دانشکده مهندسی مکانیک

تمرین درس کنترل

نام و شماره دانشجویی:

CONTROL EXERCISES

HW-4

- تمرین های زیر از کتاب کنترل مدرن اوگاتا (5th Ed.) :

  - Modern Control Engineering (5th Edition) by Katsuhiko Ogata

    - B-5-2
    - B-5-3
    - B-5-4
    - B-5-7

  - تصاویر سوالات در ادامه ارائه شده است.

B–5–2. Consider the unit-step response of a unity-feedback control system whose open-loop transfer function is

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

Obtain the rise time, peak time, maximum overshoot, and settling time.

B–5–3. Consider the closed-loop system given by

$$\frac{C(s)}{R(s)} = \frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$$

Determine the values of ζ and ω_n so that the system responds to a step input with approximately 5% overshoot and with a settling time of 2 sec. (Use the 2% criterion.)

B–5–4. Consider the system shown in Figure 5–72. The system is initially at rest. Suppose that the cart is set into motion by an impulsive force whose strength is unity. Can it be stopped by another such impulsive force?

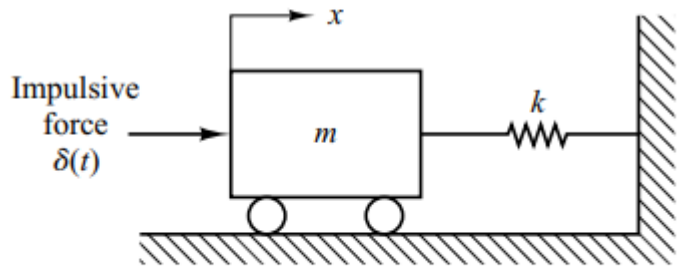

Figure 5–72
Mechanical system.

B–5–7. Consider the system shown in Figure 5–74(a). The damping ratio of this system is 0.158 and the undamped natural frequency is 3.16 rad/sec. To improve the relative stability, we employ tachometer feedback. Figure 5–74(b) shows such a tachometer-feedback system.

Determine the value of K_h so that the damping ratio of the system is 0.5. Draw unit-step response curves of both the original and tachometer-feedback systems. Also draw the error-versus-time curves for the unit-ramp response of both systems.

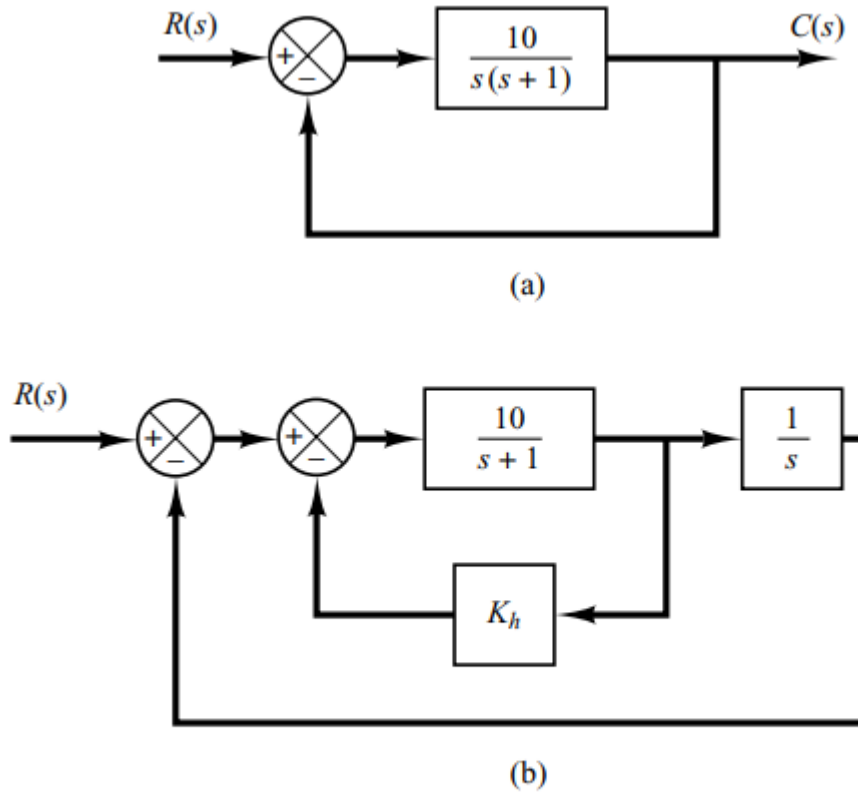

Figure 5–74
(a) Control system; (b) control system with tachometer feedback.