

APPPHYS 217

Estimation and Control Methods for Applied Physics

Stanford University, Spring Quarter 2010

Course objective

to familiarize graduate students from the physical sciences with the technical toolbox of control and dynamical systems theory

Logistics

- Class meets Tue/Thu 2:15-3:30pm in 126 McCollough
- Textbook (opt): Lawrence Perko, *Differential Equations and Dynamical Systems*
- Textbook (req): Karl Åström and Richard Murray, *Feedback Systems*
- Instructor: Hideo Mabuchi, hmabuchi@stanford.edu (office hours by appointment)

Acknowledgments / links

- Course website (coming soon): <http://mintony.stanford.edu/AP217>
- Some materials from Caltech CDS 110 (Richard Murray, Kristi Morgansen)
- See <http://www.cds.caltech.edu/~murray/amwiki>

Preliminary syllabus

Week of	Topics
March 30	Overview of dynamical systems, estimation, control Linear systems review
April 6	State observers for linear systems Linear output feedback control, pole placement
April 13	Sensitivity, complementary sensitivity, robustness Pedestrian overview of SDE's and Itô calculus
April 20	Recursive filtering; the Kalman and Wonham filters Quantum filtering
April 27	Feedback in frequency space: Nyquist stability Dynamic compensators and loop-shaping
May 4	Open- versus closed-loop response; marginal stability Application: tracking-FCS
May 11	Balanced truncation; bio/quantum applications Lyapunov stability; La Salle's Theorem
May 18*	Stable manifold and Hartman-Grobman theorems Center manifold theory
May 25	Normal forms Bifurcation phenomena
June 1 (Tuesday only)	Application: projection filtering