

National Taiwan University

Department of Engineering Science and Ocean Engineering

2019 Winter Semester

Homework 4

Chap 6 Stability / Chap 7 Steady-State Error

1. Chap 6 Prob. 6

6. How many poles are in the right half-plane, the left half-plane, and on the $j\omega$ -axis for the open-loop system of Figure P6.2? [Section: 6.3]

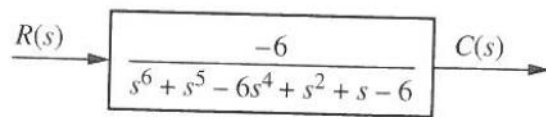


FIGURE P6.2

2. Chap 6 Prob. 9

9. Find the range of K for closed-loop stability if in Figure P6.3. [Section: 6.4]

$$G(s) = \frac{K(s-1)}{s(s+2)(s+3)}$$

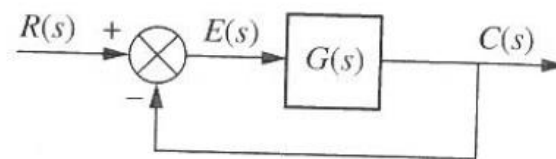


FIGURE P6.3

3. Chap 6 Prob. 25

25. In Figure P6.3, let

$$G(s) = \frac{K(s+5)}{s(s+1)(s+3)}$$

Obtain: [Section: 6.4]

- The range of K for closed-loop stability
- The value of K at which the system will start oscillating
- The frequency of oscillation in part b.

4. Chap 6 Prob. 38

38. A model for an airplane's pitch loop is shown in Figure P6.10. Find the range of gain, K , that will keep the system stable. Can the system ever be unstable for positive values of K ?

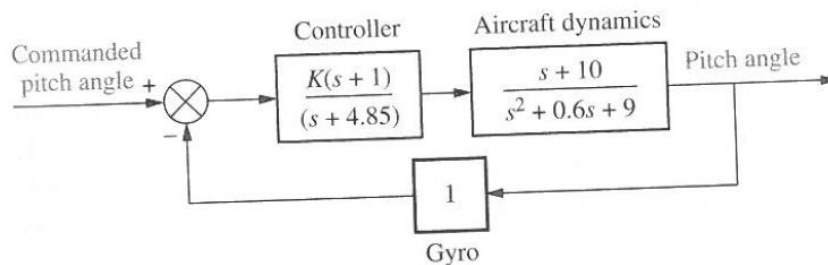


FIGURE P6.10 Aircraft pitch loop model

5. Chap 7 Prob. 4

4. For the system shown in Figure P7.3, what steady-state error can be expected for the following test inputs: $10u(t)$, $10tu(t)$, $10t^2u(t)$. [Section: 7.2]

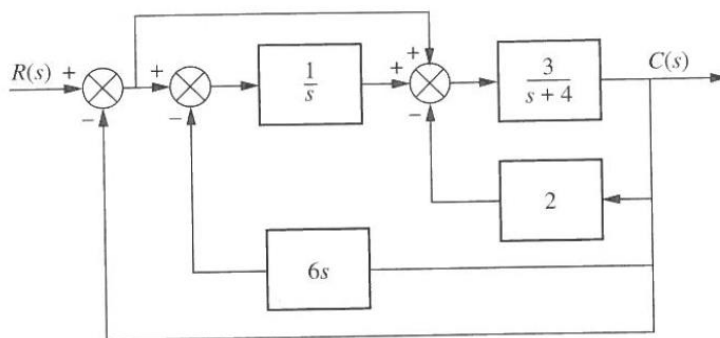


FIGURE P7.3

6. Chap 7 Prob. 12

12. Refer to the system of Figure P7.4. [Section: 7.3]
- Find the steady-state error for inputs $20u(t)$, $20tu(t)$, and $20t^2u(t)$.
 - Find the error constants K_p , K_v , and K_a .
 - Find the system type.

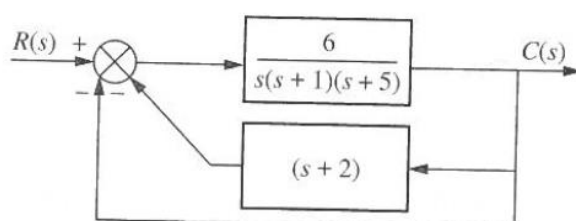


FIGURE P7.4

7. Chap 7 Prob. 19

19. For the unity-feedback system of Figure P7.1, where [Section: 7.3]

$$G(s) = \frac{K(s^2 + 6s + 6)}{(s + 5)^2(s + 3)}$$

- Find the system type.
- What error can be expected for an input of $12u(t)$?
- What error can be expected for an input of $12tu(t)$?

8. Chap 7 Prob. 25

25. Given the unity-feedback control system of Figure P7.1 where

$$G(s) = \frac{K}{s(s + a)}$$

find the following: [Section: 7.4]

- K and a to yield $K_v = 1000$ and a 20% overshoot
- K and a to yield a 1% error in the steady state and a 10% overshoot.

9. Chap 7 Prob. 33

33. Given the system shown in Figure P7.14, find the following: [Section: 7.6]

- The system type
- The value of K to yield 0.1% error in the steady state.

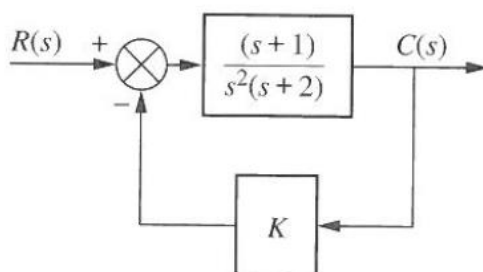


FIGURE P7.14

Submission place and deadline:

先進流體傳動控制實驗室 AFPCL R139 / 12:00 pm, November 19, 2019