

Digital Communication I

Homework 1: due Oct. 8, 2:20pm

1. The root-mean-square bandwidth W_{rms} bandwidth of a power density spectrum $\Phi_X(f)$ is defined as

$$W_{\text{rms}}^2 = \frac{\int_{-\infty}^{+\infty} f^2 \Phi_X(f) df}{\int_{-\infty}^{+\infty} \Phi_X(f) df}.$$

What is the relationship of W_{rms} and the autocorrelation function of $\phi_X(\tau)$?

Hint: Look at $d^2\phi_X(\tau)/d\tau^2|_{\tau=0}$ and $\phi_X(0)$.

2. If X_1 and X_2 are two zero-mean correlated Gaussian random variables with variance of σ^2 and correlation coefficient of ρ , $-1 \leq \rho \leq 1$. Please find the characteristic function of the random variable

$$Y = X_1 X_2.$$

3. Problem 2.13
4. Problem 2.22
5. Problem 4.9
6. Problem 4.30