Statistical Communication Theory (CT-314)

Tutorial 10.

08/04/2018

1. Let the random process X(t) consist of 6 equally likely sample functions given by $X_i(t)=it$, i=1,2,…,6. Let X and Y be the random variables obtained by sampling the process at t=1 and t=2, respectively. Find
   a) E[X] and E[Y]
   b) $f_{X,Y}(x,y)$
   c) $R_X(1,2)$
2. Let $X(t)=A\cos(w_c t+d)$, where A and w_c are constants and d is a rv with the pdf uniformly distributed between [0,2*pi]. Compute (a) mean of X(t), (b) $R_X(t_1,t_2)$.
3. Sketch the ensembles of random process X(t)=At+b where b is a constant, A is uniformly distributed in the interval [-2,2]. Check whether this process is WSS?
4. A stationary random process has

   $S_X(f)=0.1, |f|<1000\ Hz$

   ¿ $0, elsewhre$

   Find the mean square value of the random process. Also, find the smallest value of τ for which $R_X(\tau)=0$.
5. A random process X(t) consists of 5 sample functions each occurring with probability 0.2. Four of these sample function are given below.

   $X_1(t)=\cos(2\pi t)-\sin(2\pi t)$

   $X_2(t)=\sin(2\pi t)-\cos(2\pi t)$

   $X_3(t)=-\sqrt{2}\cos(t)$

   $X_4(t)=-\sqrt{2}\sin(t)$

   a) Find the fifth sample function $X_5(t)$ of the process X(t) such that the process X(t) is zero mean and $R_x(t_1, t_2) = R_X(|t_1-t_2|)$.
   b) Let V be the random variable $X(t)|_{t=0}$ and W be the random variable $X(t)|_{t=\pi/4}$. Show that, though the process is WSS, $f_V(v)$ is not equal to $f_W(w)$.