Outline

Abstract

- This document contains the explanation of question 9.12 of Papoulis Pillai Probability book of chapter sequence of random variables.

ASSIGNMENT-7

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Show that :- If x(t) is a process with zero mean and auto correlation $f(t_1)f(t_2)w(t_1 - t_2)$, then the process $y(t) = \frac{x(t)}{f(t)}$ is WSS with auto correlation $w(t_1 - t_2)$. If x(t) is white noise with auto correlation $q(t_1) \times \delta(t_1 - t_2)$ then the process $z(t) = \frac{x(t)}{q(t)}$ is WSS white noise with auto correlation $\delta(t_1 - t_2)$.

1^{st} part:-

According to question , x(t) is a zero mean process. So, E(x(T))=0 and
$u_y = u_x \int_{-\infty}^{\infty} f(\alpha) d\alpha$
$y(t) = \frac{x(t)}{f(t)}$
$R_{yy}(t_1, t_2) = \frac{R_{xx}(t_1, T_2)}{f(t_1)f(t_2)}$
$= f(t_1)f(t_2)w(t_1 - t_2)_{\overline{f(t_1)f(t_2)}}$
$= w(t_1 - t_2)$

2^{nd} part:-

x(t) is a white noise process which means
$R_x(t_1 - t_2) = F^{-1}(N_0/2) = N_0\delta(t_1 - t_2)/2$
$\delta(x) = \{\infty \quad x = 0$
0 x$\neq$ 0}
This shows that $X(t_1)$ and $x(t_2)$ are correlated only when $t_1 = t_2$ and uncorrelated when $t_1 \neq t_2$. Therefore, $R_{xx}(t_1, t_2) = 0$, when t_1 is not equal to t_2
$R_{xx}(t_1, t_2) = q(t_1) \times \delta(t_1 - t_2), when t_1 = t_2$
Hence, we can write $R_{xx}(t_1, t_2)$ as
$(q(t_1))^{1/2}(q(t_2))^{1/2} \times \delta(t_1 - t_2) \quad (q(t_1) = q(t_2))$
z(t)=x(t)$\frac{}{q(t)}$
R$_{zz} = \frac{q(t_1)q(t_2)\delta(t_1-t_2)}{q(t_1)q(t_2)}$
R$_{zz} = \delta(t_1 - t_2)$
Hence,proved