

PROBLEM:

Shown in the figure below is a cascade of two linear time-invariant systems with impulse responses $h_1[n]$ and $h_2[n]$.

$$x[n] \qquad System #1 \qquad w[n] \qquad System #2 \qquad y[n] \\ h_1[n] \qquad h_2[n] \qquad y[n]$$

The impulse responses of the two systems are

$$h_1[n] = \delta[n] - \frac{1}{2}\delta[n-1]$$
 $h_2[n] = (0.25)^n u[n]$

- (a) If $x[n] = \delta[n] + \delta[n-1]$, find the output of the first system, w[n].
- (b) Determine the system function H(z) for the cascade of the two systems. In other words, if y[n] = x[n] * h[n], what is H(z)?
- (c) Make a plot of the poles and zeros of H(z) in the z-plane, where H(z) is the system function found in part (b).

(d) If $x[n] = \delta[n] - (0.25)\delta[n-1]$, find the output of the cascade, y[n].

McClellan, Schafer and Yoder, Signal Processing First, ISBN 0-13-065562-7. Prentice Hall, Upper Saddle River, NJ 07458. © 2003 Pearson Education, Inc.