

Assignment 3

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Question

Papoulis 13.11

If $R_s(\tau) = 1e^{-\frac{t}{T}}$ and

$$E[s\left(t - \frac{T}{2}\right) | s(t).s(t - T)] = as(t) + bs(t - T)$$

find the constants a and b and the MS error.

Solution

The available autocorrelation function is shown in below: $R_s(\tau) = le^{-\frac{\tau}{T}}$ and $E[s(t - \frac{T}{2}) | s(t).s(t - T)] = as(t) + bs(t - T)$. Let us consider the function of

$$s\left(t - \frac{T}{2}\right) = as(t) + bs(t - T) \quad (1)$$

$$s\left(t - \frac{T}{2}\right) - as(t) + bs(t - T) \perp s(t), s(t - T) \quad (2)$$

$$R\left(\frac{T}{2}\right) = aR(0) + bR(T) \quad (3)$$

$$a = b = \frac{R\left(\frac{T}{2}\right)}{R(0) + R(T)} \quad (4)$$

$$a = b = \frac{e^{-\frac{1}{2}}}{1 + e^{-1}} \quad (5)$$

$$R(0) = aR\left(\frac{T}{2}\right) + b\left(\frac{T}{2}\right) \quad (6)$$

$$= \frac{R^2\left(\frac{T}{2}\right)}{R(0) + R(T)} \quad (7)$$

$$= \frac{I}{1 + e^{-1}} \quad (8)$$