Assignment 13

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Question : Ex. 13.2 , Papoulis

Show that if $\hat{z} = as(0) + bs(T)$ is the MS estimate of $z = \int_0^T s(t)\,dt$ then $a = b = \frac{\int_0^T R_s(\tau)d\tau}{R_s(0)+R_s(T)}$

Solution

Since $\hat{z}$ is MS estimate of z
So, $z - \hat{z}$ is orthogonal to s(0) and s(T)

$$z - \hat{z} \perp s(0), s(T)$$

$$\int_0^T s(t)\,dt - [as(0) + bs(T)] \perp s(0), s(T) \tag{1}$$

$$\int_0^T R(t)\,dt = aR(0) + bR(T) \tag{2}$$

$$\int_0^T R(T-t)\,dt = aR(T) + bR(0) \tag{3}$$

Since both integral are equal.So,

$$aR(0) + bR(T) = aR(T) + bR(0)$$
$$\implies a = b \tag{4}$$

Putting a=b in equation (2),we get

$$a = b = \frac{\int_0^T R(t)\,dt}{R_s(0) + R_s(T)} \tag{5}$$