EE 223: Stochastic Estimation and Control	**Spring 2007**

Lecture 24 — April 17

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This lecture was not scribed.

We discussed how the spectral density of the output WSS process that results from an input WSS process through a discrete time LTI filter with transfer function $H(z)$ can be written in terms of the spectral density of the input process. Only $H(z)H(z^{-1})$ is of interest. This explains our use of the minimum phase condition (but assuming there are no zeros of magnitude 1 in the spectral density is a nontrivial assumption).

We discussed minimum variance control for ARMAX models along the lines of Section 8 of Chapter 7 of the book of Kumar and Varaiya. In particular, the certainty equivalence principle was introduced to find a good control law in the case that there is a nontrivial moving average in the noise term (this corresponds to the state space model being truly partially observed). The discussion followed this text closely, so it does not bear repeating. Reference was made to the following papers:

- "On the linear quadratic Gaussian problem with correlated noise and its relation to minimum variance control," by R. H. Kwong, *SIAM Journal on Control and Optimization*, Vol. 29, No. 1, pp. 139 -152, Jan. 1991;

and

- "Minimum variance control of discrete time multivariable ARMAX systems," by U. Shaked and P. R. Kumar, *SIAM Journal on Control and Optimization*, Vol. 24, No. 3, pp. 396 -411, May. 1986.

The former paper makes the connection between minimum variance control and the state space based linear quadratic control formulation we worked with earlier. The latter paper describe minimum variance control in the multi-input multi-output case (the discuss in class and in Section 8 of Chapter 7 of the book of Kumar and Varaiya is in the SISO case).