دانشکده مهندسی مکانیک

تمرین درس کنترل

نام و شماره دانشجویی:

CONTROL EXERCISES

HW-2

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

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

    - B-3-3
    - B-3-4
    - B-3-7
    - B-3-10
    - B-4-2 – نیازی به پاسخ دادن بخش آخر (خطای حالت ماندگار) نیست.

  - تصاویر سوالات در ادامه ارائه شده است.

B–3–3. Obtain a state-space representation of the mechanical system shown in Figure 3–32, where u_1 and u_2 are the inputs and y_1 and y_2 are the outputs.

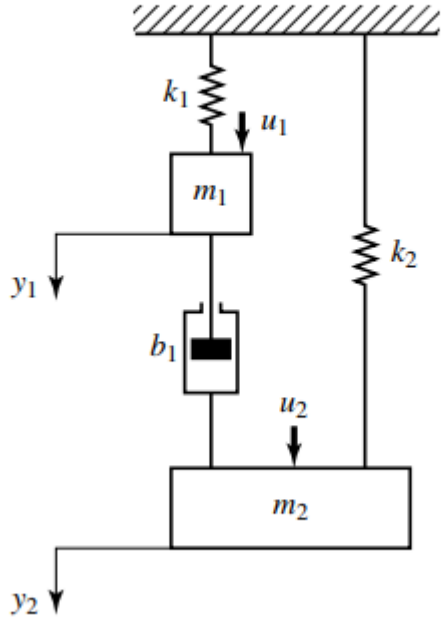
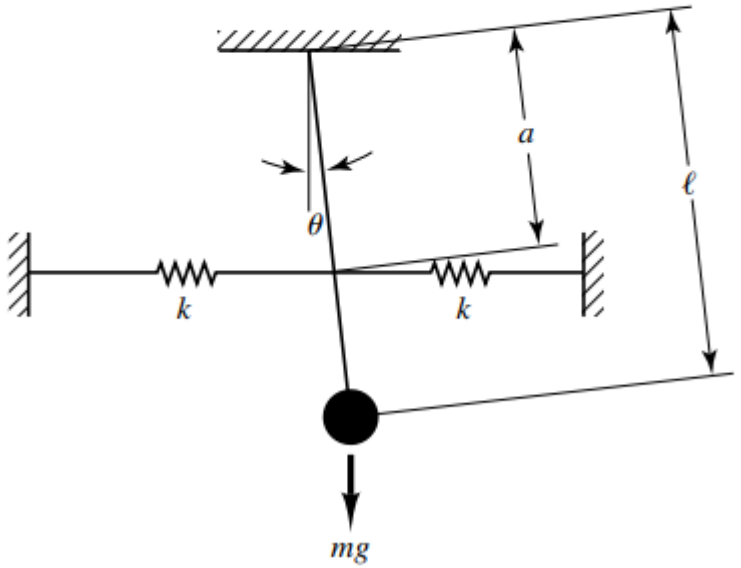


Figure 3–32 Mechanical system.

B–3–4. Consider the spring-loaded pendulum system shown in Figure 3–33. Assume that the spring force acting on the pendulum is zero when the pendulum is vertical, or $\theta = 0$. Assume also that the friction involved is negligible and the angle of oscillation θ is small. Obtain a mathematical model of the system.



B–3–7. Obtain the transfer function $E_o(s)/E_i(s)$ of the electrical circuit shown in Figure 3–36.

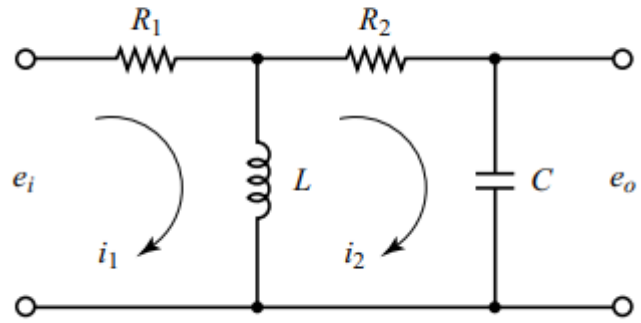


Figure 3–36 Electrical circuit.

B–3–10. Obtain the transfer function $E_o(s)/E_i(s)$ of the op-amp circuit shown in Figure 3–39.

