ECE 652: Estimation and Filtering Theory
3 cr Tues, Thurs 5:00pm-6:15pm Engr B4

Instructor: Prof. Louis Scharf
Office: B116
OH: After class on Tues and Thurs, 6:15pm-7:30pm, and by appointment
Extra Problem Sessions: To be organized by students

TA and Grader: None
OH: NA

WWW URLs:
http://www.engr.colostate.edu/EE652/
http://www.engr.colostate.edu/ecefaculty/scharf/courses/EE652/123html.

Calendar:
Jan 19: First class, Engr B4, 5:00-6:15pm
Mar 11 Midterm Exam
Mar 15-19: Spring Break
May 6: Final Exam Projects


References, selected, from early to late:


Languages of Instruction: English, Mathematics, and MATLAB

Exams and Percent of Grade:
Homework and programs 50%
Midterm 25%
Final 25%

Homework: Assigned every Thurs and due at the start of class the next Thurs.

MATLAB Programs: Approximately 6, included as part of the weekly homework.

Course Objectives:

Detection, estimation, and time series analysis are the main branches of statistical signal processing. Estimation theory is perhaps the most fundamental of these three, as it plays an important role in the other two. Our objective is to lay the probabilistic foundations for estimation and then to develop its main lines, from parameter estimation to recursive least squares to Wiener and Kalman filtering. Then we address selected topics among linear prediction, modal analysis, multi-sensor array processing, time-frequency analysis, Gaussian sums, particle filtering, and the like.
Course Outline (provisional after first 6 topics, depending on student interest)

1. Deterministic least squares, including RLS
2. Stochastic least squares, including channel and filtering models
3. The Wiener filter, including spectral factorization
4. The Kalman filter
5. Linear prediction and modal analysis
6. Fast algorithms of the Levinson, Schur, conjugate gradient type
7. Multi-sensor array processing
8. Gaussian sums and particle filters
9. Time-Frequency analysis
10. HMM, Baum-Welch, and EM
11. Compressed sensing

MATLAB Experiments:

1. various experiments in numerical linear algebra
2. more to come

Assumed Input Skills:

1. Linear Systems Theory
2. Probability Theory
3. Rudiments of Complex Analysis

Presumed Output Skills:

1. Command of the course syllabus