

Homework #3 Wiener Filters and the Steepest Descent Algorithm (due Friday, Sep. 20, 2002)

Build STEEPEST_DESCENT.M, MSE_PLOT.M, and TRAJECTORY.M in the Adaptive Signal Processing toolkit.

1. Recreate Experiment 1, Case 1 in Section 8.4 of your text.
 - (a) List the squared errors $J(0), \dots, J(10)$.
 - (b) What is $\mathbf{w}(10)$?
 - (c) Using your tools, replot Figure 8.9a and Figure 8.10 (only Case 1 in normal units).

 2. Recreate Experiment 2 in Section 8.4 of your text. For each μ do the following (a – c)
 - (a) List the squared errors $J(0), \dots, J(10)$. Which μ has the smaller $J(10)$. Why?
 - (b) What is $\mathbf{w}(10)$?
 - (c) Replot Figure 8.12.
 - (d) On a single figure, plot both MSEs (learning curves) in dB.

 3. Using the SD algorithm (with $\mu = 1 / \lambda_{\max}$) to find the Wiener filter \mathbf{w}_o , redo the Numerical Example in Section 5.6 and verify/do the following.
 - (a) How many iterations, N does it take to get $J(N) = J_{\min} \pm 0.001$ assuming we start with $\mathbf{w}(0) = \mathbf{0}$.
 - (b) Verify $\mathbf{w}(M) = \mathbf{w}_o$ as in (5.70) where $M > N$.
 - (c) Verify $J(M) = J_{\min}$ as in (5.71) where $M > N$.
 - (d) Plot trajectory of $\mathbf{w}(n)$ and compare to Figure 5.7 (your contour values need not be the same).
 - (e) Plot the MSE in dB.
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Text

Chapter 5 #5, 6
Chapter 8 #3, 4, 6