**Problem 8.13** Let X(t) be a random process defined by

$$X(t) = A\cos(2\pi f t)$$

where *A* is uniformly distributed between 0 and 1, and *f* is constant. Determine the autocorrelation function of *X*. Is *X* wide-sense stationary?

## **Solution**

$$\mathbf{E}[X(t_1)X(t_2)] = \mathbf{E}[A^2]\cos(2\pi f t_1)\cos(2\pi f t_2)$$
  
= 
$$\mathbf{E}[A^2][\cos(2\pi f (t_1 - t_2)) + \cos 2\pi f (t_1 + t_2)]$$

$$\mathbf{E}[A^2] = \int_0^1 x^2 dx = \frac{x^3}{3} \Big|_0^1 = \frac{1}{3}$$

Since the autocorrelation function depends on  $t_1 + t_2$  as well as  $t_1 - t_2$ , the process is not wide-sense stationary.

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