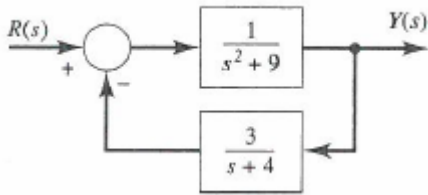


ECE311

Homework 5

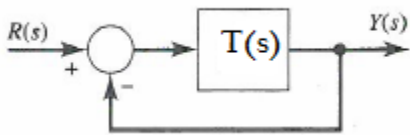
Problem 1: For the following system find the steady state error for a unit step.



Problem 2: Find the type number and steady state error with unit step, ramp, and parabolic inputs for the following system.

$$T(s) = \frac{7}{s^2 + 4s + 7}$$

Problem 3: Consider a system with loop gain given by:



where
$$T(s) = \frac{300(1+s)\left(1+\frac{s}{40}\right)}{s^3}$$

- 1) Determine whether the system is stable by finding the closed loop poles of the system using the Matlab 'roots' command.
- 2) We will next determine the gain and phase margins of the system. Use the Matlab 'margin' command to produce a Bode plot of the loop gain.
- 3) Reading the values from the plot as best as you can determine the frequency at which the magnitude plot is 0dB. This is called the unity gain crossover frequency, ω_C .
- 4) Determine whether the phase is above or below -180 degrees at this frequency and consequently whether this represents a positive or negative phase margin (Pm).
- 5) Next read the value from the plot as best as you can determine the frequency at which the phase plot is -180 degree. We will denote this frequency, ω_M .
- 6) Determine whether the magnitude is above or below 0dB at this frequency and consequently whether this represents a positive or negative gain margin (Gm).
- 7) From the title line of the Bode plot to determine the values that Matlab gives for ω_C , Pm, ω_M , and Gm.
- 8) Using the information from the Bode plot alone determine whether the closed loop system is stable or not. Explicitly state the rule(s) which determine this.
- 9) Is your result of part (8) consistent with the result that would be gleaned by examining the roots obtained in part (1). Explain.