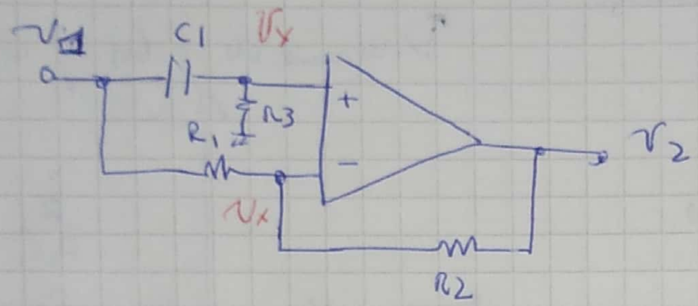


$$0 = v_x(G_3 + sC_1) - v_1 sC_1 \quad (1)$$

$$0 = v_x(G_2 + G_1) - v_2 G_2 - v_1 G_1 \quad (2)$$

(1) $v_x = \dfrac{v_1 sC_1}{(G_3 + sC_1)}$

reemplazo en (2)

$$0 = \frac{v_1 sC_1}{(G_3 + sC_1)}(G_2 + G_1) - v_2 G_2 - v_1 G_1 \Rightarrow$$

$$v_2 G_2 = v_1 \left[\frac{sC_1}{(G_3 + sC_1)}(G_2 + G_1) - G_1\right]$$

$$\frac{v_2}{v_1} = \frac{1}{G_2}\left[\frac{sC_1(G_2 + G_1)}{(G_3 + sC_1)} - G_1\right]$$

$$\frac{v_2}{v_1} = \frac{1}{G_2} \cdot \frac{sC_1G_2 \cancel{+ sC_1G_1} - G_1G_3 \cancel{- G_1 sC_1}}{G_3 + sC_1}$$

$$\frac{v_2}{v_1} = \frac{sC_1G_2 - G_1G_3}{G_3G_2 + sC_1G_2}$$

$$\boxed{\frac{v_2}{v_1} = \frac{s - \frac{1}{R_3C_1}k}{s + \frac{1}{R_3C_1}}}$$

donde $\boxed{k = \frac{R_2}{R_1}}$

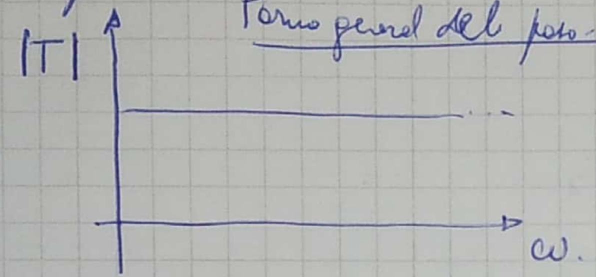
aquí el polo y el cero son

$$Z_1 = \frac{k}{R_3C_1}$$

$$P_1 = \frac{1}{R_3C_1}$$

El filtro tiene la forma de un paso-todo

Forma general del paso-todo



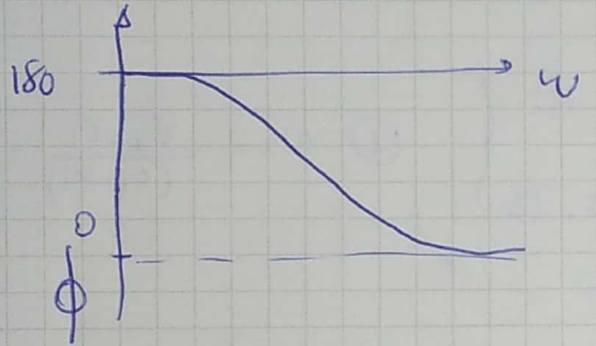
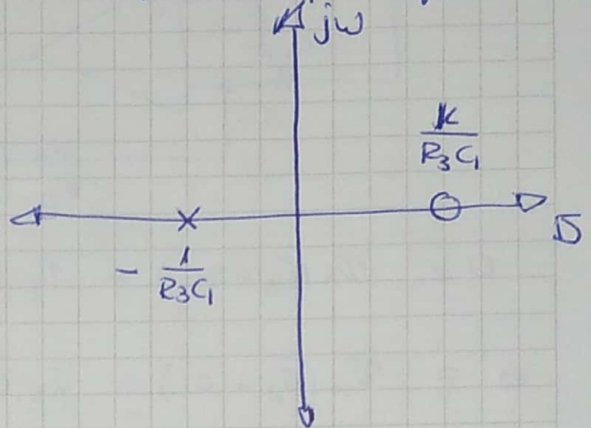


Diagrama de polos y ceros



$$\phi T(s)\Big|_{s=j\omega} = \frac{-\frac{K}{R_3C_1}+j\omega}{\frac{1}{R_3C_1}+j\omega}$$

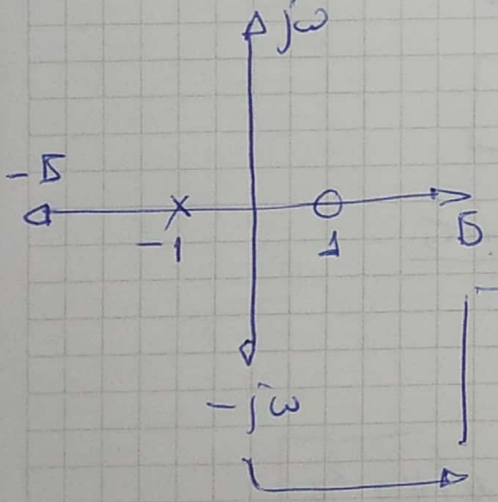
$$|T(j\omega)| = \frac{\sqrt{\omega^2+\left(\frac{K}{R_3C_1}\right)^2}}{\sqrt{\omega^2+\left(\frac{1}{R_3C_1}\right)^2}}$$

$$\theta(\omega) = \theta_n - \theta_d$$

$$= tg^{-1}\left(\frac{\omega}{-\frac{K}{R_3C_1}}\right) - tg^{-1}\left(\frac{\omega}{\frac{1}{R_3C_1}}\right)$$

Normalizando:

$$T(s) = \frac{s-1}{s+1}$$



$$T(j\omega) = \frac{\sqrt{(\omega/\omega_0)^2+1}}{\sqrt{\left(\frac{\omega}{\omega_0}\right)^2+1}} = 1 \ \forall\omega.$$

$$\theta(\omega) = tg^{-1}\left(\frac{\omega/\omega_0}{-1}\right) - tg^{-1}\left(\frac{\omega/\omega_0}{1}\right)$$

$\frac{\omega}{\omega_0} = 0 \rightarrow \phi = 0$

$\frac{\omega}{\omega_0} = 1 \rightarrow \phi = -45-45 = -90^\circ$

$\frac{\omega}{\omega_0} \rightarrow \infty \Rightarrow \phi = -90-90 = -180^\circ$