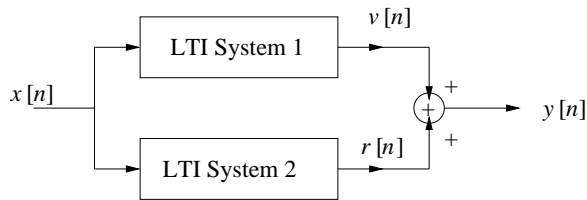


PROBLEM:

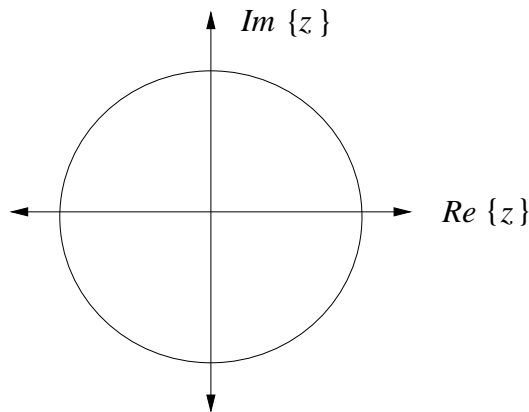
Consider the parallel form LTI system depicted below.



System 1 is defined by the difference equation $v[n] = x[n] - x[n - 5]$.

System 2 is defined by the system function $H_2(z) = z^{-1} + \frac{1}{4}z^{-2} + z^{-5}$.

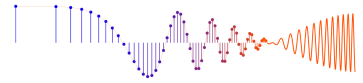
- (a) Determine the system function $H_1(z)$ associated with System 1 and plot the zeros of $H_1(z)$.



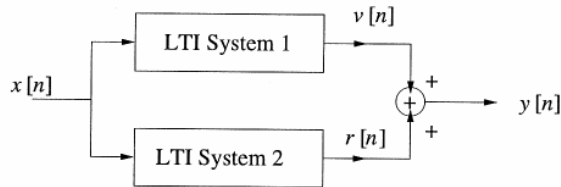
$H_1(z) =$

- (b) Determine the impulse response of the overall parallel form system. That is, find $h[n]$ such that $y[n] = x[n] * h[n]$.

$h[n] =$



Consider the parallel form LTI system depicted below.

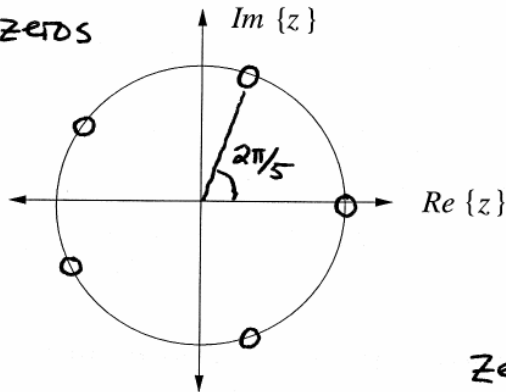


System 1 is defined by the difference equation $v[n] = x[n] - x[n - 5]$.

System 2 is defined by the system function $H_2(z) = z^{-1} + \frac{1}{4}z^{-2} + z^{-5}$.

- (a) Determine the system function $H_1(z)$ associated with System 1 and plot the zeros of $H_1(z)$.

There are 5 zeros



$$H_1(z) = 1 - z^{-5}$$

Zeros are roots of
 $1 - z^{-5}$
 $1 - z^{-5} = 0$
 $z^5 - 1 = 0$
 $z^5 = 1 = e^{j2\pi k}$, $k=0,1,2,3,4$

- (b) Determine the impulse response of the overall parallel form system. That is, find $h[n]$ such that $y[n] = x[n] * h[n]$.

$$h[n] = \delta[n] + \delta[n-1] + \frac{1}{4} \delta[n-2]$$

$$\begin{aligned} H(z) &= H_1(z) + H_2(z) \\ &= (1 - z^{-5}) + (z^{-1} + \frac{1}{4}z^{-2} + z^{-5}) \\ &= 1 + z^{-1} + \frac{1}{4}z^{-2} \end{aligned}$$