

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



CMPE-242:
APPLIED FEEDBACK CONTROL

FALL 2010 SYLLABUS

FPE: FRANKLIN, POWELL, EMAMI - FEEDBACK CONTROL OF DYNAMIC SYSTEMS, 6TH

FPW: FRANKLIN, POWELL, WORKMAN - DIGITAL CONTROL OF DYNAMIC SYSTEMS, 3RD

SHAUM'S: STUBBERUD, WILLIAMS, DiSTEFANO - SCHAUM'S OUTLINE OF FEEDBACK AND CONTROL SYSTEMS

WEEK	DATES	TOPIC	ASSIGNMENTS
0	23-SEP	Course Mechanics, Syllabus, LCCDE, Free and Forced Dynamic Response, Laplace Transform, Convolution	Read FPE Ch. 1-3, Appendix A. <u>Homework #1 out</u>
1	28/30-SEP	Transfer Function, Impulse Response, Partial Fractions, Residues, FVT, Evan's Form, Root Locus vs. Bode, Stability, Control Design Spec's, Transient Spec's, Tracking Spec's, Robustness Spec's, Evan's Form, Root Locus	Read FPE Ch. 4 & 5, Review RL techniques from Schaum's and CMPE-241 notes. <u>Homework #2 out</u> <i>Homework #1 due 30-Sep</i>
2	5/7-OCT	Root Locus review, Analysis vs. Synthesis, Lead and Lag compensators, Pole Zero Cancellations, PID Control, Bode	Read FPE Ch. 6, Review Bode techniques from Schaum's and CMPE-241 notes. <u>Homework #3 out</u> <i>Homework #2 due 7-Oct</i>
3	12/14-OCT	Bode Plots, Non-minimum phase systems, Frequency Domain Specs, Bode design examples	Re-read FPE Ch. 6 (not kidding), Schaum's and CMPE-241 notes on Nyquist. <u>Homework #4 out</u> <i>Homework #3 due 14-Oct</i>
4	19/21-OCT	Bode Plots, Non-minimum phase systems, Frequency Domain Specs, Bode design examples	Read FPE Ch. 8 and FPW Ch. ?. <u>Homework #5 out</u> <i>Homework #4 due 21-Oct</i>
5	26/28-OCT	Performance vs. Robustness tradeoffs, Nyquist, Phase and Gain Margins, Introduction to Digital Control, Sample and Hold, CCOΔE, ZOH, half-sample time delay, numerical differentiation, Padé Approximation, numerical integration	Re-Read FPE Ch. 8 and FPW Ch. ?. <u>Homework #6 out</u> <i>Homework #5 due 28-Oct</i>
6	2/4-Nov	Z-transform, Euler Integration, Backward Euler, Trapezoidal Integration, Discrete Equivalent, z-plane, Aliasing, Unit Pulse Response, z-domain stability, Unit Circle, z-grid, digital control design, ZOH-equivalent, z-plane design, Inverse Z-transform, FVT, DC gain	Re-read FPE Ch. 8 (so not kidding) and FPW Ch. ?. <u>Homework #7 out</u> <i>Homework #6 due 4-Nov</i>

7	9-Nov *	Anti-Aliasing Filters, Continuous to Discrete Equivalent (ZOH), Direct Digital design, Pade approximations	Read FPE Ch. 7, and FPW Ch. ?. <i>Homework #7(a) due 9-Nov</i>
8	16/18-Nov *	Bode and Nyquist in z-plane, Tustin, Pre-warping, Introduction to State Space, State Space to Transfer Function, Eigenvalues, Characteristic Equation, Controller Canonical Form	Re-read Ch. 7, review notes on State Space from CMPE-240. <u>Homework #8 out</u> <i>Homework #7(b) due 16-Nov</i> MIDTERM IN CLASS 18-NOV
9	23-Nov *	Similarity Transforms, Uniqueness of State, Pole Placement, Ackerman's Formula, Controllability Matrix	Re-read Ch. 7 (really, not kidding) <u>Homework #9 out</u> <i>Homework #8 due 23-Nov</i>
10	30-NOV-2-DEC	Controllability condition number equivalent to pole zero cancellation, Regulator, Estimator, Observability, Separation Principle, LQR, LQE, LQG control.	Re-read FPE Ch. 1-8, Review for Final Exam. <i>Homework #9 due 2-Dec</i>
11	7/9-DEC	Optimal Control, Bryson's Rule, LQY, Symmetric Root locus, Kalman Filter, BLUE, Integral Control (State Augmentation), Tracking commands, Digital State Space, Deadbeat Controller, Reduced Order Estimator, Pincher Control, Implicit Model Following	Final Review
FINAL	8-DEC	Covers everything in the class	Location TBD @ 12:00 – 3PM

***Note:** this syllabus is tentative, and subject to revisions. Due to the way that Veteran's Day lines up, with Thanksgiving and the Midterm, there are three less lectures than normal in the quarter. As such, there will be some make-up or supplementary lectures during the quarter, and depending on student availability, the midterm might be scheduled outside of normal class hours.