Homework #9
Due Su 11/30

Note:

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|---|---|
| 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 $Y(t)$.

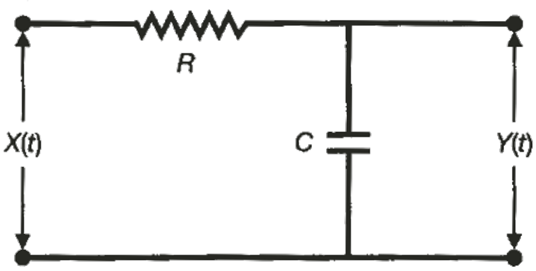


Fig. 6-7 *RC* filter.

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 $Y[n]$.

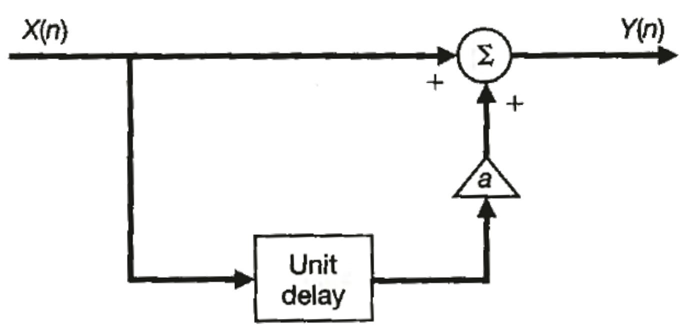


Fig. 6-9