ECE-382: Homework 8

Due: March 9, 2007

1. Problems B-5-25, B-5-28, and B-5-30 in textbook.

2. Problem B-5-24 in textbook. Additionally, use the Routh's Test to find the exact number of closed-loop poles on the RHP (Right-Half-Plane, including the imaginary axis).

3. Find the number of RHP roots of the following characteristic polynomials

   (a) $s^5 + s^3 + s^2 + 1 = 0$.

   (b) $s^3 + 3s^2 + 2s + 6 = 0$.

4. (This is a past exam question. Additional *Hint:* When the input to a system $H(s)$ is a step function, the final value of the step response $s(t)$ is $s(+\infty) = \lim_{s \to 0} s(\frac{1}{s}H(s)) = \lim_{s \to 0} H(s)$.)

This problem concerns four transfer functions $G_1(s)$, $G_2(s)$, $G_3(s)$ and $G_4(s)$.

Figure 4 shows the four pole-zero plots in some random order, labeled I, II, III and IV, and Figure 5 shows the four step responses, again in random order, labeled A, B, C and D. You are also given steady-state error parameters for the standard configuration discussed in class, which is reproduced in Figure 6. Match these parameters with the pole-zero plots and the step responses, completing the table below (each correct entry is worth five points):

Steady-state error info	Pole-zero plot	Step response
$K_p = 1$		
$K_v = 1$		
$C_0 = 0.4$		
$C_0 = 2/3$		

Hint: **Do not attempt to calculate the transfer functions!** You should be able to solve this problem by merely looking at the characteristics of the step response such as the frequency of oscillation, steady-state value etc.

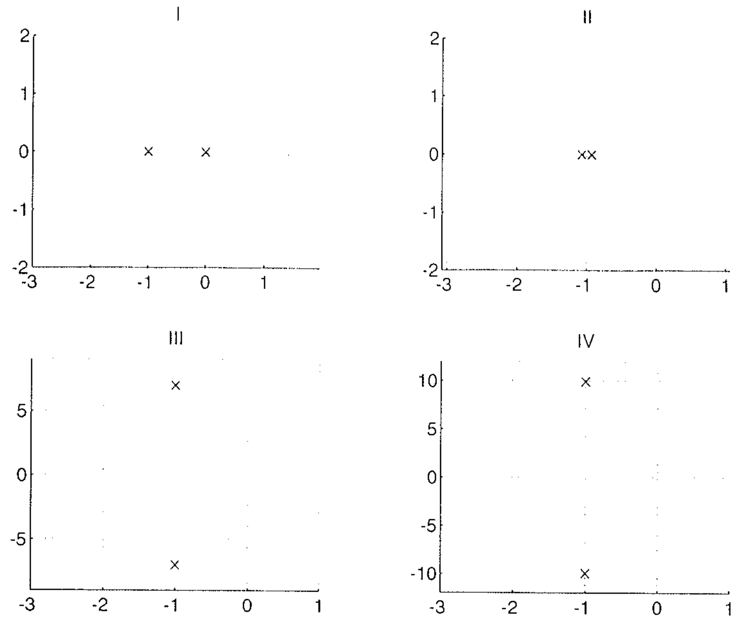

Figure 4: Pole-zero plots for Problem 4.

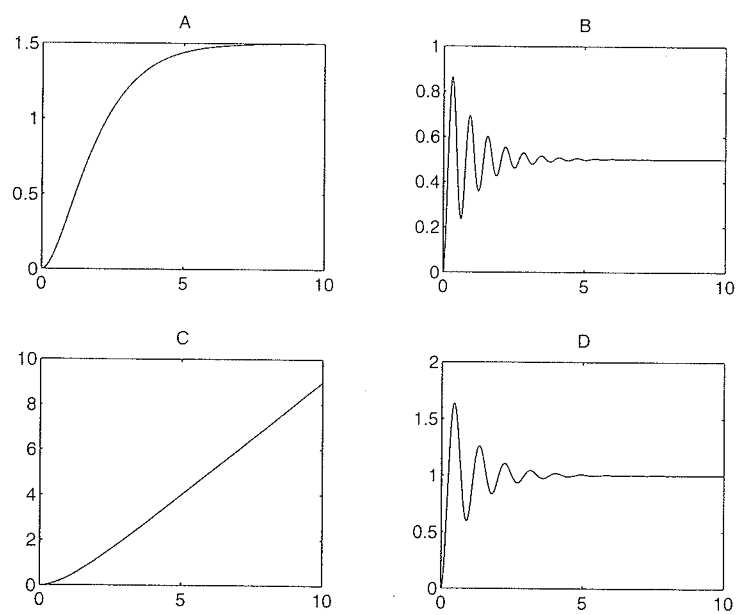

Figure 5: Step responses for Problem 4.

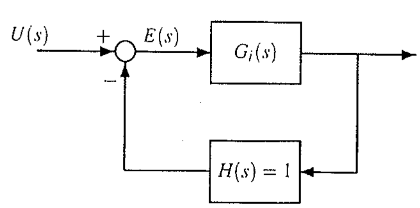

Figure 6: Standard steady-state error analysis configuration.