DUE DATE: DECEMBER 18, 2018 AT 3:30 PM

PART I

It is required to build Matlab functions to evaluate the statistical properties of random process.

Description
Write Matlab functions that do the following:
1) Calculates the statistical mean of a RP
2) Calculates the time mean of the nth waveform of a RP
3) Calculates the statistical autocorrelation function between the ith sample and the jth sample of a RP
4) Calculates the time autocorrelation function of the nth waveform of a RP
5) Calculates the power of a RP
6) Calculates the PSD of a RP

Testing your Functions
Test your functions for the random process $X(t)$ defined using the following Matlab lines

$$n \;=\; \textbf{randn(100, 1000);}$$
$$h \;=\; \textbf{ones(1, 20);}$$
$$X \;=\; \textbf{conv2(n, h);}$$

Deliverables - Part I

Deliver the following in **one pdf file**:
1) Source codes (**.m** files) of each of the functions.
2) A plot of 5 of the sample functions of the RP $X(t)$.
3) A plot of the mean waveform of the RP $X(t)$.
4) A plot of the ACF between the first sample and the rest of the samples.
5) A plot of the ACF between the last sample and the rest of the samples - Compare to the previous plot.
6) The values of the time average and the time ACF of the first sample function.
7) Answer: What is the relationship between the statistical mean and the time mean? Comment on your result.
8) Answer: What is the relationship between the statistical autocorrelation and the time autocorrelation? Comment on your result.

PART II

It is required to build Matlab functions to estimate the period of a random process.

Description

Write a Matlab program to do the following

1) Define a periodic signal $X(t)$ such that

$$X(t) = \cos(2\pi t + \pi/3)$$

2) Define an Gaussian distributed signal $N(t)$ with zero mean and unit variance.
3) Find the ACF of $N(t)$.
4) Find the ACF of $Y(t) = X(t) + N(t)$.

Deliverables - Part II

Deliver the following in **one pdf file**:

1) Source codes (**.m** files) of each of the functions
2) Plot one sample function of $Y(t)$. Is it possible to estimate the periodicity of $Y(t)$? Why?
3) A plot of the ACF of $N(t)$.
4) A plot of the ACF of $Y(t)$.
5) Write a Matlab function that uses the ACFs to estimate the the period of $Y(t)$.
6) A main **.m** file that accepts any periodic signal $X(t)$ and correctly estimates the period of $Y(t)$ defined as above.
   Note: This file should be submitted in a **.m** format with your pdf file.

Instructions

1) This is an individual project.
2) Reports are not to be shared with others.
3) Any copied reports, either fully or partially, will receive 0 points. This applies to both the original and the copy.
4) Late submission will be penalized at the rate of 15% per day for a maximum of 2 days, after which no submissions will be considered.