Trabajo semanal 2.
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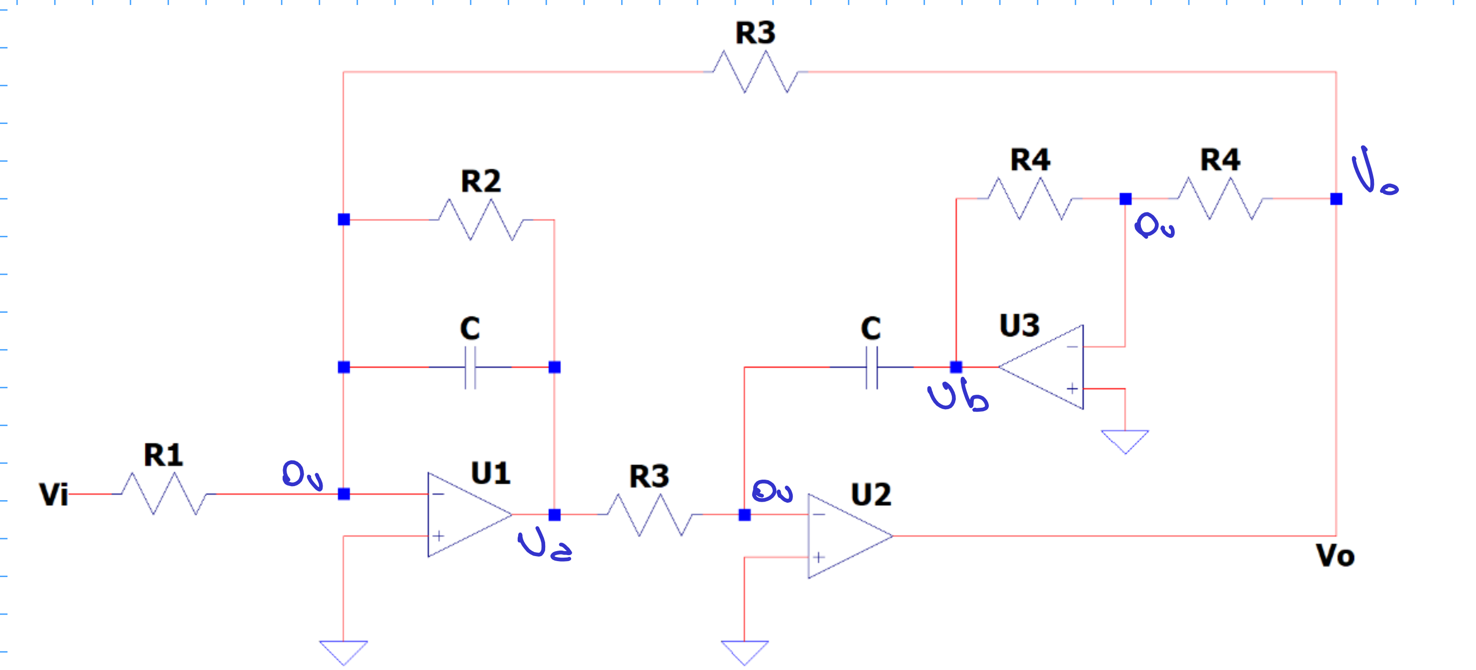
TC2 R4052



Hallar Transferencia T=Vo/Vi en función de w0 y Q.

$$V_2(Y_2+Y_c) + V_o Y_3 = V_i Y_1$$

$$V_2 \cdot Y_3 = V_b \cdot Y_c \Rightarrow V_2 = V_b \cdot Y_c/Y_3 \Rightarrow V_2 = V_o \, Y_c/Y_3$$

$$V_b \cdot Y_4 = V_o \cdot Y_4 \Rightarrow V_o = V_b$$

$$V_o\left[\frac{Y_c}{Y_3}(Y_2+Y_c)\right] + V_o Y_3 = V_i \cdot Y_1$$

$$V_o\left[\frac{Y_cY_2+Y_c^2}{Y_3} + Y_3\right] = V_i Y_1$$

$$V_o\left[\frac{Y_cY_2+Y_c^2+Y_3^2}{Y_3}\right] = V_i Y_1$$

$$\frac{V_o}{V_i} = \frac{Y_3 \cdot Y_1}{Y_c^2+Y_cY_2+Y_3^2} \Rightarrow \frac{V_o}{V_i} = \frac{1/R_3R_1}{s^2C^2 + s\frac{C}{R_2} + \frac{1}{R_3^2}}$$

$$\frac{V_o}{V_i} = \frac{1}{C^2R_3R_1}\cdot\frac{1}{s^2+s\frac{1}{CR_2}+\frac{1}{C^2R_3^2}} = \boxed{\frac{R_3}{R_1}\,\frac{1/C^2R_3^2}{s^2+s\frac{1}{CR_2}+\frac{1}{C^2R_3^2}}}$$

