Signals and Systems — 10 October 2012
Fall 2012 — Quiz: Wednesday 17 October 2012

Homework Assignment #8

1. Use z transforms to find the ZIR $y_{ZI}(k)$, the ZSR $y_{ZS}(k)$, and the complete response $y(k)$ for each system.

   (a) $(\mathrm{E}+0.5)\{y(k)\} = 0,\ y(0) = 2.$

   (b) $(\mathrm{E}^2-3\mathrm{E}+2)\{y(k)\} = u_s(k),\ y(0) = 2,\ y(1) = 1.$ ($u_s(k)$ = unit step sequence.)

   (c) $(\mathrm{E}^2-2\mathrm{E}+2)\{y(k)\} = (2)^{-k}u_s(k),\ y(0) = y(1) = 0.$

2. Use a digital computer to plot the frequency response of the system

$$H(z) = \frac{1-a}{z-a}$$

for the cases $a = 0.95$, $a = 0.85$, and $a = 0.75$. Comment on the effect of the pole location on the magnitude and phase of the frequency response.

3. The transfer function

$$G(z) = \frac{z^3 + 0.5z^2 + 0.25z + 0.125}{z^4}$$

is an FIR approximation to the transfer function

$$H(z) = \frac{1}{z-0.5}.$$

   (a) Plot the impulse response of each system.

   (b) Plot the step response of each system. Determine the d.c. gain of each system from its step response.

   (c) Plot the frequency response of each system. Determine the d.c. gain of each system from its frequency response.

4. Consider the discrete-time system having the transfer function

$$H(z) = \frac{z+1}{z-0.9}.$$

   (a) Plot the magnitude and phase of the frequency response of the system.

   (b) Program the corresponding difference equation, and iterate to determine the responses to the inputs $x_1(k) = u_s(k)$, $x_2(k) = \cos(k\pi/4)\cdot u_s(k)$, and $x_3(k) = (-1)^k \cdot u_s(k)$.

   (c) Explain the amplitudes of the steady-state responses from part (b) in terms of the system frequency response.