Assignment 7

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June 23, 2022

Outline

Question

Papoulis chap 10 Exercise 10.12

Show that if the process $x(t)\cos\omega t + y(t)\sin\omega t$ is normal and WSS, then its statistical properties are determined in terms of the variance of the process $z(t) = x(t) + jy(t)$.

Solution

From the stationarity of the process $x(t)\cos\omega t + y(t)\sin\omega t$ it folows that, (i)

$$C_{xx}(\tau) = C_{yy}(\tau)$$

and

$$C_{xy}(\tau) = -C_{yx}(\tau)$$

Using the above identities, we shall express the joint density $f(X, Y)$ of the $2n$ random variables as

$$X = [x(t_1), ..., x(t_n)]$$

$$Y = [y(t_1), ..., y(t_n)]$$

Solution

in terms of the covariance matrix C_{zz} of the complex vector $Z = X + jY$.From (i) it follows that

$$E\{x(t_i)x(t_j)\} = E\{y(t_i)y(t_j)\}$$

$$E\{x(t_i)y(t_j)\} = -E\{y(t_i)x(t_j)\}$$

This results $C_{XX} = C_{YY}$ and $C_{XY} = -C_{YX}$.