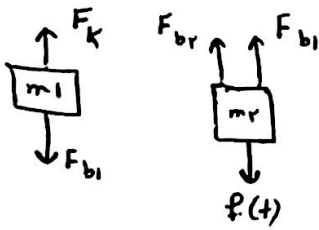


برود دلت فرماری

باسخ تمرین سیر اول

لنترل خمر

سوال 1 :



$$-Kx_1 + b_1(v_r - v_1) = m_1 \ddot{x}_1 = m_1 \dot{v}_1$$

$$-b_1(v_r - v_1) - b_r v_r + f(t) = m_r \dot{v}_r$$

$$\Rightarrow \begin{cases} m_r s v_r(s) + (b_1 + b_r) v_r(s) - b_1 v_1(s) = F(s) \\ m_1 s v_1(s) + b_1(v_1(s) - v_r(s)) + K \frac{v_1(s)}{s} = 0 \end{cases}$$

$$[m_r s + (b_1 + b_r)] v_r(s) - b_1 v_1(s) = F(s)$$

$$v_1(s) \left[ m_1 s + b_1 + \frac{K}{s} \right] = v_r(s) b_1$$

$$\Rightarrow v_r(s) = \frac{m_1 s + b_1 + K/s}{(m_r s + b_1 + b_r)(m_1 s + b_1 + K/s) - b_1^2} F(s)$$

بسن از ساده سازی خواهیم راسته

$$\Rightarrow G_r(s) = \frac{v_r(s)}{F(s)} = \frac{m_1 s^2 + b_1 s + K}{(m_r s + b_1 + b_r)(m_1 s^2 + b_1 s + K) - b_1^2}$$

$$G_1(s) = \frac{v_1(s)}{F(s)} = \frac{b_1 s}{(m_r s + b_1 + b_r)(m_1 s^2 + b_1 s + K) - b_1^2}$$

$$\text{الف) } (R(s)G_r - C(s)G_r + R(s)G_1)G_r = C(s)$$

$$\Rightarrow R(s)G_rG_r - C(s)G_rG_r + R(s)G_1G_r = C(s)$$

$$\Rightarrow R(s)(G_rG_r + G_1G_r) = C(s)(1 + G_rG_r) \Rightarrow$$

$$T(s) = \frac{G_rG_r + G_1G_r}{1 + G_rG_r}$$

$$\text{ب) } D(s) = 0$$

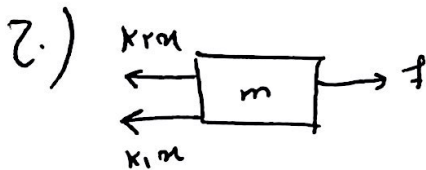
$$(R(s) + C(s)) \frac{4}{s+1} = C(s) \Rightarrow \frac{4R(s)}{s+1} = C(s) \left( \frac{s+1}{s+1} \right) \Rightarrow$$

$$\frac{C(s)}{R(s)} = \frac{4}{s+1}$$

$$R(s) = 0$$

$$(D(s) - sC(s)) \frac{4}{s+1} = C(s) \Rightarrow \frac{4D(s)}{s+1} = C(s) \left( \frac{s+1}{s+1} \right) \Rightarrow$$

$$\frac{C(s)}{D(s)} = \frac{4}{s+1}$$



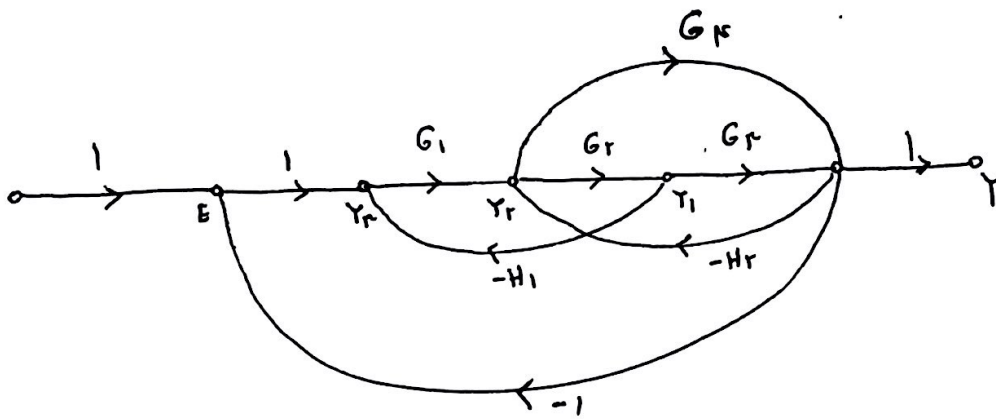
$$f - k_1x - k_r x = m\ddot{x}$$

$$\Rightarrow f - k_1x - k_r x = m s^2 x$$

$$\Rightarrow f = x(m s^2 + k_1 + k_r)$$

$$\Rightarrow \left| \frac{x}{f} \right| = \frac{1}{m s^2 + k_1 + k_r}$$

سؤال ٣ :



الف)

$$P_1 = 1 \quad L_1 = 1 \times 1 \times 1 \times 1 \times 1 = 1$$

سؤال ٤ :

$$L_2 = 1 \times 1 \times 1 \times 1 = 1 \quad L_3 = 1 \times 1 \times (-1) = -1$$

$$L_4 = 1 \times (-1) = -1 \quad L_5 = 1 \times 1 \times 1 \times 1 = 1$$

$$\Rightarrow \Delta_1 = 1 - (L_2 + L_3 + L_4) = -1 \quad \frac{E}{R} = \frac{P_1 \Delta_1}{1 + \sum_{i=1}^5 L_i} = \frac{1}{11}$$

$$\Rightarrow \boxed{\frac{E}{R} = \frac{1}{11}}$$

$$P_1 = a c d \quad P_2 = e f h$$

$$L_1 = b c \quad L_2 = f g$$

$$\Delta_1 = 1 - L_2 = 1 - f g$$

$$\Delta_2 = 1 - L_1 = 1 - b c$$

$$\Delta = 1 - (L_1 + L_2) + L_1 L_2$$

$$\Rightarrow M = \frac{P_1 \Delta_1 + P_2 \Delta_2}{\Delta} = \frac{a c d (1 - f g) + e f h (1 - b c)}{1 - b c - f g + b c f g}$$