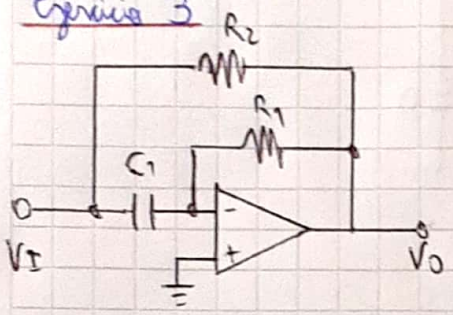
Ejercicio 3



$$Z_{in} = \frac{V_{in}}{I_{in}}$$

$V_- = 0$

$$V_-(sC_1 + G_1) - sC_1 \cdot V_{in} - G_1 \cdot V_o = 0$$

$$\frac{V_o}{V_{in}} = -\frac{sC_1}{G_1}$$

$$I_{in} = V_{in} \cdot sC_1 + (V_I - V_o) \cdot G_2$$

$$I_{in} = V_{in} \cdot sC_1 + V_2\left(1 + \frac{sC_1}{G_1}\right) \cdot G_2$$

$$\frac{V_I}{I_I} = \frac{1}{sC_1 + G_2 + \frac{sC_1 G_2}{G_1}} = \frac{1}{\frac{G_1 sC_1 + G_1 G_2 + sC_1 G_2}{G_1}}$$

$$Z_I = \frac{G_1}{sC_1(G_1 + G_2) + G_1 G_2} = \frac{\frac{G_1 \cdot G_2}{G_1 + G_2} \cdot \frac{1}{G_2}}{sC_1 + \frac{G_1 G_2}{G_1 + G_2}}$$

$G_3 = G_1 + G_2$

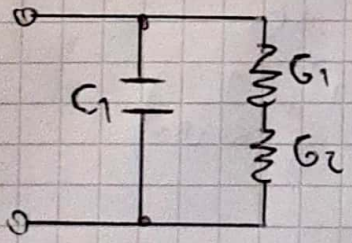
$$Z_I = R_2 \cdot \frac{G_3}{sC_1 + G_3}$$

$$\frac{G_1 G_2}{G_1 + G_2} = \frac{\frac{1}{R_1} \cdot \frac{1}{R_2}}{\frac{R_2 + R_1}{R_1 R_2}} = \frac{1}{R_1 + R_2} = G_3$$

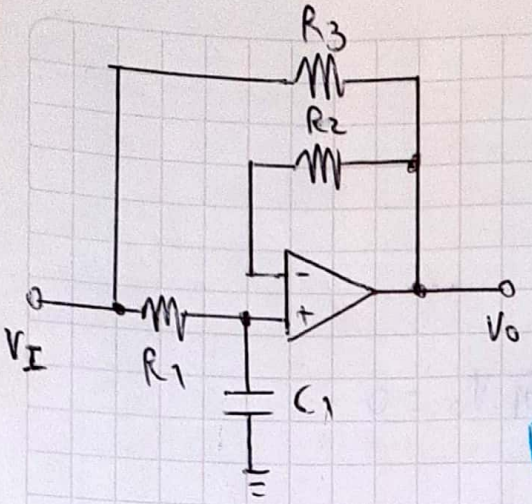
Son dos resistencias en serie paralelo a admitancia

$$Y_I = \frac{G_2}{G_3} \cdot (sC_1 + G_3)$$

$=$



Equivalente $(R_1 + R_2) // C_1$ con un factor de amplificación.



$$Z_I = \frac{V_I}{I_I}$$

① $V_+ (G_1 + sC_1) - V_I \cdot G_1 = 0$

$V_- G_2 - V_o \cdot G_2 = 0$

② $V_- = V_o$

② → ① Pues $V_- = V_+$ $\quad V_o \cdot (G_1 + sC_1) - V_I \cdot G_1 = 0$

$V_o \cdot (G_1 + sC_1) = V_I \cdot G_1$

$$\frac{V_o}{V_I} = V_I \cdot \frac{G_1}{G_1 + sC_1} = V_I \cdot \frac{\frac{1}{sC_1}}{R_1 + \frac{1}{sC_1}} = V_I \frac{1}{sC_1R_1 + 1}$$

$$I_I = \frac{V_I - V_o}{R_1} + \frac{V_I - V_o}{R_3}$$

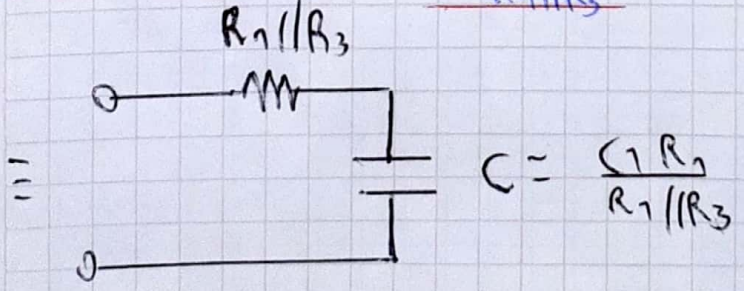
$$I_I = V_I \left(\frac{1}{R_1} - \frac{1}{R_1(sC_1R_1+1)} \right) + V_I \left(\frac{1}{R_3} - \frac{1}{R_3(sC_1R_1+1)} \right)$$

$$I_I = \frac{V_I}{R_1} \left(\frac{sC_1R_1 + 1 - 1}{sC_1R_1+1} \right) + \frac{V_I}{R_3} \left(\frac{1 + sC_1R_1 - 1}{sC_1R_1+1} \right)$$

