Control Homework IX-2019

5.20. A control system containing a reference input, $R(s)$, and a disturbance input, $D(s)$, is illustrated:

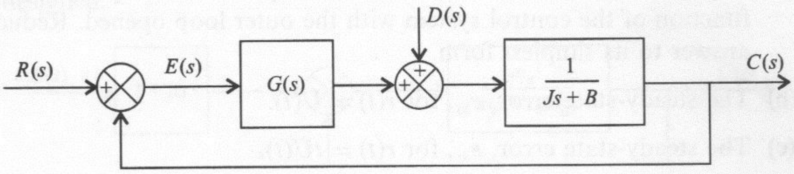


Figure P5.20

(a) Determine the steady-state error, e_{ss}, for a unit-step disturbance at $D(s)$ in terms of the unknown transfer function $G(s)$.

(b) Select the simplest value of $G(s)$ which will result in zero steady-state error for $E(s)$ when $D(s)$ is a unit step input.

5.24. We know from Eq. (5.37) that the steady-state error of a second-order control system to a unit ramp input is given by $2\zeta/\omega_n$ (reciprocal of the velocity constant, K_v). This steady-state error to a unit ramp input can be eliminated

if the input, $R(s)$, is introduced into the system through a proportional-plus-derivative filter, as illustrated in Figure P5.24, and the value of A is properly designed.

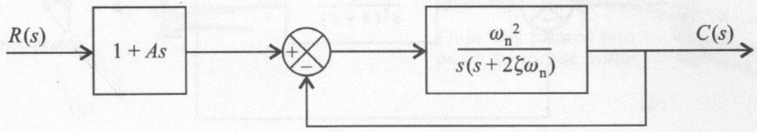
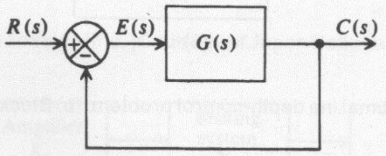


Figure P5.24

Determine the value of A which will result in zero steady-state error to a unit ramp input at the input, $R(s)$, assuming that the error, $e(t)$, is defined as

$$e(t) = r(t) - c(t).$$

6.8. Using the Routh–Hurwitz stability criterion, determine if the feedback control system shown in Figure P.68 is stable for the following transfer functions:



(a) $$G(s) = \frac{100}{s(s^2 + 8s + 24)},$$

(b) $$G(s) = \frac{3s + 1}{s^2(300s^2 + 600s + 50)},$$

(c) $$G(s) = \frac{24}{s(s + 2)(s + 4)},$$

(d) $$G(s) = \frac{0.2(s + 2)}{s(s + 0.5)(s + 0.8)(s + 3)}.$$