Assignment 5

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Outline

Problem Statement

(Papoulis chap-12 - 12.1) Find the mean and variance of the random variable

$$n_T = \frac{1}{2T}\int_{-T}^{T} x(t)dt$$

$$where x(t) = 10 + v(t)$$

For T=5 and for T=100, assume

$$E[v(t)] = 0$$

$$R_v(\tau) = 2\delta(\tau)$$

Solution

$$x(t) = 10 + v(t) \tag{1}$$

$$R_v(\tau) = 2\delta(\tau) \tag{2}$$

From question

$$E[v(t)] = 0 \tag{3}$$

$$E(x(t)) = E(10 + v(t)) \tag{4}$$

$$E[n_T] = E[x_T] = 10 \tag{5}$$

$$C_x(\tau) = 2\delta(\tau) \tag{6}$$

$$\sigma_{n_T}^2 = \frac{1}{2T}\int_{-T}^{T} C_x(\tau)(1-\frac{\tau}{2T})dt$$

From equation 6

$$\frac{1}{2T}\int_{-T}^{T} C_x(\tau)(1-\frac{\tau}{2T})dt = \frac{1}{2T}\int_{-T}^{T} 2\delta(\tau)(1-\frac{\tau}{2T})dt$$

$$\frac{1}{2T}\int_{-T}^{T} 2\delta(\tau)(1-\frac{\tau}{2T})dt = \frac{1}{T}$$

So variance $\sigma^2 is\ \frac{1}{T}$