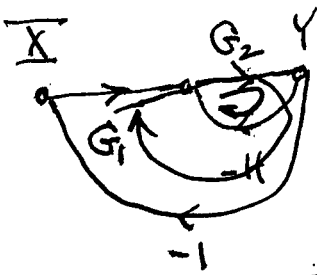
(a) (b)

① (a)



(b) $P_1 = G_1 G_2$

Loop $L_1 = G_1 G_2 (-1)$

$L_2 = -G_2 H$

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

$+ L_1 L_2 \cancel{V}$ (0)

$\Delta_1 = 1$

$\Delta = 1 + G_2 H + G_1 G_2 =$

$\Delta = 1 + G_2 (H + G_1)$

$$\frac{Y}{X} = \frac{G_1 G_2}{1 + G_2 (H + G_1)}$$

P2

(a) $= \frac{G}{1+GH} = \frac{\frac{Y}{X}}{}$ (b) $E = X - \frac{Y}{X}H \Rightarrow \frac{E}{X} = 1 - \frac{Y}{X}H$

(b) $= \frac{E}{X} = \frac{1}{1+GH}$

(c) $X(s) = \left\{\frac{12}{s} + \frac{6}{s^2}\right\} = \frac{12+6s}{s^2}$ $\boxed{X(s) = 6\frac{[2s+1]}{s^2}}$

$$E = \frac{6[2s+1]}{s^2}\left[\frac{1}{1+\left\{\frac{(s+1)H}{s^2\{s+5\}}\right\}}\right]$$

a
b
c

$$sE = \frac{6[2s+1]}{s + \left\{\frac{(s+1)H}{s(s+5)}\right\}}$$

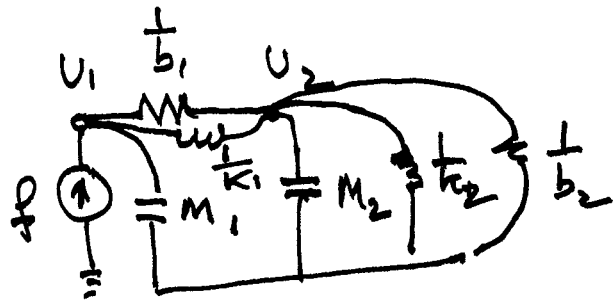
$$e(\infty) \overset{\text{(b)}}{\underset{s}{\uparrow}} = \frac{6}{0 + \left\{\frac{H}{s5}\right\}} = \frac{1}{10} \Rightarrow$$

$\boxed{H = KS}$

$$\frac{1}{10} = \frac{6}{\frac{KS}{s5}} \Rightarrow \frac{1}{10} = \frac{5}{K} \Rightarrow 1 = \frac{50}{K}$$

$K = 50$ $\boxed{H = 50s}$

P3 (a)



(b) $$F = \frac{U_1 - U_2}{\frac{1}{b_1}} + \frac{U_1 - U_2}{\frac{s}{K_1}} + \frac{U_1}{\frac{1}{M_1 s}}$$

$$\frac{U_1 - U_2}{\frac{1}{b_1}} + \frac{U_1 - U_2}{\frac{s}{K_1}} = \frac{U_2}{\frac{1}{M_2 s}} + \frac{U_2}{\frac{s}{K_2}} + \frac{U_2}{\frac{1}{b_2}}$$

(c) $$f(t) = b_1(\dot{u}_1 - \dot{u}_2) + (u_1 - u_2)K_1 + \ddot{u}_1 M_1 \quad b$$

$$b_1(\dot{u}_1 - \dot{u}_2) + K_1(u_1 - u_2) = M_2 \ddot{u}_2 + K_2 u_2 + b_2 \dot{u}_2 \quad d$$

a c

(d) find U_2/U_1

$$(M_2 s^2 + b_2 s + K_2) U_2 = U_1(K_1 + b_1 s) - U_2(b_1 s + K_1)$$

$$\left[M_2 s^2 + (b_2 + b_1)s + (K_1 + K_2)\right] U_2 = U_1 [K_1 + b_1 s]$$

$$\boxed{\frac{U_2}{U_1} = \frac{K_1 + b_1 s}{M s^2 + (b_2 + b_1)s + (K_1 + K_2)}}$$