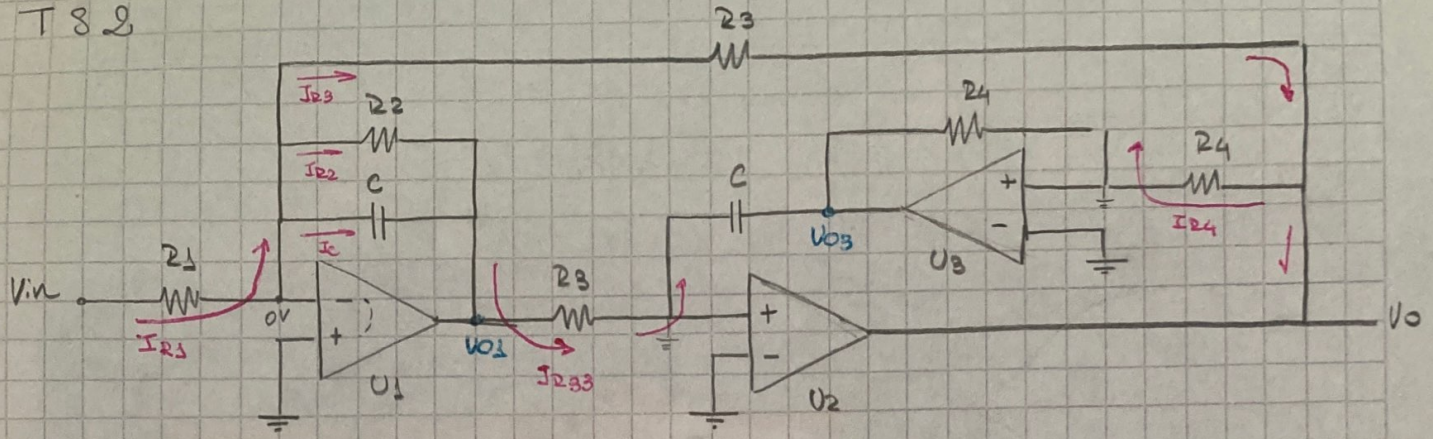
C = 5/2

T 8 2



$$\frac{Viu}{R_1} = I_{R1} \qquad I_{R1} = I_C + I_{R2} + I_{R3} = -V_{O1}\,sC - \frac{V_{O1}}{R_2} - \frac{V_O}{R_3}$$

$$\frac{Viu}{R_1} = -V_{O1}\left(sC + \frac{1}{R_2}\right) - \frac{V_O}{R_3}$$

$$\frac{V_{O1}}{R_3} = -V_{O3}\,sC$$

$$\frac{V_O}{R_4} = -\frac{V_{O3}}{R_4} \longrightarrow V_{O3} = -V_O \longrightarrow \frac{V_{O1}}{R_3} = V_O\,sC \longrightarrow V_{O1} = V_O \cdot sCR_3$$

$$\frac{Viu}{R_1} = -V_O\,sCR_3\left(sC + \frac{1}{R_2}\right) - \frac{V_O}{R_3} = -V_O\left(s^2C^2R_3 + \frac{sCR_3}{R_2} + \frac{1}{R_3}\right)$$

$$\frac{V_O}{V_i} = \frac{1}{R_1} \cdot \frac{-1}{s^2C^2R_3 + sC\frac{R_3}{R_2} + \frac{1}{R_3}} = \frac{1}{R_1} \cdot \frac{1}{C^2R_3} \cdot \frac{-1}{s^2 + s\cdot\frac{1}{CR_2} + \frac{1}{C^2R_3^2}}$$

$$T(s) = \frac{-1/C^2R_1R_3}{s^2 + s\cdot\frac{1}{CR_2} + \frac{1}{C^2R_3^2}} \Longrightarrow \frac{1}{C^2R_3^2} = \omega_0^2 \;\wedge\; \frac{1}{CR_2} = \frac{\omega_0}{Q} \qquad Q = \frac{R_2}{R_3}$$

$$T(s) = -\frac{\frac{R_3}{R_1}\omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2} = K\frac{\omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2} \qquad \text{con } K = -\frac{R_3}{R_1}$$

b) $\omega_0 = 1 \;\wedge\; Q = 3 \Longrightarrow$

$$\begin{cases} 3 = \dfrac{R_2}{R_3} \longrightarrow 3R_3 = R_2 \\ 1 = \dfrac{1}{CR_3} \longrightarrow R_3 = \dfrac{1}{C} \end{cases}$$

ω_0 y Q no dependen de R_1 y R_4. $R_2 = 3R_3 \;\wedge\; C = \frac{1}{R_3}$

c) $|T(0)| = 20\ dB$

$$|T(0)| = \frac{R_3}{R_1} \qquad |T(0)|_{[dB]} = 20 \log\left(\frac{R_3}{R_1}\right) = 20\ dB$$

$$\log\left(\frac{R_3}{R_1}\right) = 1\ dB \longrightarrow 10 = \frac{R_3}{R_1} \longrightarrow R_1 = \frac{R_3}{10}$$

Bonus

I) $\Omega_\omega = \frac{1}{R_3 C}$ normalizando $T(s) = k \frac{1}{s^2 + s\frac{R_3}{R_2} + 1}$

$\Omega_2 = R_3 \longrightarrow R_1 = \frac{R_3}{10} \longrightarrow R_1' = \frac{1}{10}$

$R_3' = 1$ $\qquad R_2 = 3R_3 \Longrightarrow R_2' = 3$

$R_4' = R_4 / R_3$ $\qquad C = 1/R_3 \Longrightarrow C' = 1$

$$T(s) = -10 \cdot \frac{1}{s^2 + s \cdot \frac{1}{3} + 1} \longrightarrow |T(\omega)| = |T(s)|_{s=j\omega} = 10 \cdot \frac{1}{\sqrt{(1-\omega^2)^2 + (\omega/3)^2}}$$

II) $S_C^{\omega_0}$ $S_{R_2}^{Q}$ $S_{R_3}^{Q}$ $\qquad \omega_0 = \frac{1}{R_3 C}$ $\qquad Q = \frac{R_2}{R_3}$

$$S_C^{\omega_0} = \frac{C}{\omega_0} \cdot \frac{\partial \omega_0}{\partial C} = R_3 C^2 \cdot \frac{1}{R_3}\left(-\frac{1}{C^2}\right) = -1$$

$$S_{R_2}^{Q} = \frac{R_2}{Q} \cdot \frac{\partial Q}{\partial R_2} = \frac{R_2 R_3}{R_2} \cdot \frac{1}{R_3} = 1$$

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