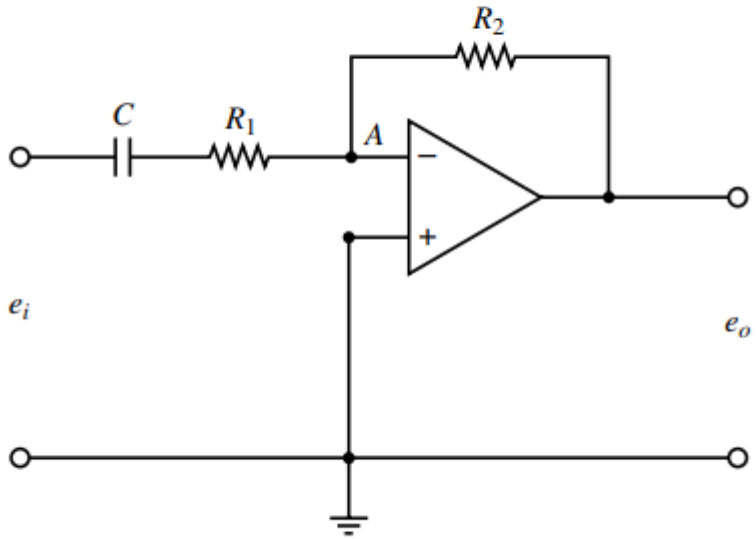


Figure 3–39 Operational-amplifier circuit.

B–4–2. Consider the liquid-level control system shown in Figure 4–43. The controller is of the proportional type. The set point of the controller is fixed.

Draw a block diagram of the system, assuming that changes in the variables are small. Obtain the transfer function between the level of the second tank and the disturbance input q_d. Obtain the steady-state error when the disturbance q_d is a unit-step function.

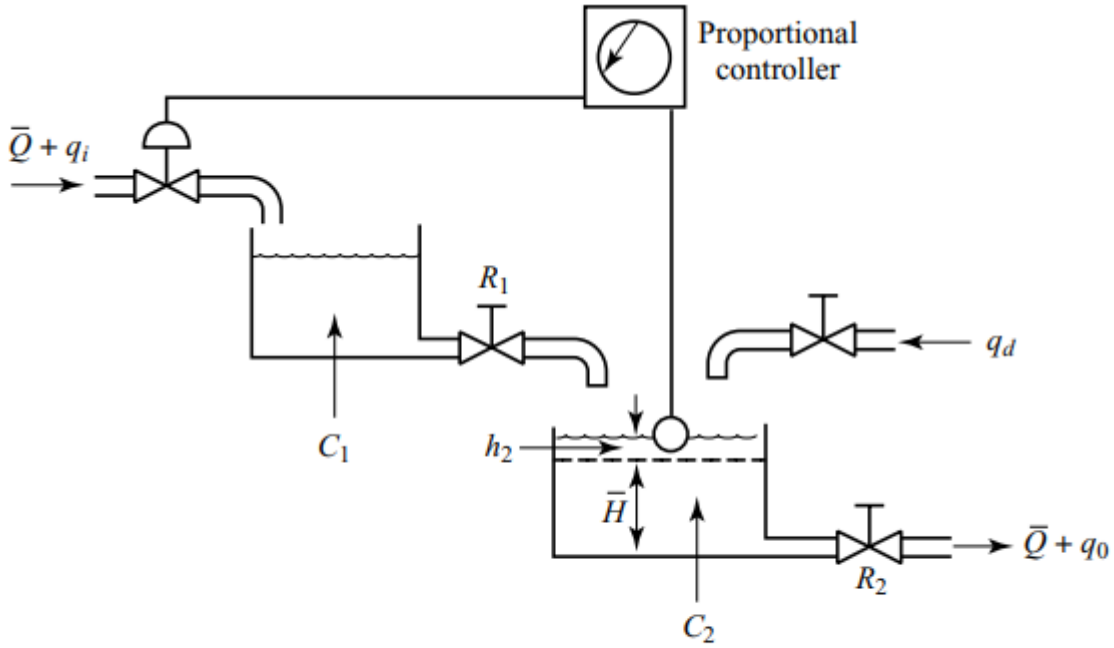


Figure 4–43
Liquid-level control system.