Control y Sistemas

Trabajo práctico: Controladores PID

Resuelva los siguientes ejercicios en MATLAB o SIMULINK.

1) B–8–2. Consider the system shown in Figure 8–71. Assume that disturbances D(s) enter the system as shown in the diagram. Determine parameters K, a, and b such that the response to the unit-step disturbance input and the response to the unit-step reference input satisfy the following specifications: The response to the step disturbance input should attenuate rapidly with no steady-state error, and the response to the step reference input exhibits a maximum overshoot of 20% or less and a settling time of 2 sec.

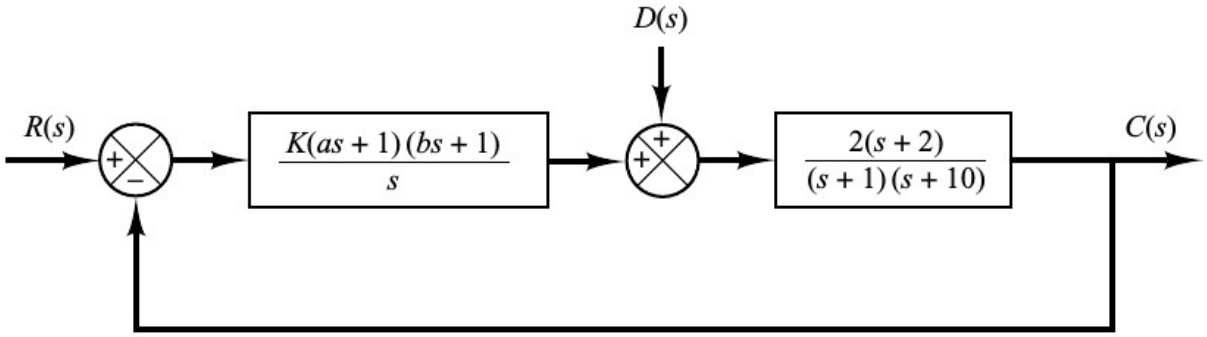

Figure 8–71
Control system.

2) B–8–4. Consider the systems shown in Figures 8–73(a) and (b). The system shown in Figure 8–73(a) is the system designed in Example 8–1. The response to the unit-step reference input in the absence of the disturbance input is shown in Figure 8–10. The system shown in Figure 8–73(b) is the I-PD-controlled system using the same Kp , Ti , and Td as the system shown in Figure 8–73(a). Obtain the response of the I-PD-controlled system to the unit-step reference input with MATLAB. Compare the unit-step response curves of the two systems.

3) B–8–5. Referring to Problem B–8–4, obtain the response of the PID-controlled system shown in Figure 8–73(a) to the unit-step disturbance input. Show that for the disturbance input, the responses of the PID-controlled system shown in Figure 8–73(a) and of the I-PD-controlled system shown in Figure 8–73(b) are exactly the same. [When considering D(s) to be the input, assume that the reference input R(s) is zero, and vice versa.] Also, compare the closed-loop transfer function C(s)/R(s) of both systems.

