

**Problem 8.28** Consider the sinusoidal process

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

where the frequency is constant and the amplitude  $A$  is uniformly distributed:

$$f_A(a) = \begin{cases} 1 & 0 < a < 1 \\ 0 & \text{otherwise} \end{cases}$$

Determine whether or not this process is stationary in the strict sense.

**Solution**

At time  $t = 0$ ,  $X(0) = A$ , and  $F_{X(0)}(0)$  is uniformly distributed over 0 to 1.

At time  $t = (4f_c)^{-1}$ ,  $X((4f_c)^{-1}) = 0$  and

$$F_{X\left(\frac{1}{4f_c}\right)}(x) = \delta(0)$$

Thus,  $F_{X(0)}(x) \neq F_{X(1/4f_c)}(x)$  and the process  $X(t)$  is not stationary to first order.

Hence not strictly stationary.