PME 3380 - Modelagem de Sistemas Dinâmicos

Exercícios Aula 01 e 06/10/2020

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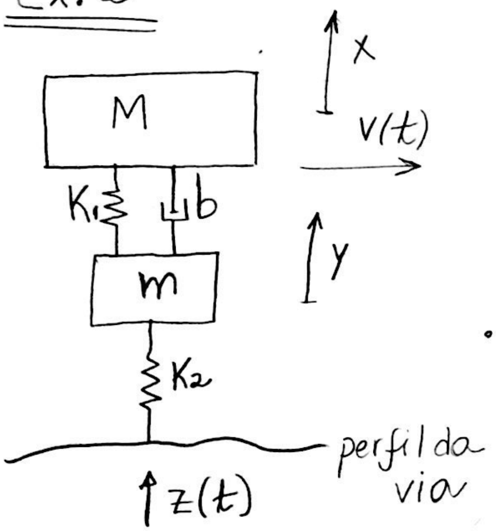
Ex. 2



- $x > y$, $\dot{x} > \dot{y}$
- M: $M\ddot{x} = -K_1(x-y) - b(\dot{x}-\dot{y})$

$$\ddot{x} = -\frac{K_1}{M}x + \frac{K_1}{M}y - \frac{b}{M}\dot{x} + \frac{b}{M}y$$

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

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

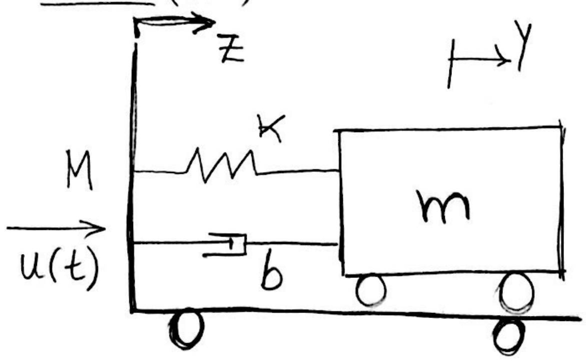
$X = [\, x \;\; y \;\; \dot{x} \;\; \dot{y} \,]$

$Y = [\, x \;\; \dot{y} \,]$; $U = z$

- $$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \ddot{x} \\ \ddot{y} \end{bmatrix} = \underbrace{\begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -K_1/M & K_1/M & -b/M & b/M \\ K_1/m & -(K_1+K_2)/m & b/m & -b/m \end{bmatrix}}_{A} \cdot \begin{bmatrix} x \\ y \\ \dot{x} \\ \dot{y} \end{bmatrix} + \underbrace{\begin{bmatrix} 0 \\ 0 \\ 0 \\ K_2/m \end{bmatrix}}_{B} \cdot U$$

- $$\begin{bmatrix} x \\ \dot{y} \end{bmatrix} = \underbrace{\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}}_{C} \cdot \begin{bmatrix} x \\ y \\ \dot{x} \\ \dot{y} \end{bmatrix}$$

Ex 3 (3.2)



Equações:

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

$$\ddot{y} = \frac{K}{m}x - \frac{K}{m}y + \frac{b}{m}\dot{x} - \frac{b}{m}\dot{y}$$

- $M\ddot{x} = U - K(x-y) - b(\dot{x}-\dot{y})$

$$\ddot{x} = \frac{U}{M} - \frac{K}{M}x + \frac{K}{M}y - \frac{b}{M}\dot{x} + \frac{b}{M}\dot{y}$$

- $X = [x \ y \ \dot{x} \ \dot{y}]$

- $$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \ddot{x} \\ \ddot{y} \end{bmatrix} = \underbrace{\begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -K/M & K/M & -b/M & b/M \\ K/m & -K/m & b/m & -b/m \end{bmatrix}}_{A} \begin{bmatrix} x \\ y \\ \dot{x} \\ \dot{y} \end{bmatrix} + \underbrace{\begin{bmatrix} 0 \\ 0 \\ 1/M \\ 0 \end{bmatrix}}_{B} \cdot U$$

$C = [0 \ 1 \ 0 \ 0]$;