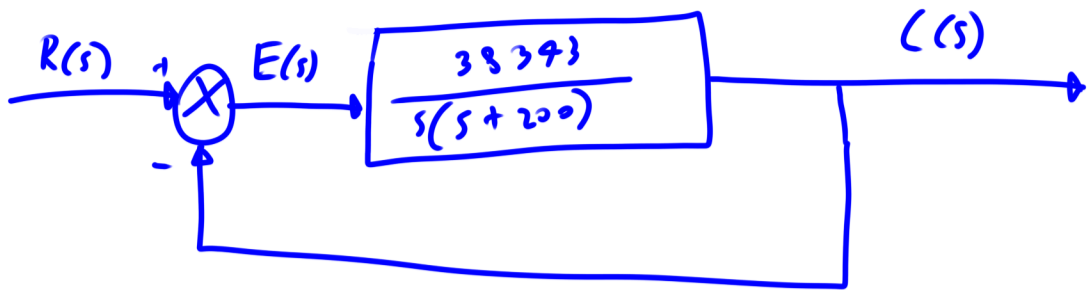


Nise 5.18



find  $\zeta$ ,  $\omega_n$ , %OS,  $T_p$ ,  $T_r$ ,  $T_s$

$$H(s) = \frac{\frac{38343}{s(s+200)}}{1 + \frac{38343}{s(s+200)}} = \frac{38343}{s(s+200) + 38343}$$

$$= \frac{38343}{s^2 + 200s + 38343}$$

$$\frac{d^2 y}{dt^2} + 200 \frac{dy}{dt} + 38343 y = 38343 u(t)$$

$$\omega_n = \sqrt{38343} = 196$$

$$2 \zeta \omega_n = 200$$

$$\zeta = \frac{200}{2(196)} = 0.51$$

$$\frac{d^2 y}{dt^2} + 2 \zeta \omega_n \frac{dy}{dt} + \omega_n^2 y = \tau(t)$$

$$\%OS = 100 \exp\left(\frac{-\zeta \pi}{\sqrt{1-\zeta^2}}\right) = 100 \exp\left(\frac{-0.51 \pi}{\sqrt{1-0.51^2}}\right)$$

$$= 15.5\%$$

$$\omega_d = \omega_n \sqrt{1-\zeta^2} = 196 \sqrt{1-0.51^2} = 169$$

$$T_p = \frac{\pi}{\omega_d} = \frac{\pi}{169} = 0.019 \text{ s}$$

$\tau_1, 2$  exact. 2

$$T_r \omega_n = 1.6$$

$$T_r = \frac{1.6}{\omega_n} = \frac{1.6}{196} = 0.0082 \text{ s}$$

$$T_s = \frac{4}{\zeta \omega_n} = \frac{4}{0.51(196)} = \frac{4}{100} = 0.04 \text{ s}$$