Ex 06/10 - Henrique Kuhlmann - 10772672

As eqs diferenciais não serão apresentadas, uma vez que já foram desenvolvidas anteriormente.

2) $$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{\dot{x}} \\ \dot{\dot{y}} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -K_1/m & K_1/m & -b/m & b/m \\ K_1/m & -\frac{K_1+K_2}{m} & b/m & -b/m \end{bmatrix} \begin{bmatrix} x \\ y \\ \dot{x} \\ \dot{y} \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ K_2/m \end{bmatrix} z(t)$$

$$\dot{u} = Au + Bz(t)$$

3) $$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{\dot{x}} \\ \dot{\dot{y}} \end{bmatrix} = \begin{bmatrix} 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \\ -K/m & K/m & -b/m & b/m \\ K/m & -K/m & b/m & -b/m \end{bmatrix} \begin{bmatrix} x \\ y \\ \dot{x} \\ \dot{y} \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1/m \\ 0 \end{bmatrix} z(t)$$

4) $$A = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ -\frac{K-K_1}{m_1} & 0 & K_1/m_1 & K_1 l/m_1 & -b_1/m_1 & 0 & b_1/m_1 & b_1 l/m_1 \\ 0 & -\frac{K-K_2}{m_2} & K_2/m_2 & -K_2 l/m_2 & 0 & -b_2/m_2 & b_2/m_2 & -b_2 l/m_2 \\ \frac{K_1}{m} & \frac{K_2}{m} & -K_1-K_2/M & l(K_2-K_1)/m & b_1/M & b_2/m & -(b_1+b_2)/m & \frac{l(b_2-b_1)}{m} \\ K_1 l/J & -K_2 l/J & l(K_2-K_1)/J & -l^2(K_2+K_1)/J & b_1 l/J & -b_2 l/J & l(b_2-b_1)/J & -\frac{l^2(b_2-b_1)}{J} \end{bmatrix}$$

Onde $\dot{X} = AX + BU$

$X = [x_1, x_2, x_G, \theta, \dot{x}_1, \dot{x}_2, \dot{x}_G, \dot{\theta}]$

5)
$$\begin{bmatrix} \dot{x} \\ \dot{\theta} \\ \ddot{x} \\ \ddot{\theta} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & \frac{-m^2 l^2}{J(M+m)-m^2 l^2} & 0 & 0 \\ 0 & \frac{gml(M+m)}{J(m+M)-m^2 l^2} & 0 & 0 \end{bmatrix} \begin{bmatrix} x \\ \theta \\ \dot{x} \\ \dot{\theta} \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ \left(M+m-\frac{m^2 l^2}{J}\right)^{-1} \\ \frac{-gml}{J(m+M)-m^2 l^2} \end{bmatrix} u.$$

$$\dot{X} = Ax + Bu$$

6)
$$\begin{bmatrix} \dot{x} \\ \dot{\theta} \\ \dot{I} \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ \frac{2KI_0^2}{mR_0^3} & 0 & \frac{-2KI_0}{mR_0^2} \\ 0 & 0 & -R/L \end{bmatrix} \begin{bmatrix} x \\ \dot{x} \\ I \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1/L \end{bmatrix} u$$