HW4

1.

CP4.3 Consider the closed-loop transfer function

$$T(s) = \frac{5K}{s^2 + 15s + K}.$$

Obtain the family of step responses for $K = 10, 200,$ and 500. Co-plot the responses and develop a table of results that includes the percent overshoot, settling time, and steady-state error.

2.

CP4.4 Consider the feedback system in Figure CP4.4. Suppose that the controller is

$$K = 10.$$

(a) Develop an m-file to compute the closed-loop transfer function $T(s) = Y(s)/R(s)$ and plot the unit step response. (b) In the same m-file, compute the transfer function from the disturbance $T_d(s)$ to the output $Y(s)$ and plot the unit step disturbance response. (c) From the plots in (a) and (b) above, estimate the steady-state tracking error to the unit step input and the steady-state tracking error to the unit step disturbance input. (d) From the plots in (a) and (b) above, estimate the maximum tracking error to the unit step input and the maximum tracking error to the unit step disturbance input. At approximately what times do the maximum errors occur?

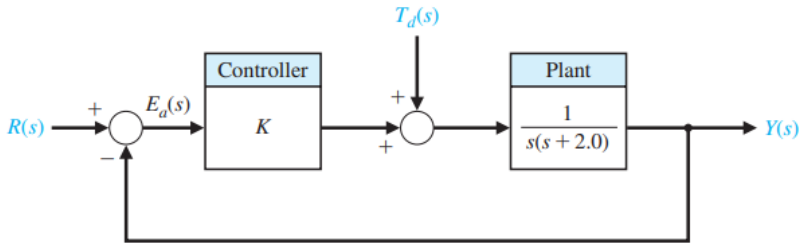

FIGURE CP4.4
Unity feedback system with controller gain *K*.

3.

CP5.1 Consider the closed-loop transfer function

$$T(s) = \frac{35}{s^2 + 12s + 35}.$$

Obtain the impulse response analytically and compare the result to one obtained using the impulse function.

4.

CP5.10 Develop an m-file to simulate the response of the system in Figure CP5.10 to a ramp input $R(s) = 1/s^2$. What is the steady-state error? Display the output on an x-y graph.

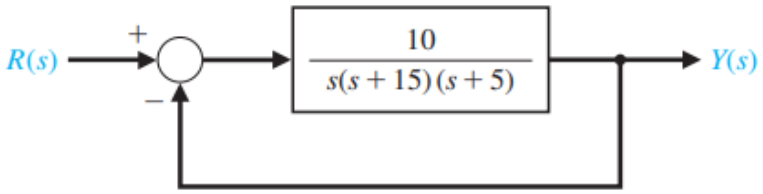

FIGURE CP5.10 Closed-loop system for m-file.