Department of Electrical and Computer Engineering
The Johns Hopkins University
520.645 Adaptive Filtering – Fall 2001

Problem Set I

1. Problem 2.4 Haykin

2. Problem 2.8 Haykin

   Use Matlab to plot the time, frequency, and phase response of the MA-generated LTI filter as well as your approximations.

3. Problem 2.1 a, c, d Diniz

   Supposing the input signal vector is composed by a delay line with a single input signal. Compute the correlation matrix for the following input signals:

   a. $x[k] = \sin(\frac{\pi}{6}k) + \cos(\frac{\pi}{4}k) + n[k]$.

   c. $x[k] = an_1[k]\sin(\omega_0 k + n_2[k])$.

   d. $x[k] = -a_1 x[k-1] - a_2 x[k-2] + n[k]$.

   In all cases, $n[k]$, $n_1[k]$, and $n_2[k]$ are white noise with uniform distribution, with zero mean and with variances σ_n^2, $\sigma_{n_1}^2$, and $\sigma_{n_2}^2$, respectively. These random signals are considered independent.

4. Problem 4.5 Haykin

5. Problem 2.3 Diniz

   For the correlation matrix below, find its eigenvalues, eigenvectors, and the matrix $\mathbf{Q}$.

$$\mathbf{R_{xx}} = \frac{1}{4}\begin{bmatrix} a_1 & a_2 \\ a_2 & a_1 \end{bmatrix}.$$

Due date: **September 21** in class