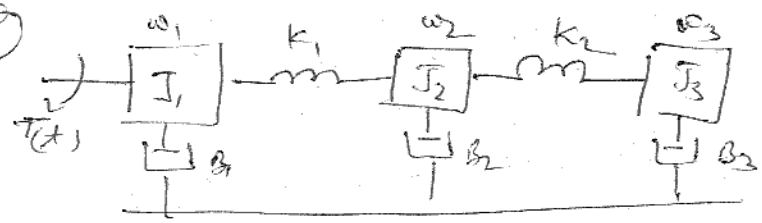
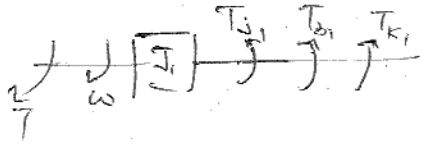
(5)





$T_{J_1} = J_1 \frac{d\omega_1}{dt}$

$T_{b_1} = B_1 \omega_1$

$T_{k_1} = K_1 \int (\omega_1 - \omega_2) dt = T(t)$

By newton second law

$T_{J_1} + T_{B_1} + T_{K_1} = T$

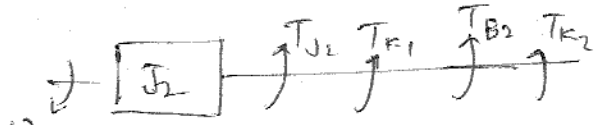
$J_1 \frac{d\omega_1}{dt} + B_1 \omega_1 + K_1 \int (\omega_1 - \omega_2)\, dt = T(t)$

Taken L.T

$J_1 S\omega_1(S) + B_1 \omega_1(S) + K_1 \left(\frac{\omega_1(S)}{S} - \frac{\omega_2(S)}{S} \right) = T(S)$

$\omega_1(S) \left[J_1 S + B_1 + \frac{K_1}{S} \right] - \omega_2(S) \left[K_1/S \right] = T(S)$ — (1)

$\omega_1(S) = \frac{T(S) + \omega_2(S)(K_1/S)}{J_1 S + B_1 + K_1/S}$ — (2)



$T_{J_2} = J_2 \frac{d\omega_2}{dt}$ $\quad T_{K_2} = K_2 \int (\omega_2 - \omega_3) dt$

$T_{K_1} = K_1 \int (\omega_2 - \omega_1)\, dt$ $\quad T_{B_2} = B_2 \omega_2$

By newton second law

$T_{J_2} + T_{K_2} + T_{K_1} + T_{B_2} = 0$

$J_2 \frac{d\omega_2}{dt} + K_2 \int (\omega_2 - \omega_3) dt + K_1 \int (\omega_2 - \omega_1)\, dt + B_2 \omega_2 = 0$

Taken L.T

$J_2 S \omega_2(S) + \frac{K_2}{S} \left[\frac{\omega_2(S)}{S} - \frac{\omega_3(S)}{S} \right] + \frac{K_1}{S} \left[\frac{\omega_2(S)}{S} - \frac{\omega_1(S)}{S} \right] + B_2 \omega_2(0) = 0$

$\omega_2(S) \left[J_2 S + K_2/S + K_1/S + B_2 \right] - \left[\frac{K_2}{S} \right] \omega_3 - \left[\frac{K_1}{S} \right] \omega_1 = 0$ — (3)

$T_{J_3} = J_3 \frac{d\omega_3}{dt}$ $\quad T_{B_3} = B_3 \omega_3$ $\quad T_{K_2} = K_2 \int (\omega_3 - \omega_2)\, dt$

By Newton's second law

$$T_{J_3} + T_{B_3} + T_{K_2} = 0$$

$$J_3 \frac{d\omega_3}{dt} + B_3 \omega_3 + K_2 \int (\omega_3 - \omega_2)\, dt = 0$$

Taking L.T

$$J_3 S\, \omega_3(S) + B_3\, \omega_3(S) + K_2 \left[\frac{\omega_3(S)}{S} - \frac{\omega_2(S)}{S}\right] = 0$$

$$\omega_3(S)\left[J_3 S + B_3 + \frac{K_2}{S}\right] - \omega_2(S)\left[\frac{K_2}{S}\right] = 0 \quad \text{---(4)}$$

$$\omega_2(S) = \frac{\omega_3(S)\left[J_3 S + B_3 + K_2/S\right]}{(K_2/S)} \quad \text{---(5)}$$