag compensator	5.5
23-Feb	Week 7	Design example using root locus, MATLAB simulation	5.6
2-Mar	Week 8	Mid-term exam.	
9-Mar	Week 9	Spring Break. No class.	
16-Mar	Week 10	State space representation, solutions to state space equations, controllability, oberservability	7.1-7.4
23-Mar	Week 11	State feedback design, pole placement	7.5-7.6
30-Mar	Wee 12	Linear quadratic regulator design, estimator design	7.7-7.8
6-Apr	Week 13	Introduction to nonlinear systems	9.1-9.2
13-Apr	Week 14	Lyapunov stability	9.5
20-Apr	Week 15	Control system design examples	10.1-10.6
27-Apr	Week 16	Course review	

Software

MATLAB is used in some of the homework assignments. The website http://www.engin.umich.edu/class/ctms/ provides a tutorial for using MATLAB in the analysis and design of feedback control systems.