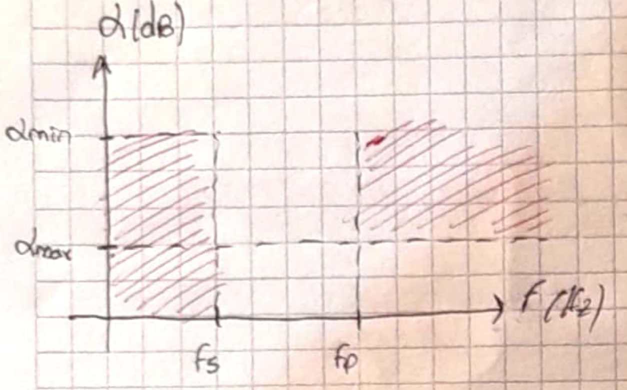
Tarea Semanal 4



$\alpha_{max} = 1dB$

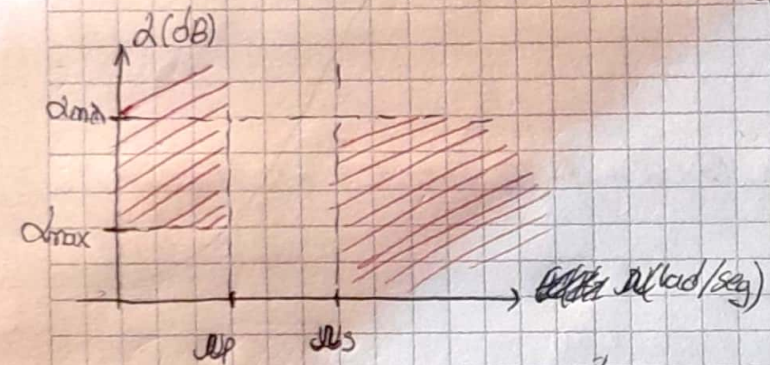
$\alpha_{min} = 30dB$

$f_p = 40kHz$

$f_s = 10kHz$

Normalizo respecto de $\omega_p = 2\pi f_p$ $\rightarrow \Omega_\omega = \omega_p$ $\left\{ \begin{array}{l} \omega_p = 1 \\ \omega_s = \frac{1}{4} \end{array} \right.$

Aplico núcleo de transformación, $\Omega = \frac{1}{\omega}$ $\rightarrow$ $\left\{ \begin{array}{l} \Omega_p = 1 \\ \Omega_s = 4 \end{array} \right.$



$\varepsilon^2 = 10^{\frac{\alpha_{max}(dB)}{10}} - 1 = 10^{\frac{1}{10}} - 1$; $\boxed{\varepsilon^2 = 0,2589}$ $\Rightarrow \varepsilon = 0,5$

$\alpha_{min}(dB) = 10 \log\left(1 + \varepsilon^2 \Omega_p^{2n}\right)$

Iterando,

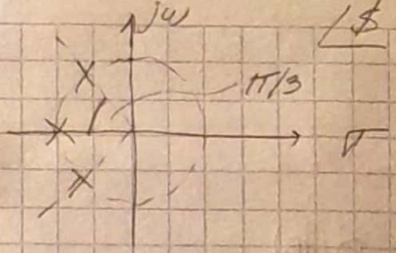
$n = 1 \Rightarrow \alpha_{min} = 7,11 \ dB$

$n = 2 \Rightarrow \alpha_{min} = 18,27 \ dB$

$n = 3 \Rightarrow \alpha_{max} = 30,26 \ dB \Rightarrow \boxed{n = 3}$

Cambio la Ω_ω. Ahora, $\Omega_\omega = \omega_p \cdot \omega_B = \omega_p \cdot \frac{1}{\varepsilon 3}$. Trabajo como si fuera un Butter.

$T(\omega) = \dfrac{1}{1+\omega^{2n}}$. Para un Butter de Orden 3,



$\psi = \dfrac{1}{2\cos\psi} = \dfrac{1}{2\cos \pi/3}$; $\psi = 1$

$\Rightarrow T_{LP}(\$) = \dfrac{1}{(\$+1)(\$^2+\$+1)}$ (Pasabajos prototipo, normalizado)

Lo transformo a pasa altos, usando el núcleo $p = \dfrac{1}{\$}$.

