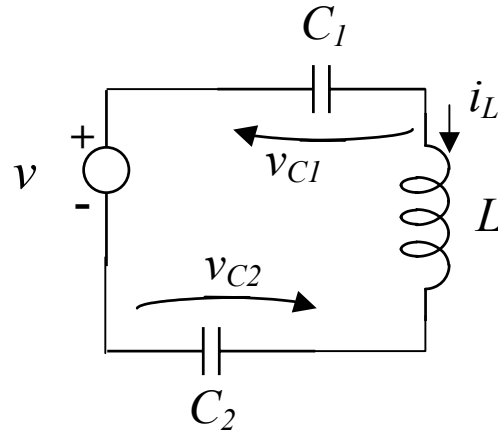


## Soluzioni esercizi proposti

### Sistemi elettrici

Es. 2

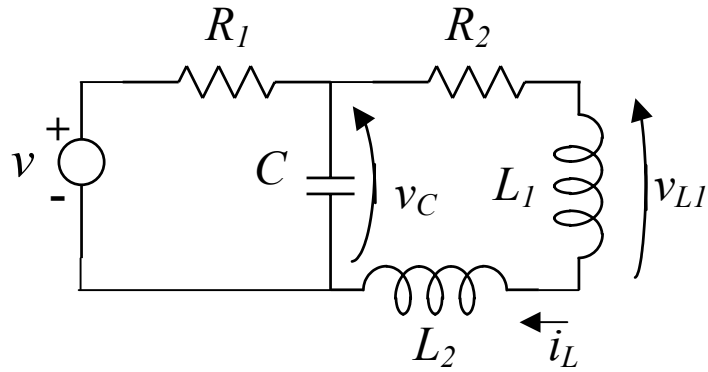


Rappresentazione in variabili di stato:

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

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

Es. 3



Rappresentazione in variabili di stato:

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

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

## Sistemi meccanici in traslazione

Es. 2

Rappresentazione in variabili di stato:

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

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

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