

Course: Communication Systems
ECSE 4520 - Section 01
Fall Semester 2005

Electrical, Computer and Systems Engineering Department
Rensselaer Polytechnic Institute

Homework 4 - Due Friday, November 4, by the end of lecture.

Problems from required text:

1. Chapter 4 Problem 4.4
2. Chapter 4 Problem 4.11 only part 4
3. (a) Look at Problem 4.24 (of Chapter 4) and solve it.
(b) Then use the relation given in class between the Q function and the $erfc$ function and find the values using Matlab.
(c) Compare the Matlab ones with your hand-written estimates.
4. Using Matlab, generate a discrete-time sequence of $N = 1000$ independent and identically distributed random numbers on the interval $(-\frac{1}{2}, \frac{1}{2})$. Call it $\{X_n\}_{n=1, \dots, 1000}$.

- (a) With Matlab, compute the estimate of the autocorrelation sequence

$$\hat{R}_x(m) = \begin{cases} \frac{1}{N-m} \sum_{n=1}^{N-m} X_n X_{n+m} & m = 0, 1, \dots, M \\ \frac{1}{N-|m|} \sum_{n=|m|}^N X_n X_{n+m} & m = -1, -2, \dots, -M \end{cases}$$

Plot $\hat{R}_x(m)$.

- (b) Estimate the power spectrum of $\{X_n\}$ by using the Discrete Fourier Transform of $\hat{R}_x(m)$ (in Matlab!). Plot it.

Homework may be handed in early by slipping it under my door or putting it in my mailbox. Late homework shall NOT be graded.

Remember, working in groups is strongly encouraged, however, you must hand in *your own work*.