Noise Definition

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Based on
Probability, Random Variables and Random Signal Principles,
P.Z. Peebles,Jr. and B. Shi

Outline

Definition

$$S_{NN}(\omega) = \frac{N_0}{2}$$

$$R_{NN}(\tau) = \frac{N_0}{2}\delta(\tau)$$

Definition

$$\frac{1}{2\pi}\int_{-\infty}^{\infty} S_{NN}(\omega)d\omega = \infty$$

$$S_{NN}(\omega) = \frac{(N_0/2)(\alpha|\omega|/T)}{e^{\alpha|\omega|/T}-1}\delta(\tau)$$

Definition

$$R_{XX}[k] = \sigma_X^2 \delta[k]$$

$$S_{YY}(e^{j\Omega}) = \sigma_X^2$$

Definition

$$S_{NN}(\omega) = \begin{cases} \frac{P\pi}{W} & -W < \omega < +W \\ 0 & otherwise \end{cases}$$

$$R_{NN}(\tau) = P\frac{sin(W\tau)}{W\tau}$$

Definition

$$S_{NN}(\omega) = \begin{cases} \frac{P\pi}{W} & \omega_0 - (W/2) < |\omega| < \omega_0 + (W/2) \\ 0 & otherwise \end{cases}$$

$$R_{NN}(\tau) = P\frac{sin(W\tau/2)}{W\tau/2}\cos(\omega_0\tau)$$

Definition

$$Y(t) = X(t) A_0 \cos(\omega_0 t)$$

$$R_{YY}(t, t+\tau) = E\left[Y(t) Y(t+\tau)\right]$$

$$= E\left[A_0^2 X(t) X(t+\tau) \cos(\omega_o t) \cos(\omega_o t + \omega_o \tau)\right]$$

$$= \frac{A_0^2}{2} R_{XX}(t, t+\tau) \left[\cos(\omega_o \tau) + \cos(2\omega_o t + \omega_o \tau)\right]$$

Definition

$$Y(t) = X(t)A_0 \cos(\omega_0 t)$$

$$R_{YY}(t, t+\tau) = E[Y(t)Y(t+\tau)]$$

$$= \frac{A_0^2}{2} R_{XX}(t, t+\tau)[\cos(\omega_o \tau) + \cos(2\omega_o t + \omega_o \tau)]$$

$$A[R_{YY}(t, t+\tau)] = \frac{A_0^2}{2} R_{XX}(t, t+\tau) \cos(\omega_o \tau)$$

$$S_{YY}(\omega) = \frac{A_0^2}{4} [S_{XX}(\omega - \omega_0) + S_{XX}(\omega - \omega_0)]$$