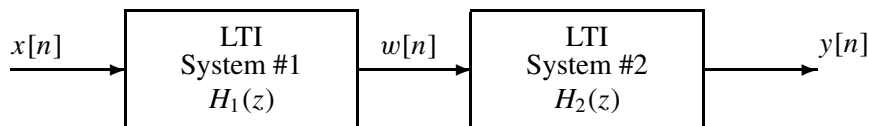


**PROBLEM:**

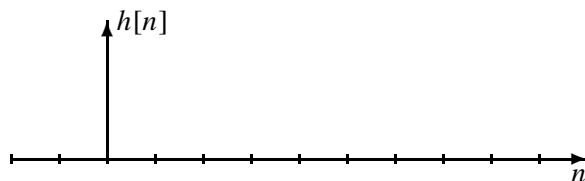
Consider the following cascade system:



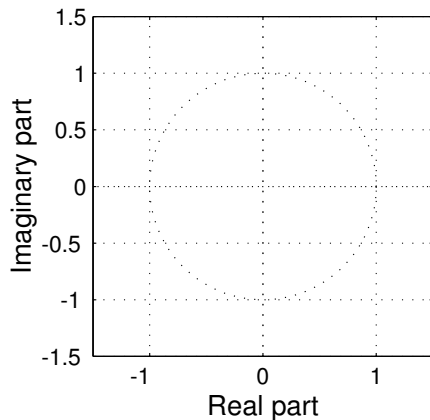
where

$$H_1(z) = 2 + 2z^{-2} \quad \text{and} \quad H_2(z) = 1 + \frac{1}{2}z^{-1}.$$

- (a) Determine the system function  $H(z)$  of the overall system. Express your answer as a polynomial in  $z^{-1}$ .
- (b) Determine and plot the impulse response  $h[n]$  of the overall system.



- (c) Return to your result in part (a). Express  $H(z)$  as the product of a constant and three first-order factors each written in the form  $(1 - az^{-1})$ . From this, determine the zeros and poles of  $H(z)$  and plot them in the  $z$ -plane plot below.



- (d) If the input is  $x[n] = Ae^{j\phi}e^{j\hat{\omega}_0 n}$  for  $-\infty < n < \infty$ , for what values of  $-\pi \leq \hat{\omega}_0 \leq \pi$  will the output be  $y[n] = 0$  for  $-\infty < n < \infty$ ?