

Assignment 13

PRABHAV SINGH (BT21BTECH11004)

June 13, 2022

Outline

1 Question

2 Solution

Question

Show that if ϕ is a random variable with $\phi(\lambda) = E\{e^{f\lambda\phi}\}$ and $\phi(1) = \phi(2) = 0$, then the process $x(t) = \cos(\omega t + \phi)$ is WSS. Find $E\{x(t)\}$ and $R_x(\tau)$ if ϕ is uniform in the interval $(-\pi, \pi)$

Solution

From

$$\phi(1) = \phi(2) = 0 \quad (1)$$

we can conclude that

$$E\{\cos \phi\} = E\{\sin \phi\} = E\{\cos 2\phi\} = E\{\sin 2\phi\} = 0 \quad (2)$$

$$\implies E\{x(t)\} = \cos(\omega t)E\{\cos \phi\} - \sin(\omega t)E\{\sin \phi\} \quad (3)$$

And using the result

$$2 \cos[\omega(t + \tau) + \phi] \cos(\omega t + \phi) = \cos(\omega \tau + \phi) + \cos(2\omega t + \omega \tau + 2\phi) \quad (4)$$

$$2R_x(\tau) = \cos(\omega\tau) \quad (5)$$

If ϕ is uniform in $(-\pi, \pi)$, then

$$\phi(\lambda) = \frac{\sin(\pi\omega)}{\pi\omega} \text{ and } \phi(1) = \phi(2) = 0 \quad (6)$$