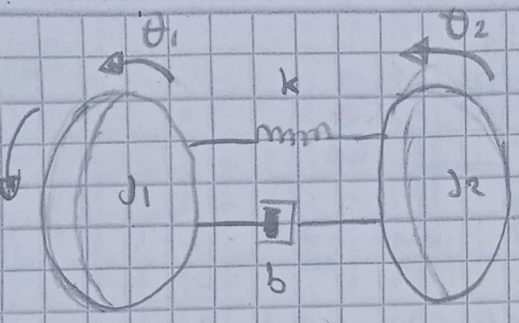

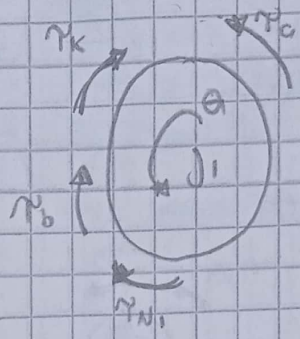

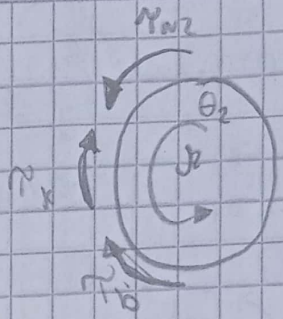

$\theta_1 > \theta_2$

$x_1 = \theta_1 \quad x_2 = \dot{x}_1 \quad U = \tau_G \quad \tau_b = b(x_2 - x_4) \quad \tau_{N2} = J_2 \dot{x}_4$

$x_3 = \theta_2 \quad x_4 = \dot{x}_3 \quad \tau_K = k(x_1 - x_3) \quad \tau_{N1} = J_1 \dot{x}_2$

$$U = k(x_1 - x_3) + b(x_2 - x_4) + J_1 \dot{x}_2 \quad \Rightarrow \quad \dot{x}_2 = -\frac{k}{J_1} x_1 - \frac{b}{J_1} x_2 + \frac{k}{J_1} x_3 + \frac{b}{J_1} x_4 + \frac{U}{J_1}$$

$$J_2 \dot{x}_4 = b(x_2 - x_4) + k(x_1 - x_3) \qquad \dot{x}_4 = \frac{k}{J_2} x_1 + \frac{b}{J_2} x_2 - \frac{k}{J_2} x_3 - \frac{b}{J_2} x_4$$

$$\dot{\vec{x}} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -\frac{k}{J_1} & -\frac{b}{J_1} & \frac{k}{J_1} & \frac{b}{J_1} \\ 0 & 0 & 1 & 0 \\ \frac{k}{J_2} & \frac{b}{J_2} & -\frac{k}{J_2} & -\frac{b}{J_2} \end{bmatrix} \vec{x} + \begin{bmatrix} 0 \\ \frac{1}{J_1} \\ 0 \\ 0 \end{bmatrix} U$$

Las salidas son x_1 y x_3

$$\vec{y} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \vec{x} + \vec{0} U$$