

### DESENVOLVIMENTO DO T3

$$m = 1,5$$

$$g = 9,79$$

$$c = 0,3$$

$$R_b = 3$$

$$L_b = 0,4 \quad \Delta v(t) \Rightarrow u(t)$$

$$p_0 = 0,04 \quad \Delta p(t) \Rightarrow y(t)$$

$$x(t) = \begin{bmatrix} \Delta p(t) \\ \Delta i(t) \\ \Delta \dot{p}(t) \end{bmatrix} \begin{matrix} x_1 \\ x_2 \\ x_3 \end{matrix} \quad \dot{x}(t) = \begin{bmatrix} \Delta \dot{p}(t) \\ \Delta \dot{i}(t) \\ \Delta \ddot{p}(t) \end{bmatrix} \begin{matrix} \dot{x}_1 = \dot{x}_3 \\ \dot{x}_2 \\ \dot{x}_3 \end{matrix}$$

$$R_b \cdot \underset{x_2}{\Delta i(t)} + L_b \cdot \underset{x_2}{\Delta \dot{i}(t)} = \underset{u(t)}{\Delta v(t)}$$

$$m \cdot \underset{x_3}{\Delta \ddot{p}(t)} = c \cdot \left( \frac{i_0}{p_0} \right)^2 \cdot \underset{x_1}{\Delta p(t)} - 2 \cdot c \cdot \left( \frac{i_0}{p_0} \right) \cdot \underset{x_2}{\Delta i(t)}$$

$$\bullet \dot{x}_1(t) = \Delta \dot{p}(t) = x_3(t)$$

$$\bullet \dot{x}_2(t) = \frac{L_b}{L_b} \cdot x_2(t) + \frac{1}{L_b} \cdot u(t)$$

$$\bullet \dot{x}_3(t) = \frac{c}{m} \left( \frac{i_0}{p_0} \right)^2 \cdot x_1(t) - \frac{2c}{m} \left( \frac{i_0}{p_0} \right) x_2$$

$$\dot{x}(t) = \begin{bmatrix} 0 & 0 & 1 \\ 0 & -R_b/L_b & 0 \\ \frac{c}{m} \left( \frac{i_0}{p_0} \right)^2 & \frac{2c}{m} \left( \frac{i_0}{p_0} \right) & 0 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1/L_b \\ 0 \end{bmatrix} u(t)$$

$A$   $B$

$$y(t) = \begin{bmatrix} 1 & 0 & 0 \\ c \end{bmatrix} x(t) + \underset{D}{[0]} u(t)$$

$$A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & -7,5 & 0 \\ 244,75 & 13,9929 & 0 \end{bmatrix}$$

$$\det(\lambda I - A) = \begin{vmatrix} \lambda & 0 & -1 \\ 0 & \lambda + 7,5 & 0 \\ -244,75 & -13,9928 & \lambda \end{vmatrix} = \begin{vmatrix} \lambda & 0 \\ 0 & \lambda + 7,5 \\ -244,75 & -13,9928 \end{vmatrix} = \lambda(\lambda + 7,5) - (-244,75)(-13,9928)$$

$$(\lambda^3 + 7,5\lambda^2 + 0 + 0) - (244,75(\lambda + 7,5) + 0 + 0) =$$

$$= \lambda^3 + 7,5\lambda^2 - 244,75\lambda - 1835,625$$

$$\lambda = \{-7,5; -15,6444; 15,6444\}$$