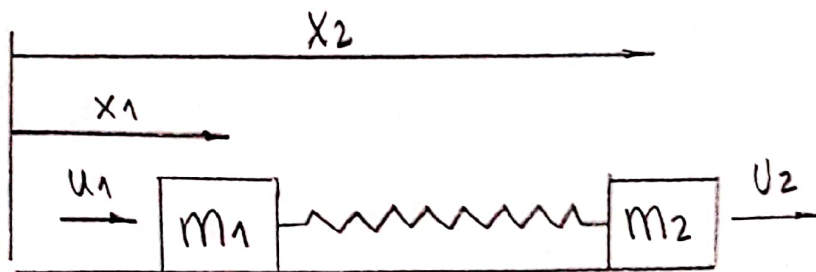


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$$\begin{cases} \delta = x_1 - x_2 \\ \bar{X} = \frac{m_1 x_1 + m_2 x_2}{m_1 m_2}, \quad m_1 + m_2 = M \end{cases}$$

$$\therefore \begin{cases} \ddot{\delta} = \frac{-kM\delta}{m_1 m_2} + \frac{u_1}{M_1} - \frac{u_2}{M_2} \\ \ddot{\bar{X}} = \frac{u_1 + u_2}{M} \end{cases}$$

ESPAÇO DE ESTADOS

$$\begin{bmatrix} \dot{\bar{X}} \\ \dot{\delta} \\ \ddot{\bar{X}} \\ \ddot{\delta} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & \frac{-km}{m_1 m_2} & 0 & 0 \end{bmatrix} \begin{bmatrix} \bar{X} \\ \delta \\ \dot{\bar{X}} \\ \dot{\delta} \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 1/M & 1/M \\ 1/m_1 & -1/m_2 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

$$\therefore \dot{z} = Az + Bu$$

■ Das variáveis δ e x temos que:

$$\begin{bmatrix} \bar{x} \\ \delta \end{bmatrix} = \begin{bmatrix} m_1/M & m_2/M \\ 1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$y = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 1 & m_2/M & 0 & 0 \\ 1 & -m_1/M & 0 & 0 \end{bmatrix} \begin{bmatrix} \bar{x} \\ \delta \\ \dot{x} \\ \dot{\delta} \end{bmatrix}$$

$$\therefore y = Cz$$

$$\therefore \dot{z} = Az + Bu$$

$$y = Cz$$