Assignment 8

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Outline

1. Problem

2. Solution

Problem Statement

(Papoulis chap-13- 13.5) Show that if
E[s(t+λ)$|s(t), s(t-\tau)] = E[s(t+\lambda)|s(t)]$
then $R_s(\tau) = Ie^{-\alpha|\tau|}$

Solution

Since,

$$E[x(t+\lambda)|s(t)] = as(t) \tag{1}$$
$$a = \frac{R(\lambda)}{R(0)} \tag{2}$$

It follows from the assumption that

$$s(t+\lambda) = as(t) \perp s(t-\tau)$$

(3)

Hence

$$R(\lambda+\tau) = \frac{R(\lambda}{R(0)} R(\tau) \tag{4}$$

The only continous function satisfying the above is an exponential . This is easily shown if we assume that
R(λ)
is differentiable for $\lambda \geq 0$.
Differentiating (4) with respect to $\lambda andsetting$
$\lambda = 0^+$

$$R^{'(\tau)+\alpha R(\tau)=o}$$

$$\alpha = \frac{-R^{'(O^+)}}{R(0)}$$

This yields

$$R(\tau) = Ie^{-\alpha\tau}$$

for $\tau \geq 0$.