



ITESO

Universidad Jesuita
de Guadalajara

Sistema de Control Automatico.

Tarea 1.3

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Tarea 3

Estados

$$\begin{aligned} x_1(t) &= \int i_2(t) dt & \dot{x}_2(t) &= i_2(t) \rightarrow i_2(t) = C_2 \frac{d}{dt} V_o(t) \\ x_2(t) &= i_2(t) & \dot{x}_1(t) &= \frac{1}{C_2} i_2(t) \\ y(t) &= \frac{1}{C_2} x_1(t) \\ u(t) &= V_{in}(t) \end{aligned}$$

Ecuaciones

$$V_{in}(t) = R_1 C_1 R_2 \frac{d}{dt} i_2(t) + i_2(t) (R_1 + R_2 + R_1 \frac{C_1}{C_2}) + V_o(t)$$

$$\frac{d}{dt} V_o(t) = \frac{1}{C_2} i_2(t)$$

$$\begin{aligned} n &= 2 & A &= 2 \times 2 & C &= 1 \times 2 \\ m &= 1 & B &= 2 \times 1 & D &= 1 \times 1 \\ p &= 1 \end{aligned}$$

$$\begin{aligned} \frac{1}{C_2} x_2(t) &= \frac{1}{C_2} \dot{x}_1(t) \\ \dot{x}_1(t) &= x_2(t) \end{aligned}$$

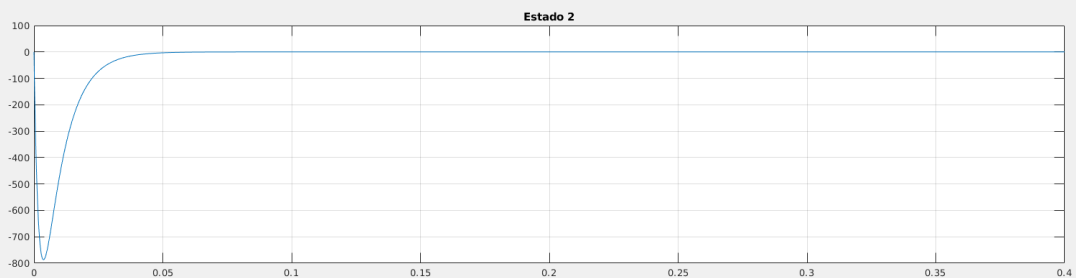
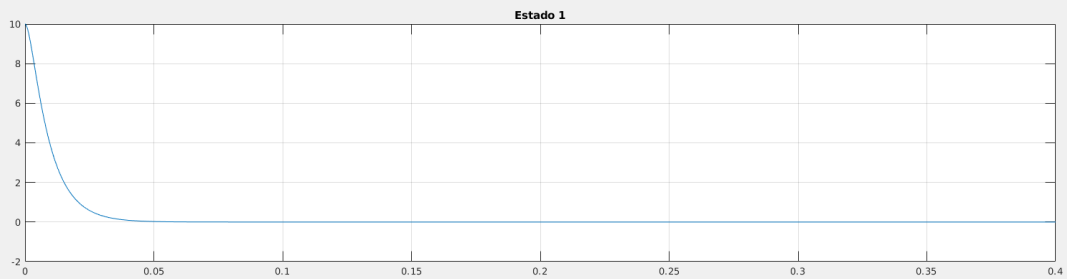
$$\begin{aligned} u(t) &= R_1 C_1 R_2 \dot{x}_2(t) + x_2(t) (R_1 + R_2 + R_1 \frac{C_1}{C_2}) + \frac{1}{C_2} x_1(t) \\ \dot{x}_2(t) &= \frac{\frac{1}{C_2} x_1(t)}{R_1 C_1 R_2} - \frac{(R_1 + R_2 + R_1 \frac{C_1}{C_2}) x_2(t)}{R_1 C_1 R_2} + \frac{u(t)}{R_1 C_1 R_2} \end{aligned}$$

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\frac{1}{R_1 R_2 C_1 C_2} & -\frac{C_2 R_1 + C_1 R_2 + R_1 C_1}{R_1 R_2 C_1 C_2} \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{R_1 R_2 C_1} \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} \frac{1}{C_2} & 0 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

