EE 342 – Homework 7

Due March 9, 2005

1. Compare the time-domain response of five-pole Bessel, Butterworth, and elliptic filters.

   (a) Design a five-pole Butterworth filter with a 3-dB cutoff frequency of 4π rad/sec. (Use the MATLAB function `buttap` to design a filter with a 1 rad/sec 3-dB point, and use the MATLAB function `lp2lp` to transform it to a filter with a 4π rad/sec 3-dB point.) Plot the gain and phase of the filter (using linear plots) from 0 to 20 rad/sec.

   (b) Use the MATLAB `lsim` function to compute and plot the output of the filter for the input $x(t) = u(t) - u(t - 1)$.

   (c) Repeat Parts (a) and (b) for a five-pole Bessel filter. Use the MATLAB function `besselap`.

   (d) Repeat Parts (a) and (b) for a five-pole elliptic filter. Use the MATLAB function `ellipap`. For `ellipap`, specify `Rp` of 3 dB, and `Rs` of 60 dB.

   (e) Which of the three filters has the best time-domain response – that is, which has the least amount of overshoot and undershoot ("ringing").

2. Problem 10.1.

3. Problem 10.3.

4. Problem 10.4.

5. Problem 10.5.