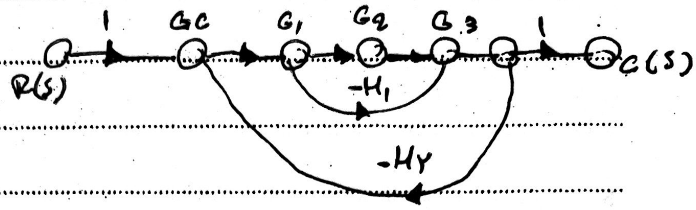
امیرمحمد محمدزاده تمرینات سری اول

Subject:

Date:

1. $\frac{C(s)}{R(s)} = ?$ $\frac{C(s)}{D(s)} = ?$



$P_1 = G_c G_1 G_2 G_3$ $\quad l_{1-1} = -G_c G_1 G_2 G_3 H_2$

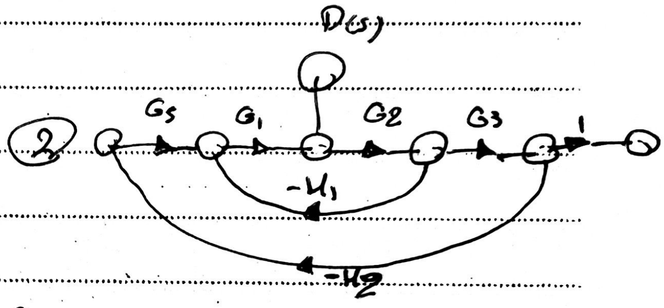
$\Delta_1 = 1$ $\quad l_{1-2} = -G_1 G_2 H_1$

$$\frac{C(s)}{R(s)} = \frac{G_c G_1 G_2 G_3}{1 + G_1 G_2 H_1 + G_c G_1 G_2 G_3 H_2}$$

2. $P_1 = G_2 G_3$ $\quad l_{1-1} = -G_c G_1 G_2 G_3 H_2$

$\Delta_1 = 1$ $\quad l_{1-3} = -G_1 G_2 H_1$

$$\frac{C(s)}{D(s)} = \frac{G_2 G_3}{G_c G_1 G_2 G_3 H_2 + G_1 G_2 H_1 + 1}$$



2- $\dot{X} = AX + BV$ $\quad Y = CX + DV$

$$\underbrace{\begin{bmatrix} \dot{u} \\ \dot{\omega} \\ \dot{q} \\ \dot{\theta} \end{bmatrix}}_{\dot{x}} = \underbrace{\begin{bmatrix} -0.5 & 0.1 & 0.2 & 0 \\ 0.3 & -0.4 & 0.1 & 0 \\ 0.2 & 0.1 & 0.6 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}}_{A} \underbrace{\begin{bmatrix} u \\ \omega \\ q \\ \theta \end{bmatrix}}_{x} + \underbrace{\begin{bmatrix} 0.1 \\ 0.2 \\ 0.3 \\ 0 \end{bmatrix}}_{B} \delta_s$$

$$Y = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} u \\ \omega \\ q \\ \theta \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \end{bmatrix} \delta_s$$

3. $G(s) = G_1(s)\, G_2(s)\, G_3(s)$ $\quad G_1(s) = \frac{k_1}{s}$, $G_2(s) = \frac{10}{s+10}$

$$G_3(s) = \frac{-k_A(1 + sT_A)}{(s^2 + 2\zeta_p \omega_{sp} s + \omega_{sp}^2)}$$

$$G(s) = \left(\frac{k_1}{s}\right)\left(\frac{10}{s+10}\right)\left(\frac{-k_A(1+sT_A)}{(s^2 + 2\zeta_p \omega_{sp} s + \omega_{sp}^2)}\right)$$

$$G(s) = \frac{G'(s)}{1 + G(s) k_a}$$

$$s(s+10)(s^2 + 2\zeta\omega_{ps} + \omega_{ps}^2)\, q(s) + 10 k_p k_1 k_A (1 + sT_A)\, q(s)$$

$$= -10 k_1 k_A (1 + sT_A)\, q'(s)$$

$$\frac{d^3 q}{dt^3} + a_2 \frac{d^2 q}{dt^2} + a_1 \frac{dq}{dt} + a_0 q = b_1 \frac{dq'}{dt} + b_0 q'$$

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$a_2 = 10 + 2\zeta\omega_{ps}$, $a_1 = 10(2\zeta\omega_{ps}) + \omega_{ps}^2 + 10k_g k_1 k_A T_A$

$a_0 = 10\omega^2_{sp} + 10k_g k_1 k_A$, $b_0 = 10k_1 k_A$, $b_1 = -10k_1 k_A T_A$

(4) $\dddot{y} - \ddot{y} + 3\dot{y} + 4y = 2\dddot{u} + 6\ddot{u} - \dot{u} + 3u$

$\dddot{y} + a_1\ddot{y} + a_2\dot{y} + a_3 y = b_0\dddot{u} + b_1\ddot{u} + b_2\dot{u} + b_3 u$

$a_1 = 1$ $a_2 = 3$ $a_3 = 4$, $b_0 = 2$ $b_2 = -1$ $b_1 = 6$ $b_3 = 3$

$$\left.\begin{aligned} y_1 &= y \\ y_2 &= \dot{y} \\ y_3 &= \ddot{y} \end{aligned}\right\} \Rightarrow \left.\begin{aligned} \dot{y} &= \dot{y} \\ \dot{y}_2 &= \ddot{y} \\ \dot{y}_3 &= \dddot{y} \end{aligned}\right\} \Rightarrow \begin{aligned} \dot{y}_1 &= y_2 \\ \dot{y}_2 &= y_3 \\ \dot{y}_3 &= -4y_1 - 3y_2 + y_3 + 2\dddot{u} + 6\ddot{u} - \dot{u} + 3u \end{aligned}$$

$$\begin{bmatrix} \dot{y}_1 \\ \dot{y}_2 \\ \dot{y}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -3 & 1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} \dddot{u} + \begin{bmatrix} 0 \\ 0 \\ 6 \end{bmatrix} \ddot{u} + \begin{bmatrix} 0 \\ 1 \\ 3 \end{bmatrix} u$$

$$Y = [1\ 0\ 0] \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + [0]u$$