Assignment 6

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Outline

1. Problem Statement

2. Solution

Question(Papoulis Chapter 9 Ex 9.49)

Show that if x(t) is a complex WSS process, then

$$E[|X(t+\tau) - X(t)|^2] = 2\mathbb{R}\{R_X(0) - R_X(\tau)\}$$

Solution

$$E[|X(t+\tau) - X(t)|^2] = E[(X(t+\tau))^2] + E[x^2(t)] - 2E[X(t+\tau)X(t)] \tag{1}$$

From definition, we know that

$$E[(X(t+\tau))] = E[X(t)] \tag{2}$$

$$E[(X(t+\tau))^2] = E[X^2(t)] \tag{3}$$

Using these, we get

$$\implies E[|X(t+\tau) - X(t)|^2] = 2E[X^2(t)] - 2R_x(\tau) \tag{4}$$

Also,

$$R_x(0) = E[X^2(t)] \tag{5}$$

Hence,

$$E[|X(t+\tau) - X(t)|^2] = 2\mathbb{R}\{R_X(0) - R_X(\tau)\} \tag{6}$$