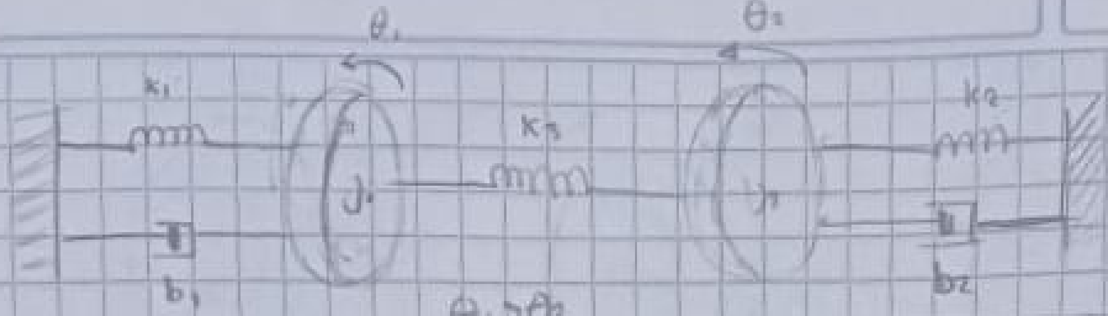
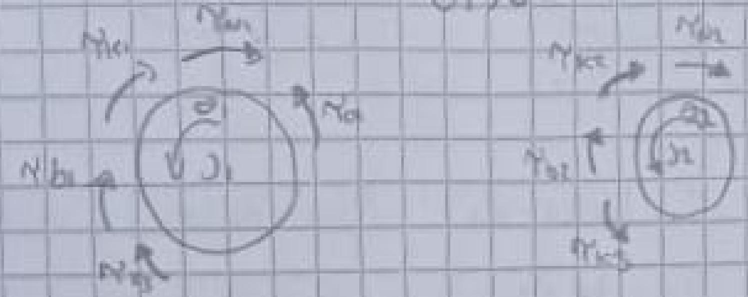


$\theta_1 > \theta_2$



definiendo estados:

$u = \tau_0 \quad x_1 = \theta_1 \quad x_2 = \dot{x}_1 \quad x_3 = \theta_2$

$x_4 = \dot{x}_3$

$\tau_{k1} = k_1 x_1 \quad \tau_{b1} = b_1 x_2 \quad \tau_{J1} = J_1 \dot{x}_2$

$\tau_{k2} = k_2 x_3 \quad \tau_{b2} = b_2 x_4 \quad \tau_{J2} = J_2 \dot{x}_4$

$\tau_{k3} = k_3(x_1 - x_3)$

$$u = J_1 \dot{x}_2 + k_1 x_1 + b_1 x_2 + k_3(x_1 - x_3)$$

$$k_3(x_1 - x_3) = J_2 \dot{x}_4 + k_2 x_3 + b_2 x_4$$

$$\dot{x}_2 = -\left(\frac{k_1}{J_1} + \frac{k_3}{J_1}\right)x_1 - \frac{b_1}{J_1}x_2 + \frac{k_3}{J_1}x_3 + \frac{u}{J_1}$$

$$\dot{x}_4 = \frac{k_3}{J_2}x_1 - \left(\frac{k_2}{J_2} + \frac{k_3}{J_2}\right)x_3 - \frac{b_2}{J_2}x_4$$

$$\dot{\vec{x}} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -\frac{k_1+k_3}{J_1} & -\frac{b_1}{J_1} & \frac{k_3}{J_1} & 0 \\ 0 & 0 & 0 & 1 \\ \frac{k_3}{J_2} & 0 & -\frac{k_2+k_3}{J_2} & -\frac{b_2}{J_2} \end{bmatrix} \vec{x} + \begin{bmatrix} 0 \\ \frac{1}{J_1} \\ 0 \\ 0 \end{bmatrix} u$$

Las salidas son x_1 y x_3

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