This lecture was not scribed.

We discussed the extended LSE identification procedure for the general ARMAX system, as described in Chapter 10 of the book of Kumar and Varaiya. The analysis of the convergence properties of this algorithm was a topic of considerable interest in the late 1980s. We described an algorithm of the extended LSE type, based on an "information criterion" for choosing the model order, given by D. Huang and L. Guo in The Annals of Statistics, Vol. 18, No. 4, pp. 1729 -1756, 1990, for which asymptotic convergence of the parameter estimate to the true value (in various senses) can be proved with minimal assumptions on the true parameter values (see that paper for details). One of the primary theoretical accomplishments of the algorithm in the Huang-Guo paper is to do away with the need for a "strictly positive real" assumption on the moving average part of the model, which is made in almost all other analyses you will see of the behaviour of adaptive control algorithms in the general ARMAX case. The price paid for accomplishing this is that the algorithm is much more complex than traditional extended least squares.

We then began a discussion of identification for finite state Markov chains, following Chapter 12 of the book of Kumar and Varaiya. We showed that the likelihood ratio relative to the true parameter, at any parameter value, is a martingale. Later we will will see the importance of "identifiability" and "forcing" (or "experimentation") in this context. These are aspects of stochastic adaptive control which do not manifest themselves in the ARMAX minimum variance control problem.