

**HOMEWORK ASSIGNMENT 7**

Reading: Text, Section 4.2 and Handout #11

**Due Date: March 20, 2003** (in class)

1. Problem 5 from HW 6.
2. Let  $X(t)$  be a WSS process with autocorrelation function  $R_X(\tau)$ . Find  $E[(X(1) + X(2))^2]$ .
3. Consider the random processes

$$X(t) = a \cos 2\pi f_0 t + \Theta$$

and

$$Y(t) = b \sin(2\pi f_0 t + \Theta)$$

where  $a$  and  $b$  are deterministic constants and  $\Theta$  is uniformly distributed on  $[0, 2\pi]$ .

- (a) Are  $X(t)$  and  $Y(t)$  each WSS?
  - (b) Find the crosscorrelation function  $R_{X,Y}(t + \tau, t)$ .
  - (c) Are the two random processes jointly WSS?
  - (d) Are the two random processes uncorrelated?
4. Suppose  $V$  is a zero-mean Gaussian random variable and define the processes  $X(t) = Vt$  and  $Y(t) = V^2t$ , for  $-\infty < t < \infty$ .
    - (a) Find the crosscorrelation function  $R_{X,Y}(t + \tau, t)$ .
    - (b) Are the two random processes jointly WSS?
    - (c) Are the two random processes uncorrelated?

Hint: You may want to prove that  $E[V^3] = 0$  first before you start part(a).

5. Let  $X(t)$  be a zero mean, WSS process with autocorrelation function  $R_X(\tau)$ . Define the process  $Y(t)$  by

$$Y(t) = X(t) \cos(2\pi f_c t)$$

Find  $R_Y(t + \tau, t)$ . Is  $Y(t)$  a WSS process?

6. Find the average power in a WSS process  $X(t)$  that has power spectral density given by

$$S_X(f) = \beta^2 \frac{2\alpha}{\alpha^2 + (2\pi f)^2}$$

Hint: Use the table on page 38 of the book.