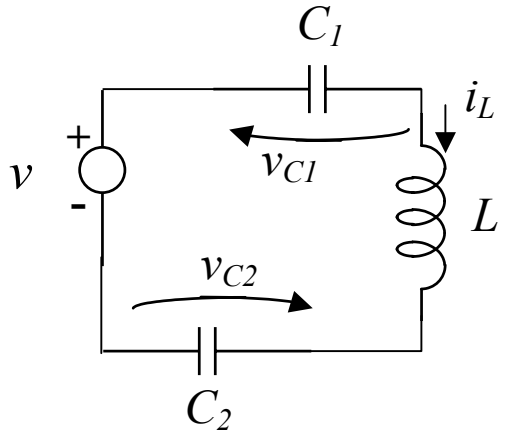
Soluzioni esercizi proposti

Sistemi elettrici

Es. 2

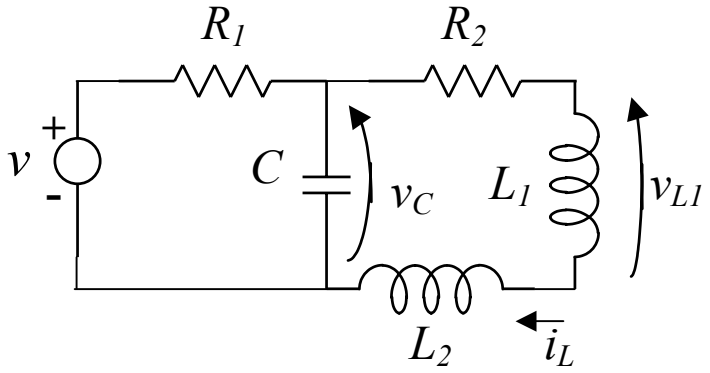


Rappresentazione in variabili di stato:

$$\begin{aligned}\dot{x}(t) &= Ax(t) + Bu(t)\\ y(t) &= Cx(t) + Du(t)\end{aligned} \quad \text{con} \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} v_{C1} \\ i_L \\ v_{C2} \end{bmatrix}, \; u = v, \; y = v_{C1}$$

$$A = \begin{bmatrix} 0 & \frac{1}{C_1} & 0 \\ -\frac{1}{L} & 0 & -\frac{1}{L} \\ 0 & \frac{1}{C_2} & 0 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ \frac{1}{L} \\ 0 \end{bmatrix}, \; C = [1\ 0\ 0], \; D = 0$$

Es. 3



Rappresentazione in variabili di stato:

$$\begin{aligned}\dot{x}(t) &= Ax(t) + Bu(t)\\ y(t) &= Cx(t) + Du(t)\end{aligned} \quad \text{con} \quad x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} v_C \\ i_L \end{bmatrix},\ u = v,\ y = v_{L1}$$

$$A = \begin{bmatrix} -\dfrac{1}{R_1 C} & -\dfrac{1}{C} \\ \dfrac{1}{L_1 + L_2} & -\dfrac{R_2}{L_1 + L_2} \end{bmatrix},\quad B = \begin{bmatrix} \dfrac{1}{R_1 C} \\ 0 \end{bmatrix},\quad C = \begin{bmatrix} \dfrac{L_1}{L_1 + L_2} & -\dfrac{R_2 L_1}{L_1 + L_2} \end{bmatrix},\quad D = 0$$

Sistemi meccanici in traslazione

Es. 2

Rappresentazione in variabili di stato:

$$\begin{aligned}\dot{x}(t) &= Ax(t) + Bu(t)\\ y(t) &= Cx(t) + Du(t)\end{aligned} \quad \text{con} \quad x = \begin{bmatrix} x_1\\ x_2\\ x_3\\ x_4\\ x_5\\ x_6 \end{bmatrix} = \begin{bmatrix} p_1\\ p_2\\ p_3\\ v_1\\ v_2\\ v_3 \end{bmatrix}, \; u = F, \; y = \begin{bmatrix} p_1\\ p_2\\ p_3 \end{bmatrix}$$

$$A = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 & 0\\ 0 & 0 & 0 & 0 & 1 & 0\\ 0 & 0 & 0 & 0 & 0 & 1\\ -\dfrac{K_1 + K_{12}}{M_1} & \dfrac{K_{12}}{M_1} & 0 & -\dfrac{\beta_1 + \beta_{12}}{M_1} & \dfrac{\beta_{12}}{M_1} & 0\\ \dfrac{K_{12}}{M_2} & -\dfrac{K_2 + K_{12}}{M_2} & 0 & \dfrac{\beta_{12}}{M_2} & -\dfrac{\beta_{12} + \beta_{23} + \beta_2}{M_2} & \dfrac{\beta_{23}}{M_2}\\ 0 & 0 & 0 & 0 & \dfrac{\beta_{23}}{M_3} & -\dfrac{\beta_{23}}{M_3} \end{bmatrix},$$

$$B = \begin{bmatrix} 0\\ 0\\ 0\\ 0\\ \dfrac{1}{M_2}\\ 0 \end{bmatrix}, \quad C = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0\\ 0 & 1 & 0 & 0 & 0 & 0\\ 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix}, \quad D = \begin{bmatrix} 0\\ 0\\ 0 \end{bmatrix}$$