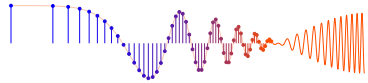


PROBLEM:

In the rotating disk and strobe demo described in Chapter 4, we observed that different flashing rates of the strobe light would make the spot on the disk stand still.

(a) Assume that the disk is rotating in the counter-clockwise direction at a constant speed of 15 revolutions per second. Express the movement of the spot on the disk as a rotating complex phasor.

(b) Assume that the flashing rate is fixed so that the interval between flashes is 50 milliseconds. Explain how the spot will move and write a complex phasor that gives the position of the spot at each flash.

(c) Draw a spectrum plot of the discrete-time signal in part (b) to explain your answer.

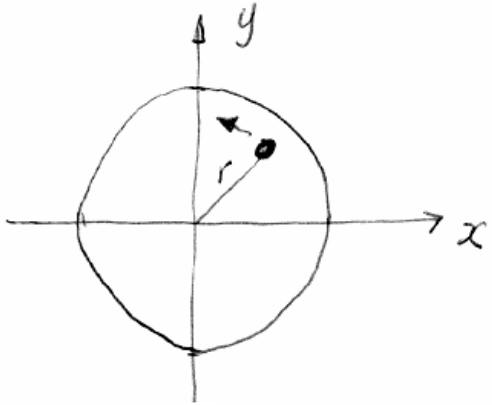
McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

(a)

$$z(t) = x(t) + j\,y(t) = r e^{j 2\pi (15) t}$$

($\phi = 0$ assume the initial phase is zero)



(b)

$$T_s = 50 \text{ msec} = 0.05 \text{ sec}$$

$$f_s = 20 \text{ Hz}$$

$$z[n] = z(n/f_s) = r e^{j 2\pi (15) \cdot n/20} = r e^{j 1.5\pi n} = r e^{-j 2\pi n + j 1.5\pi n} = r e^{-j 0.5\pi n}$$

$0.25 \times 20 = 5 \Rightarrow$ the spot rotates at 5 revolutions/sec

"$-$" sign $\Rightarrow$ the rotation is in the clockwise direction

(c)