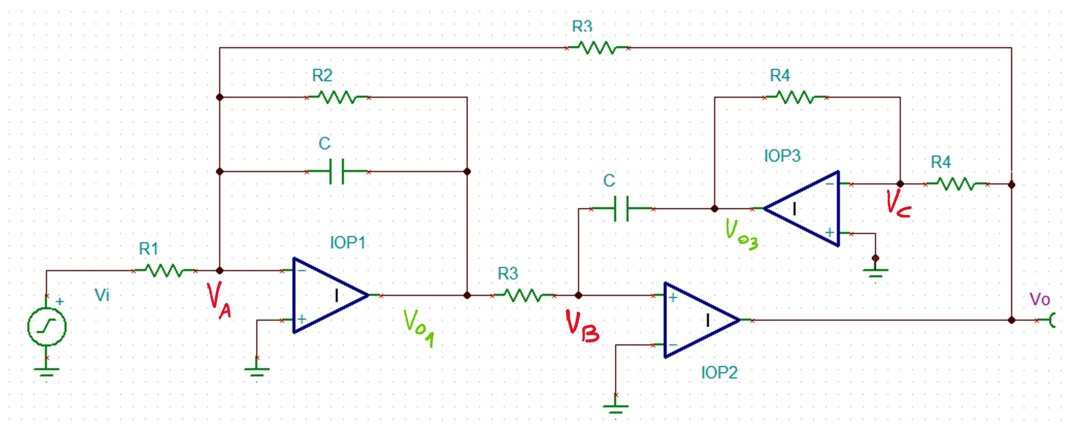
ES2



Consignas de la actividad:

- 👉 Hallar la transferencia $T = \frac{V_o}{V_i}$ en función de ω_o y Q.
- 👉 Obtener el valor de los componentes del circuito de forma tal que $\omega_o = 1$ y $Q = 3$
- 👉 Ajustar el valor de R_1 de forma tal que $|T(0)| = 20\,\text{dB}$.

Nodos:

- $V_A . \cancel{(G_1 + sC + G_2 + G_3)} - V_i . G_1 - V_{o1}(sC + G_2) - V_o . G_3 = 0$
- $V_B . \cancel{(G_3 + sC)} - V_{o1} . G_3 - V_{o3} . (sC) = 0$
- $V_C . \cancel{(2 . G_4)} - V_{o3} . G_4 - V_o . G_4 = 0 \longrightarrow V_{o3} = -V_o$

  Inversor Unitario
- $V_A = V_B = V_C = 0$
- $V_{o1} G_3 = V_o sC \longrightarrow V_{o1} = V_o \frac{sC}{G_3}$
- $V_i . G_1 = -V_o \frac{sC}{G_3} . (sC + G_2) - V_o G_3$

$$V_i . G_1 = -V_o . \left(\frac{s^2C^2 + sCG_2 + G_3^2}{G_3} \right)$$

$$\frac{V_o}{V_i} = -\frac{G_1 . G_3}{s^2C^2 + sCG_2 + G_3^2}$$

$$\frac{V_o}{V_i} = -\frac{G_1 G_3}{C^2 \cdot \left(s^2 + s\frac{G_2}{C} + \frac{G_3^2}{C^2}\right)}$$

$W_o = G_3/C$

W_o^2

$$\frac{V_o}{V_i} = -G_1 \cdot \frac{G_3}{C^2} \cdot \frac{G_3}{G_3} \cdot \frac{1}{s^2 + s\frac{G_2}{C} + \frac{G_3^2}{C^2}}$$

$$\boxed{\frac{V_o}{V_i} = -\frac{G_1}{G_3} \cdot \frac{W_o^2}{s^2 + s\frac{W_o}{q} + W_o^2}}$$

- $\boxed{W_o = \frac{G_3}{C}}$
- $W_o/q = G_2/C \rightarrow q = W_o \cdot \frac{C}{G_2} = \frac{G_3}{\cancel{C}} \cdot \frac{\cancel{C}}{G_2}$
- $\boxed{q = G_3/G_2}$

👉 Obtener el valor de los componentes del circuito de forma tal que $\omega_o = 1$ y $Q = 3$

$W_o = 1 \Rightarrow G_3 = 1\,[S] \quad C = 1[F]$

$q = 10 \rightarrow 3 = \frac{1\,[S]}{G_2} \rightarrow G_2 = \frac{1}{3}[S] \rightarrow \boxed{R_2 = 3\Omega \quad R_3 = 1\Omega \quad C = 1F}$

👉 Ajustar el valor de R1 de forma tal que $|T(0)| = 20\,dB$.

$$\left|T_{(s)}\right|\Big|_{s=0} = -\frac{G_1}{G_3} \cdot \frac{\cancel{W_o^2}}{\cancel{W_o^2}} = G_1 = [20dB]_{Veces} = 10$$

