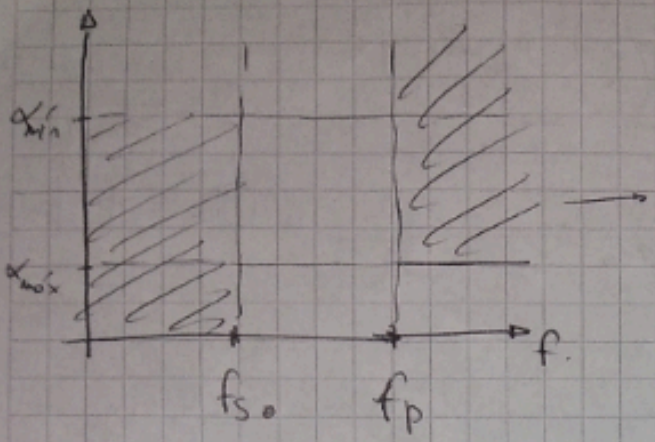
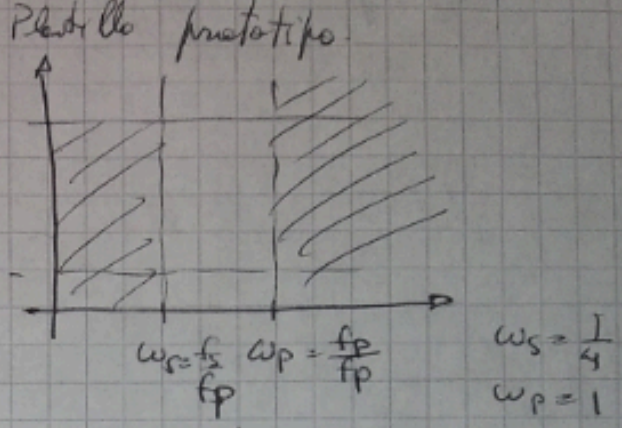
HOJA Nº

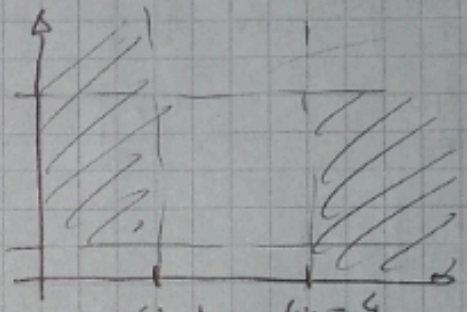
FECHA

Plantilla





↓ Plantilla PB



$f_s = 10kHz$ $\quad \alpha_{max} = 1db$

$f_p = 40kHz$ $\quad \alpha_{min} = 30db$

Calculamos ε

$$\varepsilon^2 = 10^{\frac{\alpha_{max}}{10}} - 1 \Rightarrow \boxed{\varepsilon^2 = 0,2589}$$

Calculamos n

$$n = 3 \Rightarrow \alpha_{min} = 10 \log \left(1 + \varepsilon^2 \omega_s^{2n}\right)$$

$$\alpha_{min} = 10 \log \left(1 + 0,258 \; 4^6\right)$$

$$\boxed{\alpha_{min} = 30,25db} \Rightarrow \boxed{n = 3 \text{ polos}}$$

Con $\varepsilon^2 = 0,2589$ y $n = 3 \Rightarrow$ directo al prototipo Butterworth

Con $\omega_B = \varepsilon^{1/n}$ (para PA) $\Rightarrow \boxed{\omega_B|_{PA} = 0,7983}$

$$T(s) = \frac{1}{s+1} \cdot \frac{1}{s^2 + s + 1}$$

NOTA

Hacemos la transformación:

$$T(s)\Big|_{s=\frac{1}{s}} = \frac{1}{\left(\frac{1}{s}\right)+1} \cdot \frac{1}{\left(\frac{1}{s}\right)^2 + \frac{1}{Q}\left(\frac{1}{s}\right)+1} \qquad Q = \frac{1}{2\cos\phi}$$

$$\overline{T}(s) = \frac{s}{s+1} \cdot \frac{s^2}{s^2+s+1} \qquad \boxed{Q = 1}$$

Implementamos el sistema

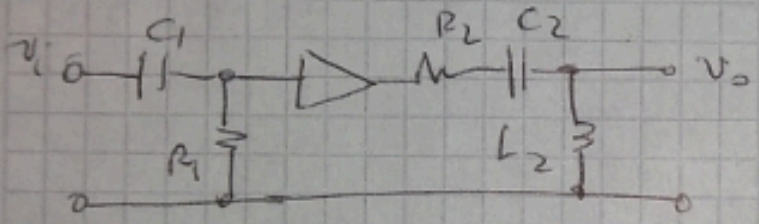
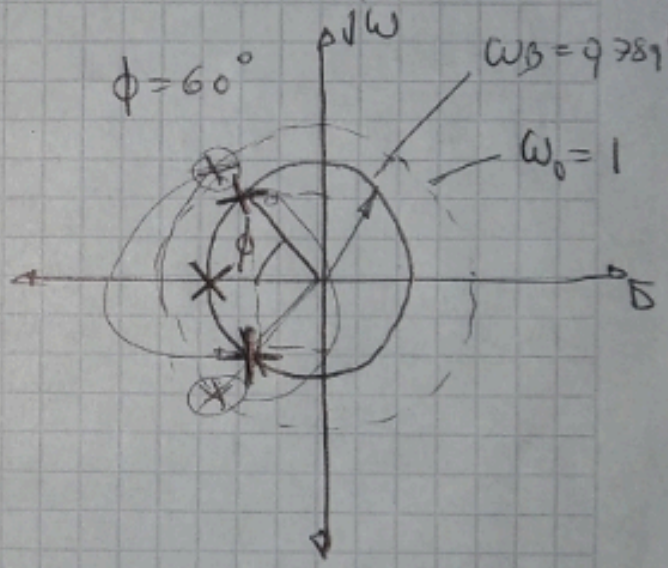


Diagrama de polos y ceros



$$\omega_B = \frac{1}{R_1 C_1} \Big| C_1 = 1$$

$$R_1 = \frac{1}{\omega_B} \Rightarrow R_1 = 1{,}252$$

$$\omega_B^2 = \frac{1}{L_2 C_2} \quad C_2 = 1$$

$$L = \frac{1}{(\omega_B)^2} \Rightarrow L_2 = 1{,}605$$

$$\frac{R_2}{L_2} = \frac{\omega_B}{Q} \Rightarrow R_2 = \frac{L_2 \omega_B}{Q} \Rightarrow R_2 = 1{,}252$$