Assignment 12
Probability and Random Variables

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Outline

Question

Question 9.47

Show that if $R_x(\tau) = Ae^{jw_0\tau}$,then $R_{XY}(\tau) = Be^{jw_0\tau}$ for any $y(t)$

solution

If $R_x(\tau) = e^{jw_0\tau}$
then $S_x(\omega) = 2\pi\delta(\omega - \omega_0)$

Hence the integral of $S_x(\omega)$ equals zero in any interval not including the point $\omega = \omega_0$
We know that the cross correlation $R_{XY}(\tau)$ satisfies the inequality

$$R_{XY}^2(\tau) \leq R_{XX}(0)R_{YY}(0)$$

Also the autocorrelation and autocovariance of $X[n]$ are given by

$$R[n_1, n_2] = E\{x[n_1]x^*[n_2]\} \quad C[n_1, n_2] = R[n_1, n_2] - \eta[n_1]\eta^*[n_2]$$

respectively where $\eta[n] = E\{x[n]\}$ that is mean of $x[n]$

hence from the above statements, it follows that same is true for integral $S_{XY}(\omega)$.

This shows that $S_{XY}(\omega)$ is a line at $\omega = \omega_0$ for any $y(t)$.