EE 342 – Homework 11

Due April 13, 2005

1. Problem 11.27.
2. Problem 11.30.
3. Problem 11.36.
4. Problem 11.38.
5. Problem 11.41.
6. Problem 11.43. Do not use the Jury test. Use MATLAB to find the pole locations.
7. Problem 11.47. For (a), find the steady-state response only. To do this, you do not need to take an inverse z-transform. Also, plot the pole-zero diagram.
8. Problem 11.48. For (a), find the steady-state response only. To do this, you do not need to take an inverse z-transform. Also, plot the pole-zero diagram.
9. A two-pole lowpass filter is given by the transfer function

$$H(s) = \frac{0.5\,\omega_c^2}{s^2 + 0.645\,\omega_c\,s + 0.708\,\omega_c^2}$$

   where ω_c is the 3 dB point.

   You want to use the bilinear transformation to turn this filter into a discrete-time filter with a 3 dB point Ω_c of 0.1 radians/sample.

   (a) Find the continuous-time cutoff frequency ω_c needed to make $\Omega_c = 0.1$ rad/sample.

   (b) Use MATLAB to plot the frequency response of the continuous-time filter.

   (c) Apply the bilinear transformation to find $H(z)$, the transfer function of the discrete-time filter.

   (d) Use MATLAB to plot the frequency response of the discrete-time filter.

   (e) Use MATLAB to find and plot the input to and the output from the filter when the input is:

      i. $x(nT) = p_1(nT)$, where $p_1(t) = u(t + 1/2) - u(t - 1/2)$, and $T = 0.01$ seconds.

      ii. $x(nT) = p_1(nT) + 0.5w(nT)$, where $w(nT)$ is a noise signal whose values are random numbers between 0 and 1. (Use `rand` in MATLAB to generate the signal $w(nT)$.)

      iii. $x(nT) = \cos(10nT) + \cos(100nT)$