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Modelagem de Sistemas Dinâmicos

PME-3380

1.1) $$\begin{bmatrix} \dot{x} \\ \dot{y} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -100 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 0 \\ 10 \end{bmatrix} u$$

$$\begin{bmatrix} sX(s) \\ sY(s) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -100 & 0 \end{bmatrix} \begin{bmatrix} X(s) \\ Y(s) \end{bmatrix} + \begin{bmatrix} 0 \\ 10 \end{bmatrix} U(s)$$

$$\begin{cases} sX(s) = Y(s) \\ sY(s) = -100X(s) + 10U_s \end{cases}$$

- $Y(s) = \dfrac{10s\,U(s)}{s^2+100}$

- $X(s) = \dfrac{10\,U(s)}{s^2+100}$

$$\begin{cases} FT(y) = \dfrac{Y(s)}{U(s)} \\ FT(x) = \dfrac{X(s)}{U(s)} \end{cases}$$

1.2) $$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{z} \end{bmatrix} = \begin{bmatrix} -1 & 4 & 0 \\ 0 & 2 & 0 \\ -1 & 0 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} u$$

Autovalores de A:

$$-3-\lambda\left((1-\lambda)(2-\lambda)-20\right)+(3+5)\left((-1-5)(2-5)-20\right)$$

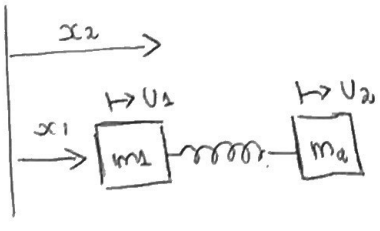
$\lambda_1 = -3$

$\lambda_2 = 4,2$

$\lambda_3 = 0,2$

Coincide com os pólos!

2.1)



$$m_1 \ddot{x}_1 = U_1 + K(x_2 - x_1)$$

$$m_2 \ddot{x}_2 = U_2 - K(x_2 - x_1)$$

Autovalores:

$$\det = \begin{vmatrix} -\lambda & 0 & 1 & 0 \\ 0 & -\lambda & 0 & 1 \\ -K/m_1 & K/m_1 & -\lambda & 0 \\ K/m_2 & -K/m_2 & 0 & \lambda \end{vmatrix} \rightarrow \lambda^4 + \frac{k^2}{m_1 m_2} - \frac{\lambda^2 K}{m_1} - \frac{\lambda^2 K}{m_2} = 0$$

$$\lambda_1 = -\sqrt{\frac{k}{m_1}}$$

$$\lambda_2 = -\sqrt{\frac{k}{m_2}}$$

$$\lambda_3 = \sqrt{\frac{k}{m_1}}$$

$$\lambda_3 = \sqrt{\frac{k}{m_2}}$$