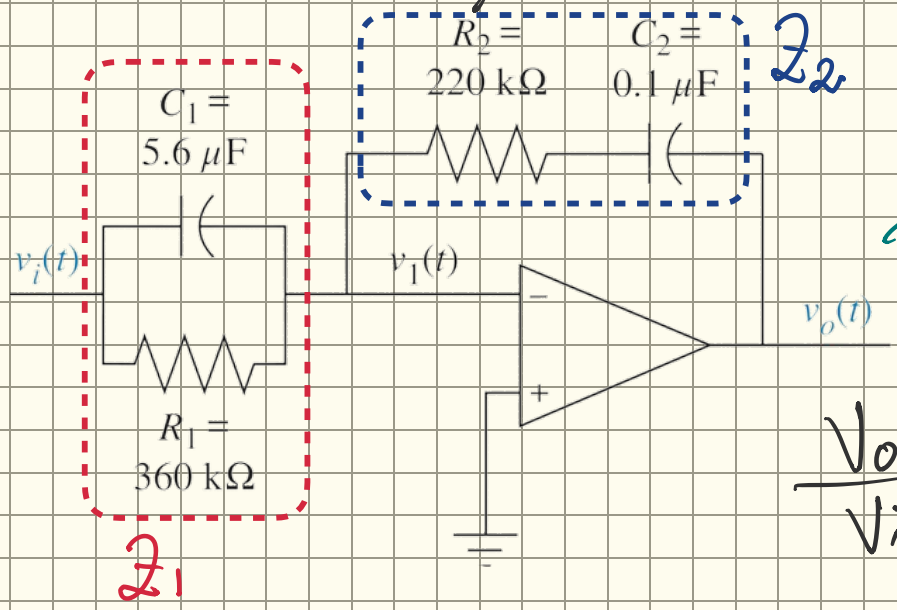
① Hallar $V_o(s)/V_i(s)$



→ Configuración Inversora

$$\frac{V_o(s)}{V_i(s)} = -\frac{Z_2}{Z_1}$$

$$Z_1 = \frac{1}{\frac{1}{Z_{C_1}} + \frac{1}{Z_{R_1}}} = \frac{1}{C_1 s + \frac{1}{R_1}} = \frac{R_1}{R_1 C_1 s + 1}$$

$$Z_2 = Z_{C_2} + Z_{R_2} = \frac{1}{C_2 s} + R_2 = \frac{R_2 C_2 s + 1}{C_2 s}$$

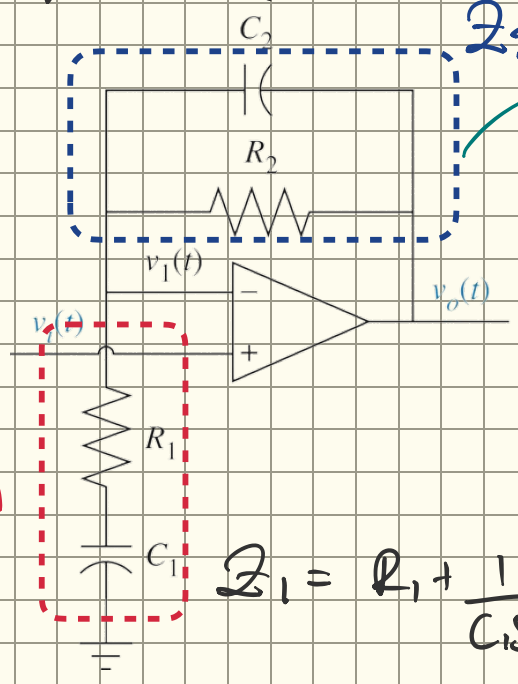
$$\frac{V_o(s)}{V_i(s)} = -\frac{\frac{R_2 C_2 s + 1}{C_2 s}}{\frac{R_1}{R_1 C_1 s + 1}} = -\frac{(R_2 C_2 s + 1)(R_1 C_1 s + 1)}{R_1 C_2 s}$$

$$\frac{V_o(s)}{V_i(s)} = -\frac{R_1 R_2 C_1 C_2 s^2 + (R_1 C_1 + R_2 C_2) s + 1}{R_1 C_2 s}$$

$$\frac{V_o(s)}{V_i(s)} = -\frac{44.352 \times 10^{-3} + 2.038 s + 1}{36 \times 10^{-3} s}$$

$$\boxed{\frac{V_o(s)}{V_i(s)} = -1.232\,\frac{s^2 + 45.98 + 22.55}{s}}$$

② Halla $V_o(s)/V_i(s)$



→ Configuración no Inversora.

