ASSIGNMENT-11

AI1110

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Outline

Exercise 12-3

Show that if X(t) is normal with $\eta_x = 0$ and $R_x(\tau) = 0$ for $|\tau| > a$, then it is correlation-ergodic.

Solution

We know that the process x(t) is covariance-ergodic if and only if

$$\frac{1}{T}\int_0^T C_{zz}(\tau)d\tau \xrightarrow[T\to\infty]{} 0$$

if x(t) is a normal process then equation simplifies to

$$C_{zz}(\tau) = C(\lambda+\tau)C(\lambda-\tau) + C^2(\tau) \tag{1}$$

Solution

Here we can replace

$$C(\lambda+\tau) = R_x(\lambda+\tau)$$
$$C(\lambda-\tau) = R_x(\lambda-\tau)$$
$$C^2(\tau) = R_x^2(\tau)$$

$$\implies C_{zz}(\tau) = R_x(\lambda+\tau)R_x(\lambda-\tau) + R_x^2(\tau), \;\; z(t) = x(t+\lambda)x(t)$$

Solution

It is given that $R_x(\tau) = 0$ for $|\tau| > a$, Substituting the values we get $C_{zz}(\tau) = 0$ for $|\tau| > \lambda + a$. Froim the above integral if we substitute integral it tends to 0.

$$\frac{1}{T}\int_0^T C_{zz}(\tau)d\tau = 0$$

so from the if and only if condition x(t) is correlation-ergodic.