AAE 364 Control Systems Analysis
Problem Set 6

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Reading Assignment:

- Sections 1-3 in Chapter 6.
- Paper "Bringing Root Locus to The Classroom: The story of Walter R. Evans and his textbook Control-System Dynamics".

Problem 1

Figure 1 is a block diagram of a spacecraft attitude control system. Assuming the time constant T of the controller to be $3\,sec$ and the ratio K/J to be $\frac{2}{9}\ rad^2/sec^2$. Note that $K > 0$ and $J > 0$.

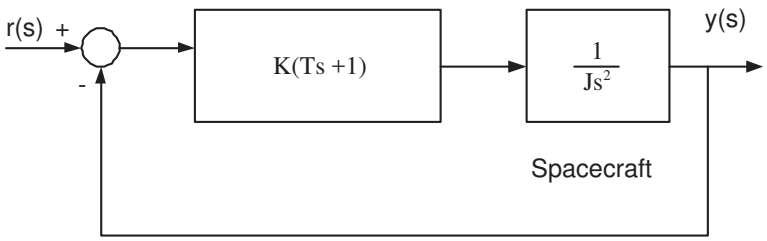

Figure 1: Spacecraft attitude control system

1. Is the spacecraft stable?
2. Is the closed-loop system stable?
3. Find the damping ratio of the closed-loop system.

Problem 2

Consider the unity feedback system shown in Figure 2:

Plot the root locus for the system with

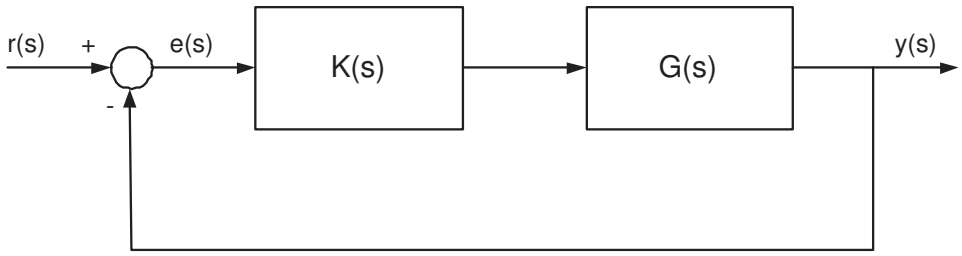

Figure 2: A unity feedback system.

1. $$K(s) = k, \;\; G(s) = \frac{s+2}{s^2}$$

2. $$K(s) = k, \;\; G(s) = \frac{1}{s(s+2)(s^2+4s+5)}$$

3. $$K(s) = k, \;\; G(s) = \frac{1}{s(s+0.5)(s^2+0.6s+10)}$$

4. $$K(s) = k, \;\; G(s) = \frac{s+0.2}{s^2(s+3.6)}$$

Remarks: First, draw the root locus by hand and then use MATLAB to validate your solution. When you present results obtained with MATLAB as your solutions, you should explain your results clearly to get full credits. (Just giving figures and numbers is not enough for answers)