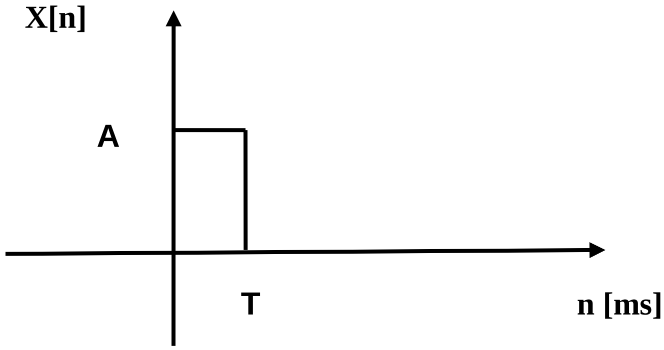
STOCHASTIC PROCESSES

Exercises for Lecture 4

Exercise 1

We will investigate a very simple detector which is based on a threshold set on the estimate of the mean value of the signal. Consider the signal X[n] represented below:



with A=1 and T=10 ms, Fc=1000 Hz. The received signal can be modeled as following

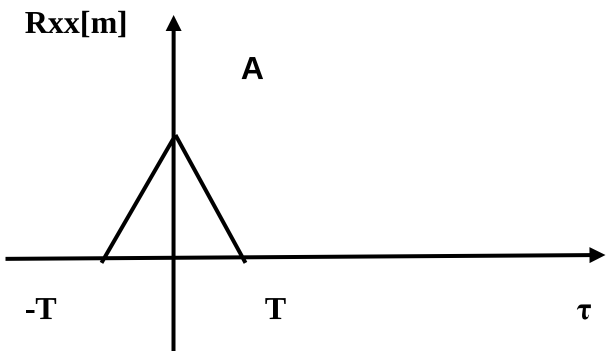
$$Y(n) = X(n) + W(n)$$

Suppose that the noise W[n] is white, Gaussian, with zero mean and $\sigma_W^2 = 1$. Demonstrate that

$$\bar{Y} = \frac{1}{N}\sum_n Y(n) \quad \text{has } \mu_{\bar{Y}} = 1 \text{ and in case of no event } \sigma_{\bar{Y}}^2 = \frac{\sigma_W^2}{N}.$$

Exercise 2

In this exercise, we will investigate the use of linear prediction for building a compression methods applied to EMG signals.
Consider the stochastic process S[n] that models an EMG signal recording. S[n] is zero mean and has autocorrelation function Rxx[m], represented below



with A=1 and T=10 ms, Fc=1000 Hz and zero mean.

1) Find the linear minimum mean squared predictor of S[n] based on the preceding N=2 samples.

2) Find the mean and variance of the error when using the linear predictor developed in point 1.