The Ohio State University
Department of Electrical and Computer Engineering

ECE 894a – Adaptive Filtering

Autumn 2005

Instructor: Dr. Phil Schniter, Associate Professor
760 Dreese Labs, *schniter@ece.osu.edu*

Web Page: `http://eewww.eng.ohio-state.edu/~schniter/ee894a`

Will contain homework, homework modifications, homework solutions, relevant handouts, and MATLAB help links.

Lectures: MWF 9:30am–10:18pm, Dreese 705. (Some may need to be rescheduled.)

Office Hours: To be posted on course web page.

Objectives: To develop an fundamental understanding of the theory and application of adaptive signal processing, including Wiener filtering, LMS, and RLS.

Text: No official text. Consult reserve materials below if needed.

Outline:

A. *Applications*: system identification, inverse modelling, prediction, interference cancellation.

B. *Background*: correlation, wide-sense stationarity, ARMA processes, Wiener filtering, MSE cost surface.

C. *Prelude*: a comparison of direct, iterative, and model-based approaches to adaptive filtering.

D. *Steepest descent and LMS*: convergence, transient behavior, steady-state behavior, tracking, modifications to LMS.

E. *Least squares and RLS*: convergence, transient behavior, steady-state behavior, tracking, implementations of RLS.

F. *Advanced Topics (time permitting)*: block algorithms, subband adaptive filtering, adaptive IIR filters, blind adaptive equalization.

Prerequisites:

1. Basic understanding of random variables and random processes (e.g., EE-804 concurrently).
2. Basic understanding of continuous time and discrete time signal processing in both time and frequency domains (e.g., EE-600).
3. Basic understanding of linear algebra and finite dimensional vector spaces (e.g., Math 601 concurrently).
4. Strong familiarity with MATLAB.

On Reserve:

1. S. Haykin, *Adaptive Filter Theory,* 4th Ed., Prentice Hall, 2001.
2. S. Haykin, *Adaptive Filter Theory,* 3rd Ed., Prentice Hall, 1996.
3. D.G. Manolakis, V.K. Ingle, S.M. Kogan, *Statistical and Adaptive Signal Processing: Spectral Estimation, Signal Modeling, Adaptive Filtering, and Array Processing*, McGraw-Hill, 1999.
4. A. H. Sayed, *Fundamentals of Adaptive Filtering*, Wiley, 2003.
5. V. Solo and X. Kong, *Adaptive Signal Processing Algorithms*, Prentice Hall, 1994.

Grading: The course grade will be based on MATLAB-intensive homework ($\sim 33\%$), an in-class midterm ($\sim 33\%$), and a final project ($\sim 33\%$). Note: These weightings are approximate and may change. Not necessarily all problems on each homework assignment will be graded.

Late Policy: No late material (projects, homework, etc.) will be accepted unless prior arrangements have been made. Arrangements need to be made at least 24 hours in advance. Any emergency situation will be handled on a case by case basis.

Attendance: The student is responsible for all assignments, changes to assignments, announcements, and subject material presented during the regularly scheduled classroom lecture. Copies of lecture notes will not made available. If you miss a lecture, please obtain notes from a classmate.

Other: All homework and examinations in this course will must be accomplished in accordance with the EE Honor System. This means that *all submitted work must be your own.* While discussions among students relating to the homework are permitted (and often encouraged), a student's submitted assignment must reflect his/her *own* understanding of the material. Discussion of an exam is strictly prohibited until after the exam is submitted.