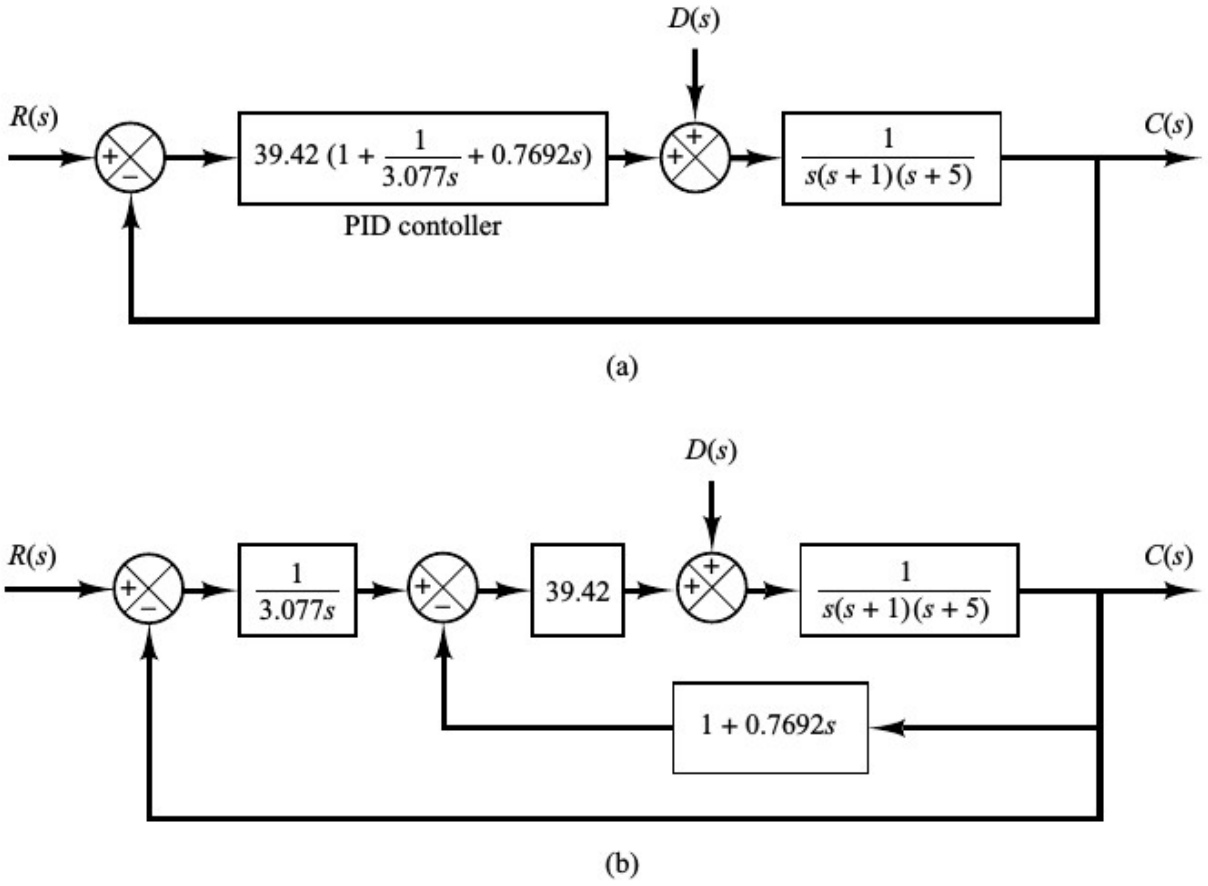

Figure 8–73
(a) PID-controlled system; (b) I-PD-controlled system.

4) B–8–11. Consider the control system shown in Figure 8–79. Assume that the PID controller is given by

$$G_s(s) = K\frac{s+a^2}{s}$$

It is desired that the unit-step response of the system exhibit the maximum overshoot of less than 10%, but more than 2% (to avoid an almost overdamped system), and the settling time be less than 2 sec. Using the computational approach presented in Section 8–4, write a MATLAB program to determine the values of K and a that will satisfy the given specifications. Choose the search region to be

$$1 \le K \le 4 \qquad 0.4 \le a \le 4$$

Choose the step size for K and a to be 0.05. Write the program such that the nested loops start with the highest values of K and a and step toward the lowest. Using the first-found solution, plot the unit-step response curve.

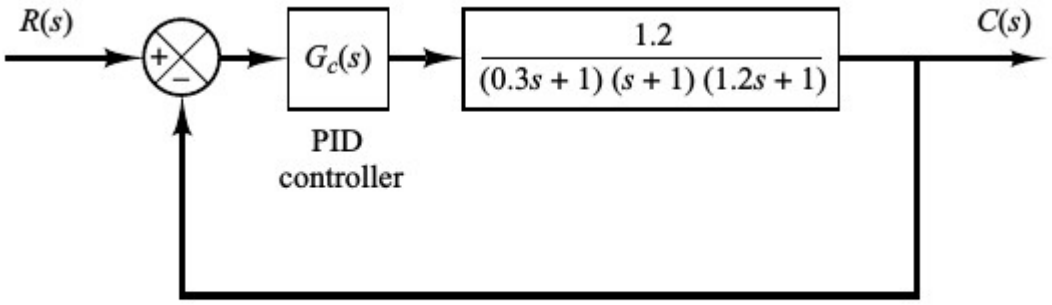

Figure 8–79
Control system.

5) B–8–14. Consider the system shown in Figure 8–81. The plant G p(s) is given by

$$G_p(s)=\frac{2(s+1)}{s(s+3)(s+5)}$$

Determine the controllers Gc1(s) and Gc2(s) such that, for the step disturbance input, the response shows a small amplitude and approaches zero quickly (in a matter of 1 to 2 sec). For the response to the unit-step reference input, it is desired that the maximum overshoot be 20% or less and the settling time 1 sec or less. For the ramp reference input and acceleration reference input, the steady-state errors should be zero.

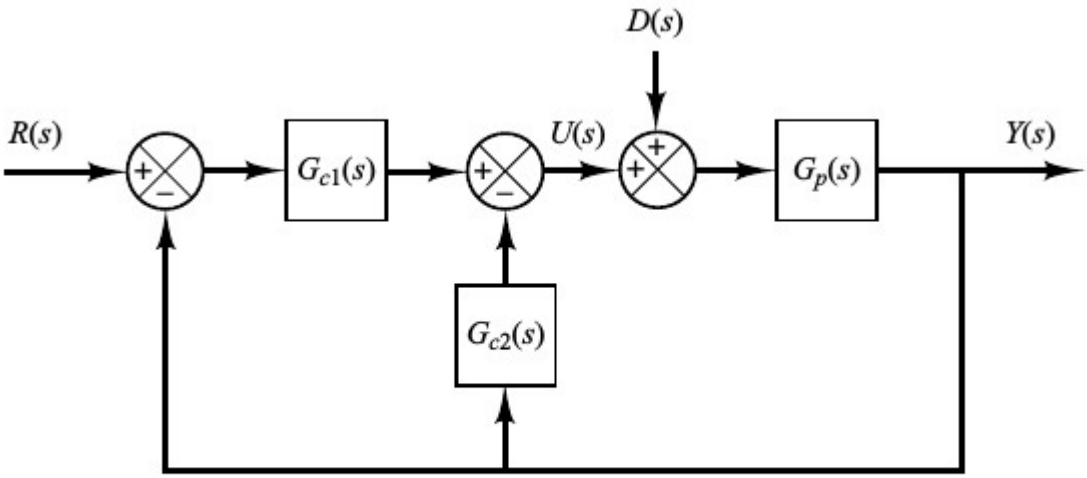

Figure 8–81
Two-degrees-of-freedom control system.