University of California at Berkeley
Department of Mechanical Engineering

ME 233: Advanced Control Systems II **Spring 2011**

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

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Lectures: Tu, Th 11:00-12:30 in Rm. 3105 Etcheverry Hall
Discussion: W 3-4pm in Rm. 121 Wheeler Hall

Grading Scheme:

2 Midterm Exams (20% each)	40 %
Final Examination	40 %
Homework	20 %

Class Notes: **ME233 Class Notes by M. Tomizuka (Parts I and II)**
Part I may be purchased at Copy Central, 2483 Hearst Avenue

ME233 PowerPoint Class Notes
(Will be distributed weekly electronically)

Tentative Schedule (Subject to change):

Week	Topics
1	Review of Probability Theory; Sample Space, Random Variable, Probability Distribution and Density Functions.
2	Continuation of Probability Theory: Random Process, Correlation Function, Spectral Density.
3	Principle of Least Squares estimation; Stochastic State Estimation (Kalman Filter).
4	Stochastic State Estimation (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 (ME232 Class Notes)
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.
15	Review, catching up.

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.