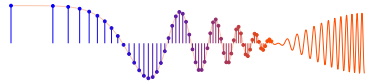


PROBLEM:

Given a feedback filter defined via the recursion:

$$y[n] = -y[n-5] + x[n] \qquad \text{(DIFFERENCE EQUATION)} \qquad (1)$$

(a) Determine the system function $H(z)$.

(b) How many poles does the system have? Compute and plot the pole locations.

(c) When the input to the system is the two-point pulse signal:

$$x[n] = \begin{cases} +1 & \text{when } n = 0, 1 \\ 0 & \text{when } n \neq 0, 1 \end{cases}$$

determine the output signal $y[n]$, so that you can make a plot of its general form. Assume that the output signal is zero for $n < 0$.

(d) The output signal is periodic for $n > 0$. Determine the period.

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

SOLUTION

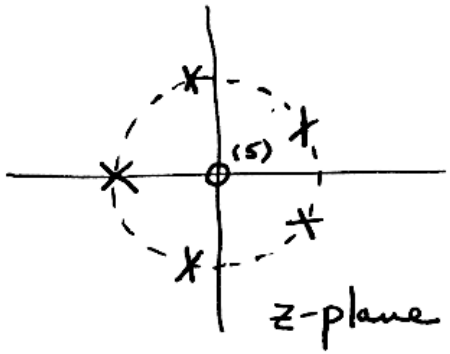
(a) $H(z) = \dfrac{1}{1+z^{-5}}$

(b) FIVE POLES. Find roots of

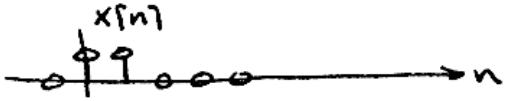
$z^5 + 1 = 0$

$z = e^{j\pi/5}, e^{j3\pi/5}, e^{j\pi}, e^{-j\pi/5}, e^{-j3\pi/5}$

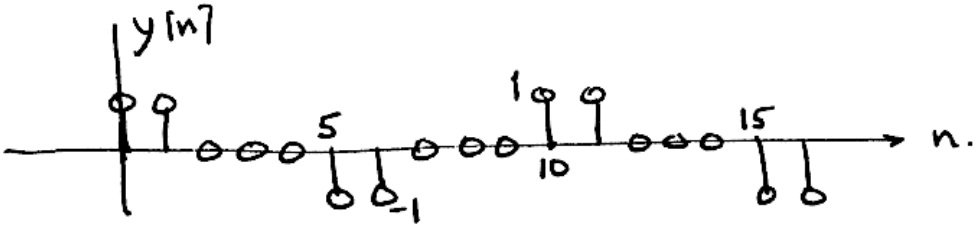
36° 108°



(c)



n	<0	0	1	2	3	4	5	6	7	8	9	10	11	12
y[n]	0	1	1	0	0	0	-1	-1	0	0	0	1	1	0



(d) PERIOD = 10

which can be determined from the plot above.