

Homework #9  
Due Th. 12/06

Note:

OW Oppenheim and Wilsky  
SSS Schaum's Signals and Systems  
SPR Schaum's Probability, Random Variables, and Random Processes

Be sure to show all your work for credit.

1. (SPR 6.52)

Let  $X(t) = A \cos(\omega_0 t + \Theta)$ , where  $A$  and  $\omega_0$  are constants,  $\Theta \sim U[-\pi, \pi]$  (Problem 5.20). Find the power spectral density of  $X(t)$ .

2. (SPR 6.53)

A random process  $Y(t)$  is defined by

$$Y(t) = AX(t) \cos(\omega_c t + \Theta)$$

where  $A$  and  $\omega_c$  are constants,  $\Theta$  is a uniform r.v. over  $(-\pi, \pi)$ , and  $X(t)$  is a zero-mean WSS random process with the autocorrelation function  $R_X(\tau)$  and the power spectral density  $S_X(\omega)$ . Furthermore,  $X(t)$  and  $\Theta$  are independent. Show that  $Y(t)$  is WSS, and find the power spectral density of  $Y(t)$ .

3. (SPR 6.61)

The input  $X(t)$  to the RC filter below is a white noise specified by  $S_W(\omega) = \sigma^2$ . Find the mean-square value of  $Y(t)$ .

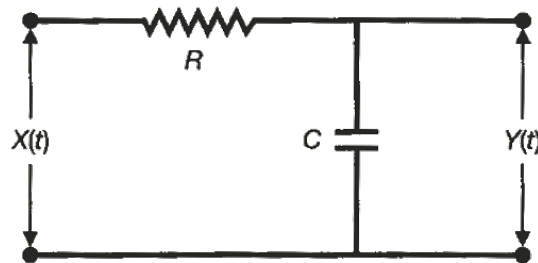


Fig. 6-7 RC filter.

4. (SPR 6.65)

Suppose that the input to the discrete-time filter shown below is a discrete-time white noise with average power  $\sigma^2$ . Find the power spectral density of  $Y[n]$ .

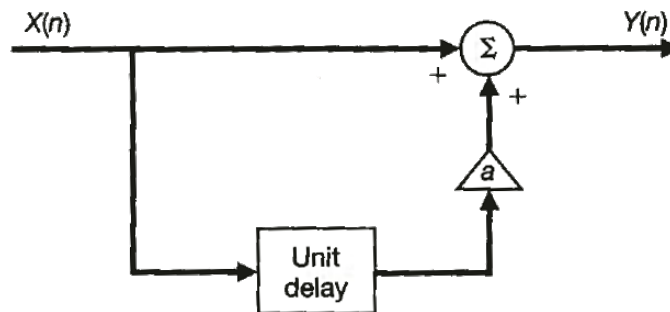


Fig. 6-9