EEE 184: Review Problems

12/11/15

PROBLEM 1

Consider figure 1-left which shows the block diagram of a DC motor control system in the presence of constant disturbance. The output is the motor’s angular velocity.

1) What is the numerical value for the disturbance in the time domain?
2) Find an expression for the steady state error as a function of $D(s)$ and $R(s)$.
3) What is the final value for the output when $K_2 = 6.95, K_1 = 0.68$?
4) Knowing that the desired value for the motor’s angular velocity is $10 rad/s$. What is the total steady state error when $K_2 = 6.95, K_1 = 0.68$?
5) Now the desired values for the percent overshoot and the settling time are

$$\% OS = 15.8\%$$

$$T_s = 3s$$

Find $K_1$ and $K_2$

6) What are the closed loop poles in this case?
7) Figure 1-right shows the systems closed loop response. From the graph, determine the steady state error, the percent overshoot and the settling time.

PROBLEM 2

1) Figure 2 shows the root locus of two different systems.
2) What is the number of branches for each case?
3) What is the interval of the gain for which the system is stable?

PROBLEM 3

Figure 3 shows the root locus of two different systems.
1) What is the interval of the gain for which the system is stable?

PROBLEM 4

1) Write the state space model and the transfer function for the circuit of figure 4. The output is the voltage across the resistor.
2) What is the final value of the resistor’s voltage when $i_s = 5A$?

Fig. 1. Block diagram and closed loop response for problem 1
Fig. 2. Root loci for problem 2

Fig. 3. Root loci for problem 3

Fig. 4. Circuit for problem 4