. filtro Pasabajos

$$T(s) = k \frac{\omega_0^2}{s^2 + s.\frac{\omega_0}{Q} + \omega_0^2}$$

. $k = R_3/R_1$

. $\omega_0^2 = \frac{1}{C^2 R_3^2} \Rightarrow \omega_0 = \frac{1}{C R_3}$

. $\frac{\omega_0}{Q} = \frac{1}{C.R_2} \Rightarrow \frac{1}{Q} = \frac{1}{C.R_2} \cdot \frac{1}{\omega_0} = \frac{1}{CR_2} C R_3 \Rightarrow Q = \frac{R_2}{R_3}$

Valores de componentes tal que w0=1 y Q=3

. $T(s) = \frac{k.}{s^2 + s.\frac{1}{3} + 1}$ $\Rightarrow$ Red Normalizada en frecuencia $s = \frac{S}{\omega_0}$

. Si $\omega_0 = 1 \Rightarrow \omega_0 = \frac{1}{CR_3} \Rightarrow R_3 = \frac{1}{C}$

. $Q = 3 \Rightarrow Q = \frac{R_2}{R_3} \Rightarrow 3 = \frac{R_2}{R_3} \Rightarrow R_2 = 3.R_3$

. Normalización en impedancia

. Norma de impedancia $\Rightarrow$ $\boxed{R_3 = 1}$ $\Rightarrow R_2 = QR_3 = Q$; $R_1 = \frac{R_3}{k} = \frac{1}{k}$

$C = \frac{1}{R_3} \Rightarrow C = 1$

$\Rightarrow R_2 = 3$; $R_1 = 1/10$ para $Q = 3$ y $k = 10$

Ajustar R1 tal que |T(0)|=20dB

$$|T(j\omega)| = \left|\frac{R_3}{R_1}\right| \left| \frac{1}{-\omega^2 + j\omega \frac{R_2}{R_1} + 1} \right| = \frac{R_3}{R_1} \frac{1}{\sqrt{(1-\omega^2)^2 + \left(\omega.\frac{R_2}{R_1}\right)^2}}$$

$$|T(j0)| = \frac{R_3}{R_1} \frac{1}{\sqrt{(1-0)^2 + \left(0 \frac{R_2}{R_1}\right)^2}} = \frac{R_3}{R_1}$$

$$|T(j0)| = 20 \log\left(\frac{R_3}{R_1}\right) = 20\,db \Rightarrow \frac{R_3}{R_1} = 10 \Rightarrow \boxed{R_1' = \frac{R_3}{10}}$$

Calculo de sensibilidad de parámetros

- $k = R_3/R_1$
- $\omega_0^2 = \dfrac{1}{C^2 R_3^2} \Rightarrow \omega_0 = \dfrac{1}{C R_3}$
- $\dfrac{\omega_0}{Q} = \dfrac{1}{C \cdot R_2} \Rightarrow Q = \dfrac{1}{C \cdot R_2} \cdot \dfrac{1}{\omega_0} = \dfrac{1}{C R_2} C R_3 \Rightarrow Q = \dfrac{R_2}{R_3}$

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

$S_C^{\omega_0} = \dfrac{1}{\omega_0^2 R_3} \cdot \left(-\dfrac{1}{\omega_0^2 R_3}\right) = \dfrac{-1}{\omega_0^4 \cdot R_3^2} = \dfrac{(-1)}{\omega_0^2} \cdot \underbrace{\dfrac{1}{\omega_0^2 R_3^2}}_{C^2}$

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

- $S_{R_2}^{Q} = \dfrac{R_2}{Q} \cdot \dfrac{\partial Q}{R_2} = \dfrac{\cancel{R_3}}{\cancel{R_2}} \cancel{R_2} \dfrac{1}{\cancel{R_3}} = 1$

$Q = \dfrac{R_2}{R_3}$

$\dfrac{\partial Q}{\partial R_2} = \dfrac{1}{R_3}$

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

$Q = \dfrac{R_2}{R_3}$

$\dfrac{\partial Q}{\partial R_3} = -\dfrac{R_2}{R_3^2}$