University of California at Berkeley
Department of Mechanical Engineering

ME 233: Advanced Control Systems II   **Spring 2012**

URL: http://bspace.berkeley.edu/

Instructor	Richard Conway
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Teaching Assistant	(none)
Lectures	Tu, Th 3:30-5:00 in 1165 Etcheverry Hall
Discussion	TBD

Grading Scheme

Midterm 1	20%
Midterm 2	20%
Final Exam	40%
Homework	20%

Class Notes

ME233 PowerPoint Lectures
(These will be made available on bSpace)

ME233 Class Notes by M. Tomizuka, Part I
(This can be purchased at Copy Central, 2483 Hearst Avenue)

ME233 Class Notes by M. Tomizuka, Part II
(This will be made available on bSpace)

Tentative Schedule (Subject to change):

Week	Topics
1	Probability Theory—Sample Space, Random Variable, Cumulative Distribution and Probability Density Functions
2	Probability Theory—Random Process, Correlation Function, Spectral Density
3	Least Squares Estimation; Stochastic State Estimation (Kalman Filter)
4	Kalman Filter (continued)
5	Properties of the Kalman Filter
6	Dynamic Programming; Discrete-Time LQ problem; Properties of LQ Systems—Return Difference Equality, Robustness, Closed-Loop Eigenvalues and Symmetric Root Locus
7	Linear Stochastic Control (Linear Quadratic Gaussian (LQG) Control) **Midterm Examination I**
8	Minimum Variance Regulation
9	Tracking Control; Feedforward and Preview Control
10	Internal Model Principle and Repetitive Control
11	System Identification and Adaptive Control **Midterm Examination II**
12	Parameter estimation algorithms
13	Stability analysis of adaptive systems
14	Self-tuning regulators

References:

Probability

- D. P. Bertsekas, *Introduction to Probability*, Athena Scientific
- R.D. Yates and D.J. Goodman, *Probability and Stochastic Processes,* second edition, Willey.
- K. Poolla, *Probability Notes.* The PDF file can be downloaded from the ME233 website
- J. Walran, *EECS126 class notes.* The PDF file can be downloaded from the ME233 website

Linear Quadratic Optimal Control

- B.D.O. Anderson and J.B. Moore, *Optimal Control: Linear Quadratic Methods*, Dover Books on Engineering (paperback), 2007. A PDF can be downloaded from:
  http://users.rsise.anu.edu.au/%7Ejohn/papers/index.html
- Frank L. Lewis, Vassilis L. Syrmos, *Optimal Control*, Wiley-IEEE, 1995.
- E. Bryson and Y-C. Ho, *Applied Optimal Control: Optimization, Estimation, and Control*, Wiley

Stochastic Control Theory and Optimal Filtering

- R. Grover Brown and P. Hwang, *Introduction to Random Signals and Applied Kalman Filtering,* Third Edition, Willey
- Frank L. Lewis, L. Xie and D. Popa, *Optimal and Robust Estimation,* Second Edition CRC
- M. Grewal and A. Andrews, *Kalman Filter, Theory and Practice,* Prentice Hall
- B.D.O. Anderson and J.B. Moore, *Optimal Filtering*, Dover Books on Engineering (paperback), New York, 2005. A PDF can be downloaded from:
  http://users.rsise.anu.edu.au/%7Ejohn/papers/index.html
- K.J. Astrom, *Introduction to Stochastic Control Theory,* Dover Books on Engineering (paperback), New York, 2006.

Adaptive Control

- Astrom, K. J. and Wittenmark, B., *Adaptive Control*, Addison Wesley, 2nd Ed., 1995.
- G.C. Goodwin and K.S. Sin, Adaptive *Filtering Prediction and Control*, Prentice Hall, 1984.
- S. Sastry and M. Bodson, *Adaptive Control: Stability, Convergence, and Robustness,* Prentice Hall, 1989. (Book can be downloaded from
  http://www.ece.utah.edu/~bodson/acscr/)
- M. Krstic, I. Kanellakopoulos, and P. V. Kokotovic, *Nonlinear and Adaptive Control Design*, Willey.