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Modelagem Ex aula (01/10 e 06/10)

2) $M\ddot{x} + b(\dot{x}-\dot{y}) + K_1(x-y) = 0$

$m\ddot{y} - b(\dot{x}-\dot{y}) - K_1(x-y) + K_2(y-z)$

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

3) $m\ddot{y} + b(\dot{y}-\dot{x}) + K(y-x) = 0$

$M\ddot{x} - b(\dot{y}-\dot{x}) + K\,y-x) = u$

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

4) $m_1\ddot{x}_1 + K(x_1 - z) - K_1(x_G - x_1 - l\theta) - b_1(\dot{x}_G - \dot{x}_1 + l\dot{\theta})$

$m_2\ddot{x}_2 + K(x_2 - z') - K_2(x_G - x_2 - l\theta) - b_2(\dot{x}_G - \dot{x}_2 + l\dot{\theta})$

$M\ddot{x}_G + K_1(x_G - x_1 + l\theta) + K_2(x_G - x_2 - l\theta) + b_1(\dot{x}_G - \dot{x}_1 - l\dot{\theta}) + b_2(\dot{x}_G - \dot{x}_2 - l\dot{\theta})$

$J_G\ddot{\theta} + lK_1(x_G - x_1 + l\theta) - lK_2(x_G - x_2 - l\theta) + lb_1(\dot{x}_G - \dot{x}_1 - l\dot{\theta}) + lb_2(\dot{x}_G - \dot{x}_2 - l\dot{\theta})$

5) $(M+m)\ddot{x} + ml\ddot{\theta} = u$

$J\ddot{\theta} + ml\ddot{x} + mlg\theta = 0$

$\dot{x} = Ax + Bu$

$$A = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & -\dfrac{m^2L^2}{J(M+m)-m^2L^2} & 0 & 0 \\ 0 & \dfrac{gml(M+m)}{J(M+m)-m^2L^2} & 0 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ \dfrac{1}{(M+m)-m^2l^2/J} \\ -\dfrac{gmL}{J(M+m)-m^2L^2} \end{bmatrix}$$

6) $m\ddot{x} = mg - kI^2/x^2$

$L\dot{I} + RI = V$

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 2kI_0^2/mx_0^3 & 0 & -\dfrac{2kI_0}{mx_0^3} \\ 0 & 0 & -R/L \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1/L \end{bmatrix}$$