$\therefore T_{HP}(\$) = T(\$) = \dfrac{1}{\left(\frac{1}{\$}+1\right)\left(\frac{1}{\$^2}+\frac{1}{\$}+1\right)} = \dfrac{1}{\frac{1}{\$}(1+\$)\cdot\frac{1}{\$^2}(1+\$+\$^2)}$

$$\boxed{T_{HP}(\$) = \dfrac{\$^3}{(\$+1)(\$^2+\$+1)}}$$

Desnormalizo sólo con la ω_B. Como transformé, transformo también ω_B. $\Rightarrow \Omega_\omega = \varepsilon^{+1/3}$

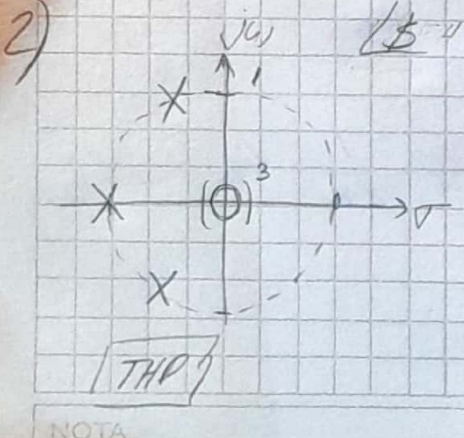
$\Omega_\omega = 0{,}794$

$T_{HP}(\$) = \dfrac{\frac{\$^3}{0{,}794^3}}{\left(\frac{\$}{0{,}794}+1\right)\left(\frac{\$^2}{0{,}794^2}+\frac{\$}{0{,}794}+1\right)}$

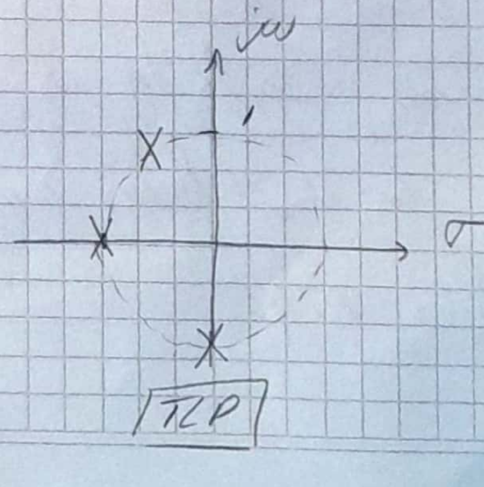
$T_{HP}(\$) = \dfrac{\$^3 / \cancel{0{,}794^3}}{\frac{1}{\cancel{0{,}794}}(\$+0{,}794)\,\frac{1}{\cancel{0{,}794^2}}(\$^2+\$\cdot 0{,}794+0{,}794^2)}$

$$\boxed{T_{HP}(\$) = \dfrac{\$^3}{(\$+0{,}794)(\$^2+\$\cdot 0{,}794+0{,}794^2)}}$$

2)



THP



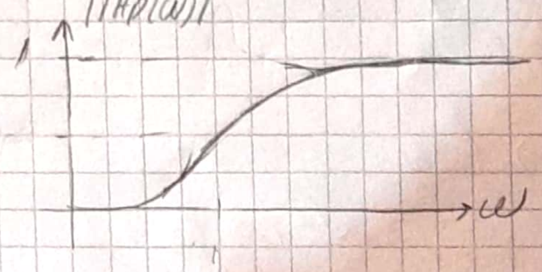
TLP

NOTA

Los ceros y polos de

Grafico ambas transferencias totalmente normalizadas, se ven como Butter pero no lo son.

Se observa que el diagrama es el mismo en ambos casos, solo que al convertirlo en pasa altos agregó un cero de orden 3 en el origen.



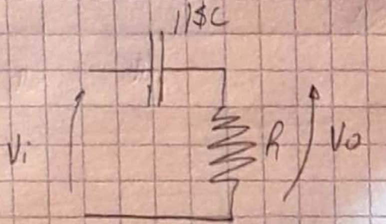
$|T_{HP}(\omega)|\Big|_{\omega=0} = 0$

$|T_{HP}(\omega)|\Big|_{\omega\to\infty} = 1$

3) Primera etapa

Necesito implementar $\dfrac{s}{s+0{,}794}$.

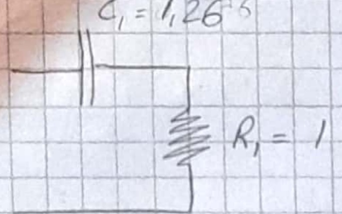
Propongo



$\dfrac{V_o}{V_i} = H_1(s) = \dfrac{R}{R+1/sC} = \dfrac{sCR}{sCR+1}$

$H_1(s) = \dfrac{s}{s+1/CR}$, si $R=1 \Rightarrow H_1(s) = \dfrac{s}{s+1/C}$

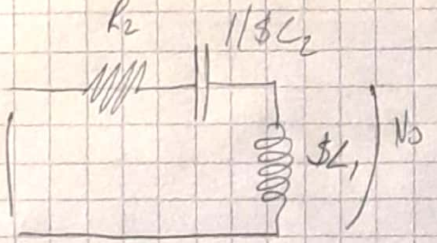
$\therefore \dfrac{1}{C} = 0{,}794 \Rightarrow \underline{C_1 = 1{,}26}$



