EECS 861

Homework #6

1. Z(t) = Xt+Y

Where X and Y are jointly Gaussian random variables with $E[X] = \mu_X=0$, $E[Y] = \mu_Y=0$, $\sigma_x=4$, $\sigma_Y=4$, and $\rho_{XY}=0.75$.

a. Find E[Z(t)]

b. Find Var[Z(t)]

c. What is the pdf of Z(t), name of pdf and its parameters?

d. Find P(Z(1)>17.4)

e. Find autocorrelation function, $R_{ZZ}(t_1, t_2)$

f. Find autocovariance function, $C_{ZZ}(t_1, t_2)$

g. Find the joint pdf of Z(0) and Z(1).

h. Find P(Z(1)>17.4|Z(0)=15)

2. Given Z(t) in problem 1.

a. Is Z(t) strict sense stationary?

b. Is Z(t) wide sense stationary?

3. X(t) and Y(t) are SI WSS zero mean random process with $R_{XX}(\tau)$ and $R_{YY}(\tau)$. Find the autocorrelation function of Z(t):

a. Z(t) = 1 + 2X(t) +3Y(t)

b. Z(t) = X(t)Y(t)

c. Let X(t) and Y(t) be Gaussian SI WSS random processes with zero mean and unit variance, for Z(t) = 2X(t) +3Y(t) find P(Z(1)<4.6).

4. Z(t) = X(t) + 0.5X(t-2)

Where $E[X(t)] = \mu_X=0$ and the autocorrelation function of X(t) is $R_{XX}(t_1, t_2)$.

a. Find E[Z(t)]

b. Find $R_{ZZ}(t_1, t_2)$.

c. Repeat b. assuming that X(t) is a wide sense stationary random process.

5. For this problem use the data in this file.

http://www.ittc.ku.edu/~frost/EECS_861/EECS_861_HW_Fall_2023/HW-5-Problem-2.xls

Each Sheet contains data from one discrete time random process,

Case 1 X[n],

Case 2 Y[n],

Case 3 Z[n].

Each row is a sample function of that discrete time random process.

a. Consider column i and i+1 as a pair of random samples (e.g., X[i], X[i+1]); calculate and plot the correlation coefficient between these samples for all i. That is, column 1 & 2 is random sample one (e.g., X[1], X[2]), column 2 & 3 is random sample 2 (e.g., X[2], X[3]),, column 3 & 4 (e.g., X[3], X[4]), is random sample 3.

b. Repeat part a) for column i and i+2 (e.g., X[3], X[5]).

c. Repeat part a) for column i and i+3 (e.g., X[3], X[6]).

d. Repeat a. - c. for Y[n] and Z[n]

e. Comment on the stationary of these random processes.

6. Find the autocorrelation function of the discrete time sequence X[n]=Acos(ωn+θ), where A is normally distributed with mean 0 and variance σ^2, and the phase θ is uniformly distributed between $-\pi$ and π.