Assignment 8 : Papoulis Textbook

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Outline

Question

Chapter 9 Example 9.11

Suppose that x(t) is a WSS process with autocorrelation

$$R(\tau) = Ae^{\alpha|\tau|}$$

Determine the second moment of the random variable x(8) - x(5).

Solution

A stochastic process x(i) is called wide-sense stationary (abbreviated WSS) if its mean is constant. $E\{x(i)\} = \eta$.
Its autocorrelation depends only on $\tau = t_1 - t_2$
$E\{x(t+\tau)x(t)\} = R(\tau)$.
$E\{|x(t)|^2\} = R(0)$
Therefore

$$\begin{aligned} E\{[x(8) - x[5]]^2\} &= E\{[x(8)]^2\} + E\{[x(5)]^2\} - 2E\{x(8)x(5)\} \\ &= R(0) + R(0) - 2R(3) \\ &= 2A - 2Ae^{-3\alpha} \end{aligned}$$