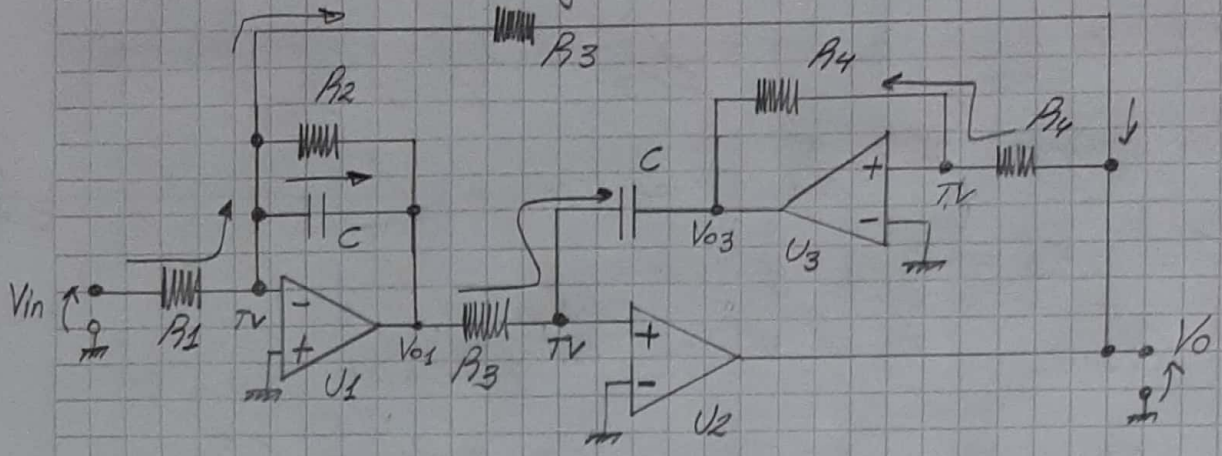
T52 Åckerberg-Mossberg filter



Hallar $T(s) = \frac{V_o}{V_i}$

$$Z_2(s) = \frac{1}{\frac{1}{R_2} + sC} = \frac{R_2}{1 + sCR_2}$$

- $\frac{V_{in}}{R_1} = -\frac{V_{o1}}{Z_2(s)} - \frac{V_o}{R_3}$ (1)
- $\frac{V_{o1}}{R_3} = -V_{o3} \cdot sC$ (2)
- $\frac{V_o}{R_4} = -\frac{V_{o3}}{R_4} \Rightarrow V_o = -V_{o3}$ (3)

(3) en (2) $\Rightarrow \frac{V_{o1}}{R_3} = V_o sC \Rightarrow V_{o1} = V_o sCR_3$ (4)

(4) en (1)

$$\frac{V_{in}}{R_1} = -\frac{V_o sCR_3}{Z_2(s)} - \frac{V_o}{R_3} \Rightarrow \frac{V_i}{R_1} = -V_o\left(sCR_3 \cdot \frac{(1+sCR_2)}{R_2} + \frac{1}{R_3}\right)$$

$$\Rightarrow \frac{V_i}{R_1} = -V_o\left(\frac{sCR_3 + s^2C^2R_2R_3}{R_2} + \frac{1}{R_3}\right)$$

$$\frac{V_i}{R_1} = -V_o\left(\frac{sCR_3^2 + s^2C^2R_2R_3^2 + R_2}{R_2R_3}\right)$$

$$T(s) = \frac{V_o}{V_i} = -\frac{R_2R_3}{R_1}\left(\frac{1}{s^2C^2R_2R_3^2 + sCR_3^2 + R_2}\right)$$

$$T(s) = -\frac{R_2R_3}{R_1} \cdot \frac{1}{C^2R_2R_3^2} \cdot \frac{1}{s^2 + s\frac{1}{CR_2} + \frac{1}{C^2R_3^2}}$$

NOTA

$$T(s) = \frac{-1}{C^2 R_1 R_3} \cdot \frac{1}{s^2 + s\frac{1}{CR_2} + \frac{1}{C^2 R_3^2}} \Rightarrow \text{Pasa bajo}$$

$$\frac{\omega_0}{Q} = \frac{1}{CR_2} \quad y \quad \omega_0 = \frac{1}{CR_3} \; ; \; \text{Elijo norma de frec} \quad \Omega_\omega = \frac{1}{CR_3}$$

cambio de variable $\phi = \frac{s}{\Omega_\omega} \Rightarrow T(\phi) = \frac{1}{\phi^2 + \phi\frac{1}{Q} + 1} \cdot \frac{1}{CR_1 R_3}$

$\Rightarrow Q = CR_2 = 3_{(1)}$ y $\omega_0 = \frac{1}{CR_3} = 1_{(2)}$

de (2) $\boxed{C = 1/R_3}_{(3)} \Rightarrow$ de (3) en (1) $\Rightarrow \boxed{R_2 = 3R_3}$

Elijo como norma $\Omega_Z = R_3 \Rightarrow R_3' = \frac{R_3}{\Omega_Z} = 1$

- $C' = C \cdot \Omega_Z = \frac{1}{R_3} \cdot R_3 = 1$
- $R_2' = \frac{R_2}{\Omega_Z} = \frac{3R_3}{R_3} = 3$

$R_4' = 1 \rightarrow$ No modifica nada en el circuito

Tengo que elegir R_1 tal que $\left\{ |T(0)| = 20\,dB = 10 \text{ veces} \right.$

$$|T(0)| = \frac{1}{CR_1 R_3} \cdot C^2 R_3^2 = \frac{R_3}{R_1} = 10 \text{ veces}$$

$\Rightarrow R_1' = 1/10$