Figure 1

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Tarea 3

Estados

$$\begin{aligned} x_1(t) &= V_o(t) \\ x_2(t) &= \int i_3(t) dt \end{aligned}$$

$$\begin{aligned} \dot{x}_1(t) &= \frac{d}{dt} V_o(t) \\ \dot{x}_2(t) &= i_3(t) \end{aligned}$$

$$\begin{aligned} u(t) &= V_{in}(t) \\ y(t) &= V_o(t) \end{aligned}$$

Ecuaciones

$$1. V_{in}(t) = R_1 i_1(t) + \frac{1}{C_1} \int i_1(t) dt$$

$$2. C_1 \int i_1(t) dt = R_2 i_2(t) + V_o(t)$$

$$3. V_o(t) = \frac{1}{C_2} \int i_2(t) dt \quad \frac{d}{dt} \rightarrow C_2 \frac{d}{dt} V_o(t) = i_2(t)$$

$$4. i_3(t) = i_1(t) - i_2(t) \rightarrow i_2(t) = i_1(t) - i_3(t)$$

Eq 3 \rightarrow Eq 2

$$C_1 \frac{d}{dt} \int i_1(t) dt = R_2 (C_2 \frac{d}{dt} V_o(t)) + V_o(t)$$

Eq 3 \rightarrow Eq 4 \rightarrow Eq 1

$$C_2 \frac{d}{dt} V_o(t) = i_1(t) - i_2(t)$$

$$i_1 = C_2 \frac{d}{dt} V_o(t) + i_2(t)$$

$$2. V_{in}(t) = R_1 C_2 \frac{d}{dt} V_o(t) + R_1 i_2(t) + \frac{1}{C_1} \int (C_2 \frac{d}{dt} V_o(t) + i_2(t)) dt$$

$$1. \frac{1}{C_1} x_2 = R_2 C_2 \dot{x}_1 + x_1$$

$$\dot{x}_1 = (\frac{1}{C_1} x_2 - x_1) (\frac{1}{R_2 C_2})$$

$$\ddot{x}_1 = \frac{\dot{x}_2}{C_1 R_2} - \frac{x_1}{R_1 C_2}$$

$$2. i_1(t) = R_1 C_2 \dot{x}_1 + R_1 x_2 + \frac{1}{C_1} x_2$$

$$\dot{i}_1(t) = R_1 C_2 \left[\frac{\dot{x}_2}{C_1} - \frac{x_1}{R_1 C_2} \right] + R_1 \dot{x}_2 + \frac{1}{C_1} \dot{x}_2$$

$$\dot{x}_2 = i_1(t) - \frac{1}{C_1} x_2 - \frac{R_1 C_2 \dot{x}_1}{R_1 C_2} + \frac{R_1 C_2 \dot{x}_1}{R_1 C_2}$$

$$\dot{x}_2 = \left(i_1(t) - \frac{1}{C_1} x_2 - \frac{R_1}{C_1 R_2} x_2 + \frac{R_1}{R_2} x_1 \right) \frac{1}{R_1}$$

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -\frac{1}{R_2 C_2} & \frac{1}{C_1 R_2} \\ \frac{1}{R_2} & -(\frac{1}{C_1} + \frac{1}{C_1 R_2}) \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{R_1} \end{bmatrix} u(t)$$

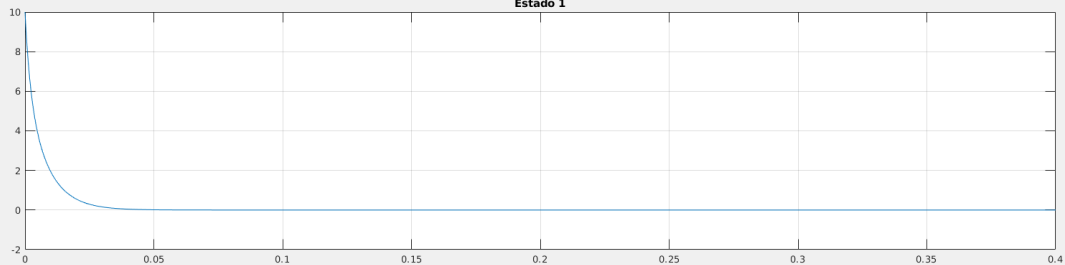
$$y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Figure 1

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Estado 1



Estado 2

