Project

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Problem 1
Statement:
Consider the system

$$G(s) = \frac{50(s+3)}{s(s+2)(s+5)}$$

a) Use Bode plot to design a lead compensator $C(s)$ with unity DC gain so that the phase marginS of the closed-loop system is no less than 40°.

b) Use MATLAB to verify the resulting phase marginally

c) What is the bandwidth of the resulting closed-loop system?

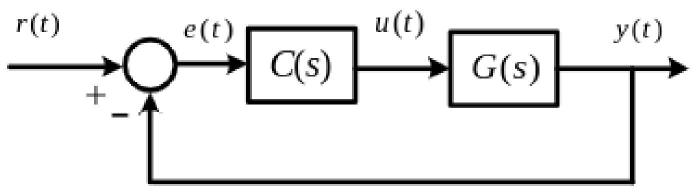

Figure 1: Problem1

Solution

Problem 2
Statement:
Consider the system

$$G(s) = \frac{K}{s(s/5+1)(s/250+1)}$$

a) Use Bode to design a lag compensator $C(s)$ so that the closed loop system satisfies:

- The steady state error to a unit ramp reference input is less than 0.01
- The phase margin is no less than 40°

b) Use MATLAB to verify the resulting phase margin

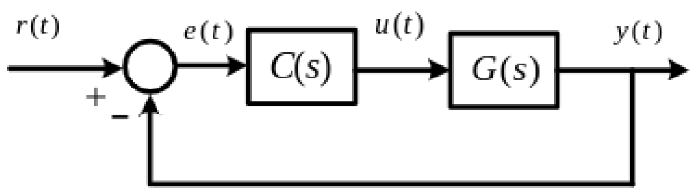

Figure 2: Problem2

Solution

Problem 3
Statement:
Given the state space model of a system:

$$\dot{x} = \begin{bmatrix} 2 & 1 \\ -1 & 1 \end{bmatrix} x + \begin{pmatrix} 1 \\ 2 \end{pmatrix} u$$
$$y = \begin{pmatrix} 1 & 1 \end{pmatrix} x$$

a) Find the state feedback gain F such that the closed-loop system has -1 and -2 at its poles. Compute F without using any state transformation.

b) Design an observer to estimate the state of the system. Select the poles for the error dynamics to be $-2 \pm 2i$

c) Construct an observer-based output feedback law that stabilizes the system.

Solution

Problem 4
Statement:
Complete the class evaluation:

Solution

Yes