Esta etapa implementa $H_1(s) = \dfrac{s}{s+0{,}794}$

Segunda Etapa: Necesito implementar $H_2(s) = \dfrac{s^2}{s^2 + s\,0{,}794 + 0{,}794^2}$

Propongo

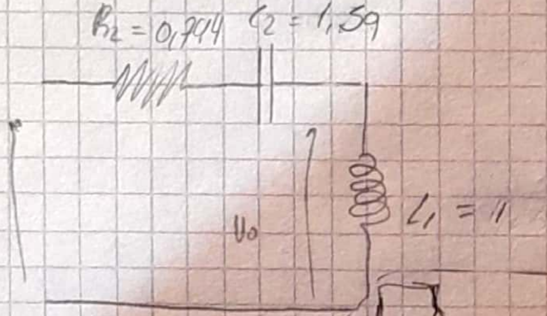


$$H_2(s) = \frac{V_o(s)}{V_i(s)} = \frac{sL_1}{sL_1 + 1/sC_2 + R_2}$$

$$H_2(s) = \frac{sL_1}{\dfrac{s^2L_1C_2 + 1 + sC_2R_2}{sC_2}} \quad ; \quad H_2(s) = \frac{s^2L_1C_2}{s^2L_1C_2 + sC_2R_2 + 1}$$

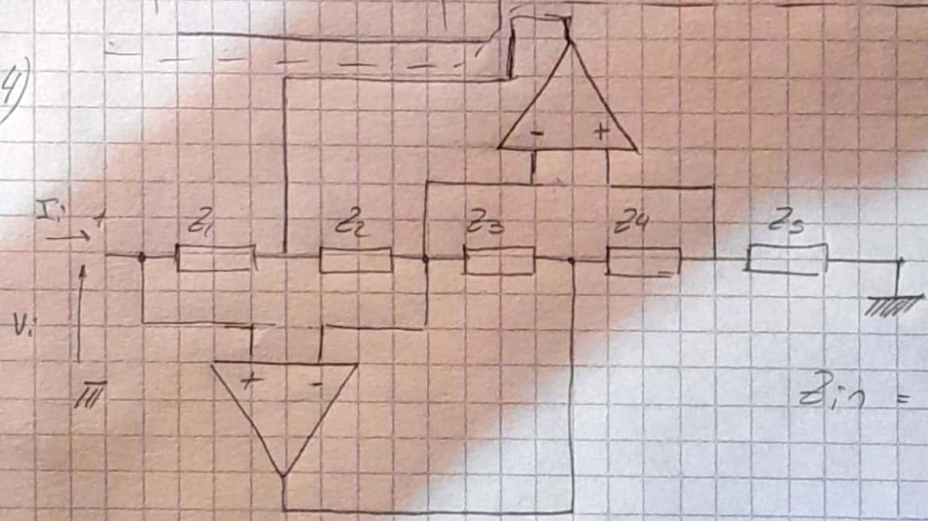
$$H_2(s) = \frac{s^2}{s^2 + s\,\dfrac{R_2}{L_1} + \dfrac{1}{L_1C_2}} \quad , \text{ si } L_1 = 1 \Rightarrow H_2(s) = \frac{s^2}{s^2 + s\,R_2 + \dfrac{1}{C_2}}$$

$\underline{R_2 = 0{,}794}$; $\dfrac{1}{C_2} = 0{,}794^2 \Rightarrow \underline{C_2 = 1{,}59}$



Implemento $H_2(s) = \dfrac{s^2}{s^2 + s\,0{,}794 + 0{,}794^2}$

4)



$$Z_{in} = \frac{Z_1 Z_3 Z_5}{Z_2 Z_4}$$

Necesito que sea un inductor. Adopto $Z_{1,3,5,2} = R_3$; $Z_4 = \dfrac{1}{sC_3}$

$\Rightarrow Z_{in} = \dfrac{R_3 \cancel{{}^{2}}}{R_3 \cdot \dfrac{1}{sC_3}}$; $Z_{in} = s\underbrace{C_3 R_3}_{L_{eq}}$; $\boxed{Z_{in} = s\,L_{eq},\ L_{eq} = 1, \text{ si } R_3 = 1 \Rightarrow C_3 = 1}$

NOTA