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

Fazendo a transformada de Laplace:

$$\begin{bmatrix} sX_{(s)} - X_{(0)} \\ sY_{(s)} - Y_{(0)} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -100 & 0 \end{bmatrix} \begin{bmatrix} X_{(s)} \\ Y_{(s)} \end{bmatrix} + \begin{bmatrix} 0 \\ 10 \end{bmatrix} U_{(s)}$$

$$\left.\begin{array}{l} sX_{(s)} = Y_{(s)} \\ sY_{(s)} = -100X_{(s)} + 10U_{(s)} \end{array}\right\} \quad Y_{(s)} = \frac{10sU_{(s)}}{s^2+100}$$

$$X_{(s)} = \frac{10U_{(s)}}{s^2+100}$$

$$\begin{cases} F_{T(y)} = \dfrac{Y_{(s)}}{U_{(s)}} = \dfrac{10s}{s^2+100} \\ F_{T(x)} = \dfrac{X_{(s)}}{U_{(s)}} = \dfrac{10}{s^2+100} \end{cases}$$

1.2) $\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{z} \end{bmatrix} = \begin{bmatrix} -1 & 4 & 0 \\ 5 & 2 & 0 \\ -1 & 0 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} U$

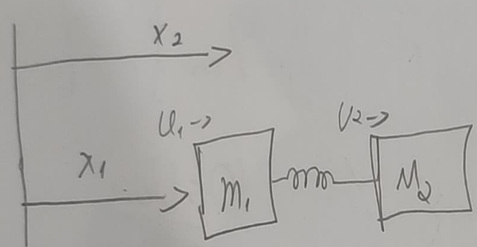
$$\det(A - \lambda I) = \begin{bmatrix} -1-\lambda & 4 & 0 \\ 5 & 2-\lambda & 0 \\ -1 & 0 & -3-\lambda \end{bmatrix} = -3-\lambda\left((-1-\lambda)(2-\lambda)-20\right]$$
$$+ (3+s)\left(\left((-1-s)(2-s)-20\right)\right.$$

ecẽ8 Calculando raízes $\begin{cases} S_1 = -3 \\ S_2 = -4{,}2 \\ S_3 = 5{,}2 \end{cases}$

isto é, os Polos e os auto-Valores coincidiram

$$Ft_{(y)} = \frac{S+1}{(S-2)(S+1)-20} \qquad Ft_{(x)} = \frac{1}{(S-2)(S+1)\cancel{+}20}$$

2.1)



$$m_1 \ddot{x}_1 = u_1 + K(x_2 - x_1)$$
$$m_2 \ddot{x}_2 = u_2 - K(x_2 - x_1)$$

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \\ \dot{x}_4 \end{bmatrix} = \begin{bmatrix} & & 1 & \\ & & & 1 \\ -K/m_1 & +K/m_2 & & \\ K/m_2 & -K/m_2 & & \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 1/m_1 & \\ & 1/m_2 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

-> Auto Valores

$$\begin{vmatrix} -\lambda & 0 & 1 & 0 \\ 0 & -\lambda & 0 & 1 \\ -K/m_1 & K/m_1 & -\lambda & 0 \\ K/m_2 & -K/m_2 & 0 & -\lambda \end{vmatrix} = \text{Resolvendo o sistema}$$

$$\lambda^2 = \frac{-\left(\frac{K}{m_1} + \frac{K}{m_2}\right) \pm \sqrt{\left(\frac{K}{m_1} + \frac{K}{m_2}\right)^2 - \frac{4K^2}{m_1 m_2}}}{2}$$