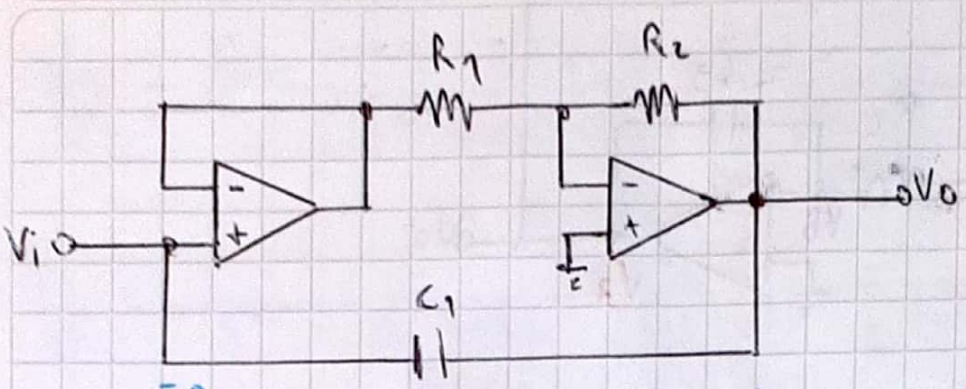
$$I_I = V_I \left(\frac{sC_1R_3 + sC_1R_1}{R_1R_3(sC_1R_1+1)} \right)$$

$$\frac{V_I}{I_I} = \frac{R_3(sC_1R_1+1)}{sC_1(R_1+R_3)} = \underbrace{\frac{R_1R_3}{R_1+R_3}}_{R_1 \| R_3} \cdot \frac{sC_1 + \frac{1}{R_1}}{sC_1} \quad \left(1 + \frac{1}{sC_1R_1}\right)$$

$$Z_I = R_1 \| R_3 + \frac{1}{s \frac{C_1R_1}{R_1 \| R_3}}$$



$$C = \frac{C_1R_1}{R_1 \| R_3}$$



$V_{(-)} = 0$

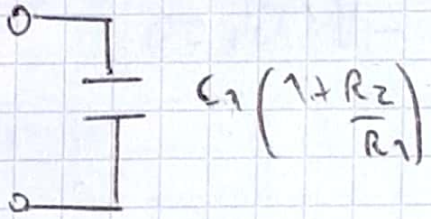
$V_{(-)} \cdot (G_1 + G_2) - G_1(-V_i) - G_2 \cdot V_o = 0$

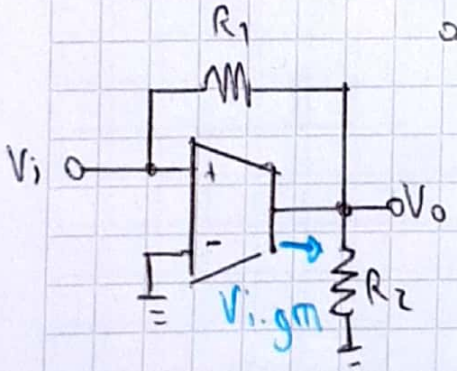
$-G_1 \cdot V_i = G_2 \cdot V_o$

$V_o = -\frac{G_1}{G_2} \cdot V_i = -\frac{R_2}{R_1} \cdot V_i$

$I_I = (V_i - V_o) \cdot sC_1 = \left(V_i + \frac{R_2}{R_1} V_i\right) \cdot sC_1$

$Z_I = \frac{V_I}{I_I} = \frac{1}{sC_1\left(1 + \frac{R_2}{R_1}\right)}$

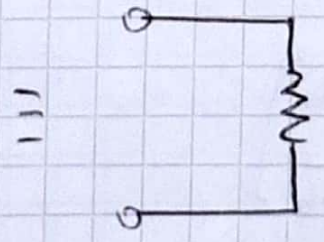
$\equiv$  $C_1\left(1 + \frac{R_2}{R_1}\right)$



$Z_i = \frac{V_i}{I_i}$ $\quad I_i = I_{R_1} = V_i \cdot gm + I_{R_2}$

$I_{R_2} = \frac{V_o}{R_2} = V_i \cdot \frac{R_2}{R_1+R_2} \cdot \frac{1}{R_2}$

$Z_i = \frac{V_i}{I_i} = \frac{1}{gm + \frac{1}{R_1+R_2}} = \frac{R_1+R_2}{gm(R_1+R_2)+1}$

$\equiv$  $\frac{R_1+R_2}{gm(R_1+R_2)+1}$