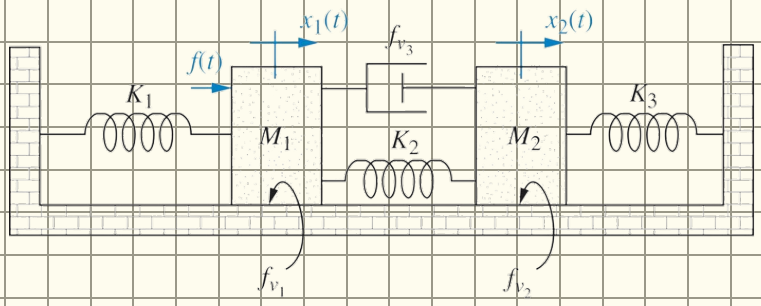
$$\frac{V_o(s)}{V_i(s)} = \frac{Z_1 + Z_2}{Z_1}$$

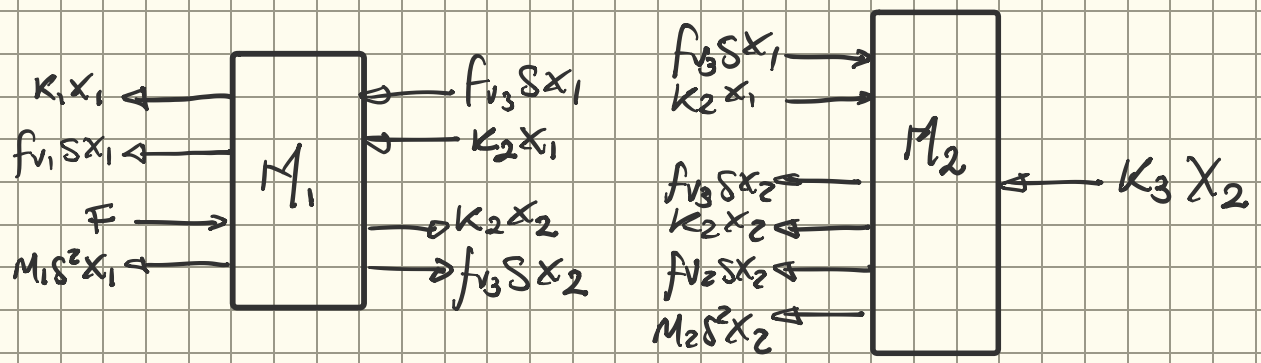
$$Z_1 = R_1 + \frac{1}{C_1 s} = \frac{R_1 C_1 s + 1}{C_1 s} \quad / \quad Z_2 = \frac{1}{\frac{1}{R_2} + C_2 s} = \frac{R_2}{R_2 C_2 s + 1}$$

$$\frac{V_o(s)}{V_i(s)} = \frac{\frac{R_1 C_1 s + 1}{C_1 s} + \frac{R_2}{R_2 C_2 s + 1}}{\frac{R_1 C_1 s + 1}{C_1 s}}$$

$$\boxed{\frac{V_o(s)}{V_i(s)} = \frac{R_1 R_2 C_1 C_2 s^2 + (R_1 C_1 + R_2 C_2 + R_2 C_1) s + 1}{R_1 R_2 C_1 C_2 s^2 + (R_1 C_1 + R_2 C_2) s + 1}}$$

③ Hallar $X_2(s)/F(s)$





$$\left[K_1+K_2+(f_{v_1}+f_{v_3})S+M_1S^2\right]X_1-(K_2+f_{v_3}S)X_2=F$$

$$-(f_{v_3}S+K_2)X_1+\left[(K_2+K_3)+(f_{v_2}+f_{v_3})S+M_2S^2\right]X_2=0$$

¡Hay que eliminar X_1 de las ecuaciones!

Regla de Cramer: $X_2=\dfrac{\Delta_2}{\Delta}$

$$\Delta_2=\begin{vmatrix} K_1+K_2+(f_{v_1}+f_{v_3})S+M_1S^2 & F \\ -(f_{v_3}S+K_2) & 0 \end{vmatrix}=(f_{v_3}S+K_2)F$$

$$\Delta=\begin{vmatrix} K_1+K_2+(f_{v_1}+f_{v_3})S+M_1S^2 & -(f_{v_3}S+K_2) \\ -(f_{v_3}S+K_2) & K_2+K_3+(f_{v_2}+f_{v_3})S+M_2S^2 \end{vmatrix}$$

$$\Delta = \left[k_1 + k_2 + (f_{v_1} + f_{v_3})s + m_1 s^2\right]\left[k_2 + k_3 + (f_{v_2} + f_{v_3})s + m_2 s^2\right] - (f_{v_3} s + k_2)^2$$

$$\Delta = m_1 m_2 s^4 + (f_{v_1} m_2 + f_{v_2} m_1 + f_{v_3} m_1 + f_{v_3} m_2) s^3 + (f_{v_1} f_{v_2} + f_{v_1} f_{v_3} + f_{v_2} f_{v_3} + k_1 m_2 + k_2 m_1 + k_2 m_2 + k_3 m_1) s^2 + (f_{v_1} k_2 + f_{v_2} k_1 + f_{v_1} k_3 + f_{v_2} k_2 + f_{v_3} k_1 + f_{v_3} k_3) s + k_1 k_2 + k_1 k_3 + k_2 k_3$$

$$\frac{X_2}{F} = \frac{f_{v_3} s + k_2}{\Delta}$$