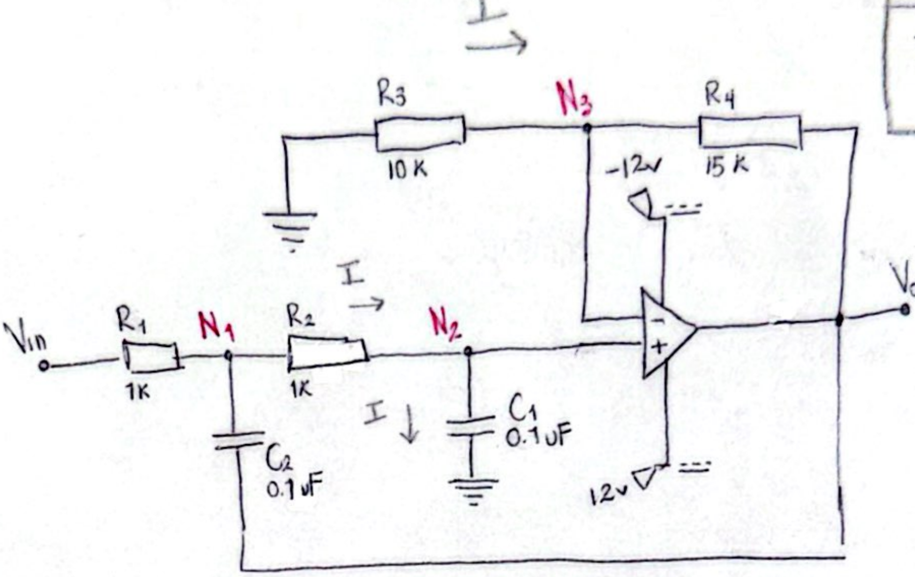
Practica 5

Valeria Marcial Salazar



$$I_R = \frac{N_{nodo} - V_{salida}}{R}$$

$$I_C = C\,\frac{d(N_{inicio} - V_{salida})}{dt}$$

Ecuación diferencial

Nodo 3

misma corriente en R_3 y R_4

resistencia 4 • $\frac{N_3 - V_0}{R_4} = \frac{0 - N_3}{R_3}$ • resistencia 3

$$V_0 = \frac{N_3 R_4}{R_3} + N_3$$

$$V_0 = N_3\left(\frac{R_4}{R_3} + 1\right)$$

$R_4 = 10,\ R_3 = 15$

$$\boxed{N_3 = \frac{V_0}{2.5} = 0.4V_0}$$

Nodo 2

misma corriente

resistencia 2 • $\frac{N_1 - N_2}{R_2}$ =

capacitor 1 • $\frac{C_1 d(N_3)}{dt}$

$N_3 = N_2$

$$\frac{N_1 - 0.4V_0}{R_2} = \frac{C_1 d(0.4V_0)}{dt}$$

$$(0.4C_1\dot{V}_0)$$

$$\boxed{N_1 = 0.4C_1\dot{V}_0 R_2 + 0.4V_0}$$

Nodo 1

Ley de Kirchhoff

• $\frac{V_{in} - N_1}{R_1}$ • $\frac{N_1 - N_3}{R_2}$ $\frac{C_2 d(N_1 - V_0)}{dt}$ •

resistencia 1 resistencia 2 capacitor 2

$$\frac{V_{in} - N_1}{R_1} = \frac{N_1 - 0.4V_0}{R_2} + \frac{C_2 d(N_1 - V_0)}{dt}$$

$$\frac{V_{in} - (0.4C_1\dot{V}_0 R_2 + 0.4V_0)}{R_1} = \frac{\boxed{0.4C_1\dot{V}_0 \cancel{R_2}} + \cancel{0.4V_0} - \cancel{0.4V_0}}{\cancel{R_2}} + \frac{C_2 d(N_1 - V_0)}{dt}$$

$$= \frac{C_2 d(0.4\dot{V}_0 R_2 C_1 + 0.4V_0 - V_0)}{dt} = \frac{C_2 d(0.4\dot{V}_0 R_2 C_1 - 0.6V_0)}{dt}$$

$$= 0.4\ddot{V} R_2 C_1 C_2 - 0.6C_2\dot{V}_0$$

juntamos todo

$$\boxed{\frac{V_{in} - (0.4C_1\dot{V}_0 R_2 + 0.4V_0)}{R_1} = 0.4C_1\dot{V}_0 + 0.4\ddot{V} R_2 C_1 C_2 - 0.6\dot{V}_0 C_2}$$

simplificamos

$$\frac{V_{in} - 0.4V_0 - 0.4R_2C_1\dot{V}_0}{R_1} = 0.4R_2C_2C_1\ddot{V}_0 - 0.6C_2\dot{V}_0 + 0.4C_1\dot{V}_0 \ (R_1)$$

$$\ddot{V}_0\, 0.4R_2C_2C_1R_1 + (0.4R_2C_1 + 0.4R_1C_1 - 0.6R_1C_2)\dot{V}_0 + 0.4V_0 = V_{in}$$

Solo quedan R_2 y R_1 que son iguales, al igual que los capacitores

$$0.4R^2C^2\ddot{V}_0 + 0.2RC\dot{V}_0 + 0.4V_0 = V_{in}$$

ahora

$$0.4R^2C^2\mathcal{L}\{\ddot{V}_0\} + 0.2RC\mathcal{L}\{\dot{V}_0\} + 0.4\mathcal{L}\{V_0\} = V_{in}(s)$$

$$0.4R^2C^2(s^2V_0(s)) + 0.2RC(sV_0(s)) + 0.4V_0(s) = V_{in}(s)$$

factorizamos

$$V_0(s)[0.4R^2C^2s^2 + 0.2RCs + 0.4] = V_{in}(s)$$

función de transferencia

$$\boxed{\frac{V_0(s)}{V_{in}(s)} = \frac{1}{0.4R^2C^2s^2 + 0.2RCs + 0.4}}$$