$G_3 \rightarrow 1[S]$

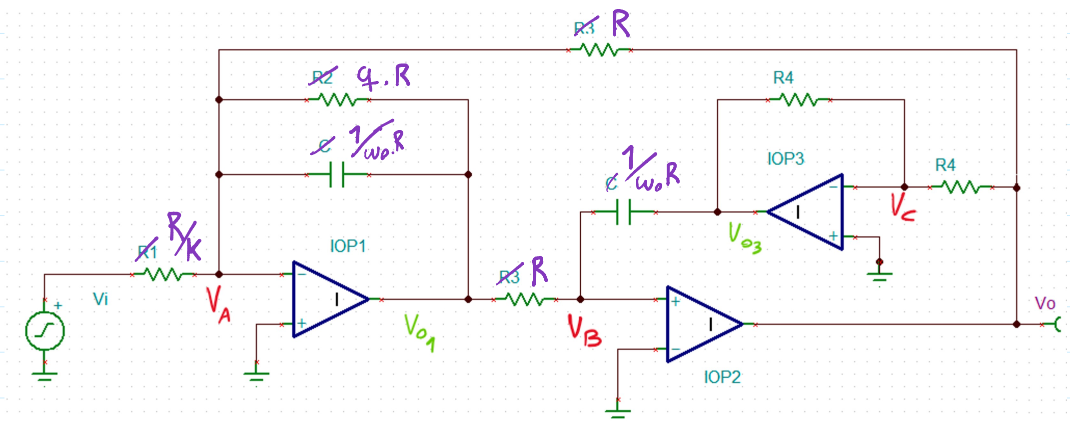
$G_1 = 10\,[S] \Rightarrow 100[m\,\Omega] = R_1$

- +10 💎 Obtener los valores de la red normalizados en frecuencia e impedancia.

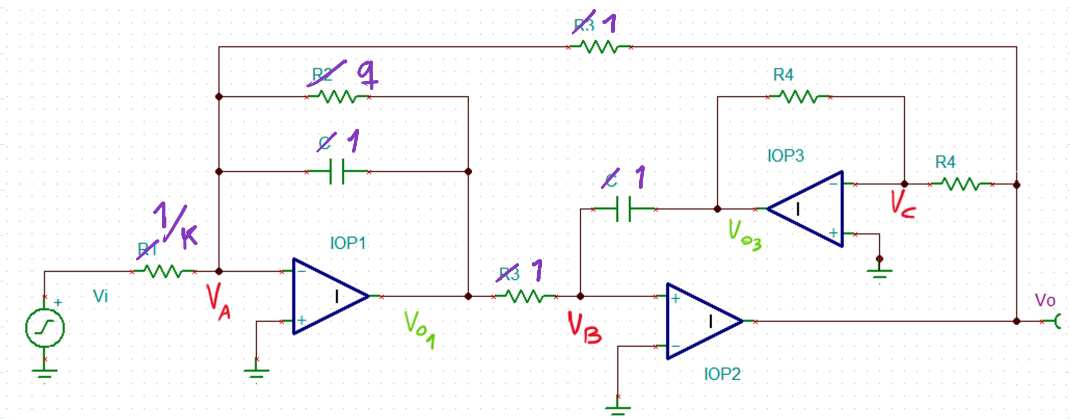
$\boxed{\frac{V_o}{V_i} = -\frac{G_1}{G_3} \cdot \frac{W_o^2}{s^2 + s\frac{W_o}{q} + W_o^2}}$ $\boxed{W_o = \frac{G_3}{C}}$ $\boxed{q = G_3/G_2}$

si fijamos G_3 quedan componentes independientes para cada parametro

$R_3 = R \rightarrow R_2 = q \cdot R$
$\quad\;\rightarrow R_1 = R/k$
$\quad\;\rightarrow C = 1/W_o R$



Normalizamos → $R=1 \quad \omega_0 = 1$



- +10 Calcular las sensibilidades $S_C^{\omega_0}, S_{R_2}^{Q}, S_{R_3}^{Q}$.

$$S_C^{\omega_0} = \frac{C}{\omega_0(C)} \cdot \frac{\partial \omega_0(C)}{\partial C} = \frac{\cancel{C}}{\frac{\cancel{G_3}}{\cancel{C}}} \cdot \left(\cancel{G_3} \left(-\frac{1}{\cancel{C^2}} \right) \right) = -1$$

$$S_{R_2}^{q} = \frac{R_2}{q(R_2, \ldots)} \cdot \frac{\partial q(R_2, \ldots)}{\partial R_2} = \frac{\cancel{R_2}}{\frac{\cancel{R_2}}{\cancel{R_3}}} \cdot \frac{1}{\cancel{R_3}} = 1$$

$$S_{R_3}^{q} = \frac{\cancel{R_3}}{\frac{\cancel{R_2}}{\cancel{R_3}}} \cdot \cancel{R_2} \cdot \left(-\frac{1}{\cancel{R_3^2}} \right) = -1$$

→ Todas sensibilidades unitarias → Lineales

→ La proporción que van a afectar es de 1 $\langle^{\oplus}_{\ominus}$ → Si $R_2 = R_{2_{ideal}} \cdot \underset{}{\overset{\text{Variación}}{1{,}03}}$

↳ ω_0, q

↳ $q = q_{ideal} \cdot 1{,}03$

- +20 😱 Recalcular los valores de la red para que cumpla con una transferencia Butterworth.

$$T_{B_2}(s) = \frac{1}{s^2 + s \cdot \sqrt{2} + 1}$$

$\to \omega_0 = 1$

$\to \frac{\omega_0}{q} = \sqrt{2} \to q = \frac{\sqrt{2}}{2}$

$\to R_3 = 1 \to R_1 = \frac{1}{k} = 1\,\Omega$ ($k \to 1$)

$\to C = \frac{1}{\omega_0} = 1\,F$ ($\omega_0 \to 1$)

$\to R_2 = q = \frac{\sqrt{2}}{2}\,\Omega$