

AI1110

Assignment 8

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Outline

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Exercise 9.34

Show that the power spectrum of an SSS process $X(t)$ equals

$$S(\omega) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} x_1 x_2 G(x_1, x_2; \omega) dx_1 dx_2$$

Solution

We have,

$$G(x_1, x_2; \omega) = \int_{-\infty}^{\infty} f(x_1, x_2; \tau) e^{-j\omega\tau} d\tau \quad (1)$$

Also,

$$R(\tau) = E\{X(t + \tau)X(t)\} \quad (2)$$

$$= \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} x_1 x_2 f(x_1, x_2; \tau) dx_1 dx_2 \quad (3)$$

Answer

Hence,

$$S(\omega) = \int_{-\infty}^{\infty} R(\tau) e^{-j\omega\tau} d\tau \quad (4)$$

$$= \int_{-\infty}^{\infty} e^{-j\omega\tau} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} x_1 x_2 f(x_1, x_2; \tau) dx_1 dx_2 d\tau \quad (5)$$

$$= \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} x_1 x_2 \int_{-\infty}^{\infty} e^{-j\omega\tau} f(x_1, x_2; \tau) d\tau dx_1 dx_2 \quad (6)$$

$$= \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} x_1 x_2 G(x_1, x_2; \omega) dx_1 dx_2 \quad (7)$$