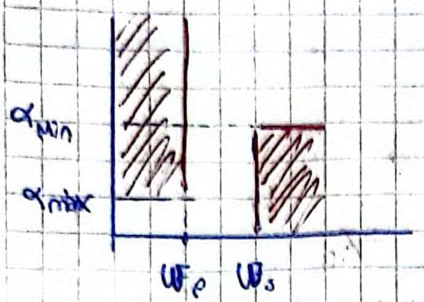
HOJA Nº

FECHA

TP Semanal 3



$\alpha_{min} = 12$ dB $\omega_s = 2\pi \cdot 3000$ Hz

$\alpha_{max} = 1$ dB $\omega_p = 2\pi \cdot 1500$ Hz

* **Normalizo** $\omega_p = 1$ $\omega_s = 2$ $\Omega_\omega = 2\pi \cdot 1500$ Hz

* **Calculo ε**

$$\varepsilon^2 = 10^{\frac{\alpha_{max}}{10}} - 1 \rightarrow \varepsilon = 0{,}5088$$

* **Calculo n**

$$\alpha_{min} < 10 \log\left(1 + \varepsilon^2 \, \omega_s^{2n}\right)$$

Iteración:

n	α_{min}	
1	3,087	< 10
2	7,11	< 10
3	12,45	> 10 ✓ → $n = 3$

* **Armo Transferencia**

$$|T(\omega)|^2 = \frac{1}{1 + \varepsilon^2 (\omega)^{2n}}$$

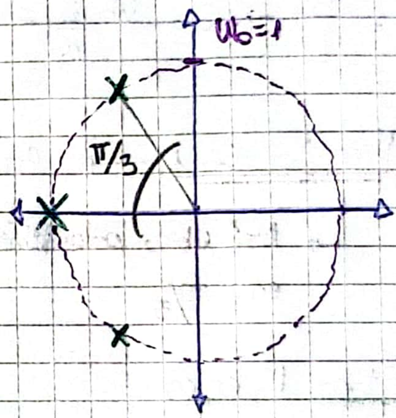
* **Renormalizo** $\Omega_\omega = \dfrac{2\pi \cdot 1500 \text{ Hz}}{\sqrt[n]{\varepsilon}} = 11805 \ \dfrac{\text{rad}}{\text{seg}}$

$$|T(\omega)|^2 = \frac{1}{1 + \omega^{2n}}$$

* **Armo Pz map**

↳ n: impar → polo sobre eje σ

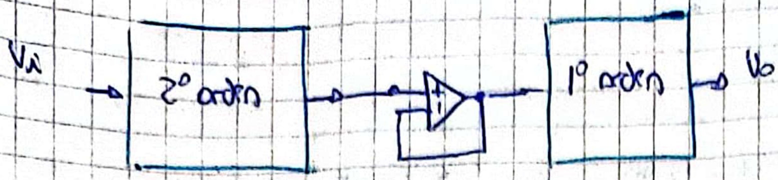
↳ polos separados π/n



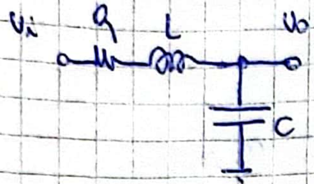
$$\frac{1}{2\cos(\pi/3)} = Q = 1$$

NOTA

* Diseño Circuito



* Etapa 2° orden



$$\frac{V_o}{V_i} = \frac{1/sC}{\frac{1}{sC} + sL + R} = \frac{1/LC}{\frac{1}{LC} + s^2\frac{LC}{LC} + \frac{sCR}{LC}} = \frac{\frac{1}{LC}}{s^2 + s\frac{R}{L} + \frac{1}{LC}}$$

$$\omega_o = \frac{1}{\sqrt{LC}}$$

$$\frac{\omega_o}{Q} = \frac{R}{L} \rightarrow Q = \omega_o \frac{L}{R} = \frac{1}{R}\cdot\sqrt{\frac{L}{C}}$$

<u>Normalizo</u>

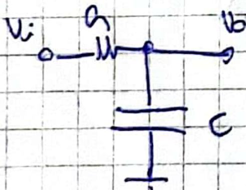
$\omega_o = 1 \rightarrow L = 1/C$

$R = 1 \rightarrow R = L$

<u>Necesito $Q = 1$</u> $\longrightarrow R = 1$; $C = 1$; $L = 1$

↳ Así ubico polos en $\pi/3$

* Etapa 1° orden



$$\frac{V_o}{V_i} = \frac{1/sC}{\frac{1}{sC} + R} = \frac{1}{sCR + 1} = \frac{1/CR}{s + 1/CR}$$

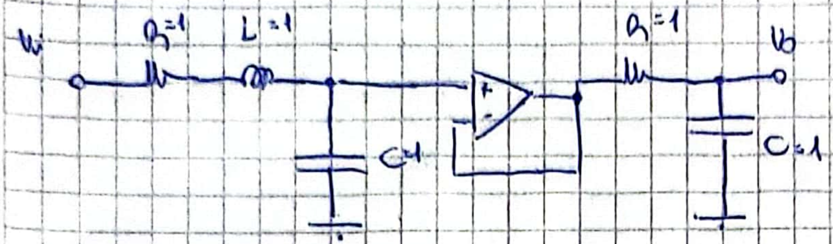
Necesito polo en $-1 \rightarrow \frac{1}{s+1} \rightarrow \frac{1}{CR} = 1$

Normalizo $R = \frac{1}{C}$ → $R = 1$, $C = 1$

HOJA N°

FECHA

Bosquejo Circuito



Bosquejo Valores Escalar

$R = 1 \cdot \Omega_z \rightarrow R = 847\Omega$

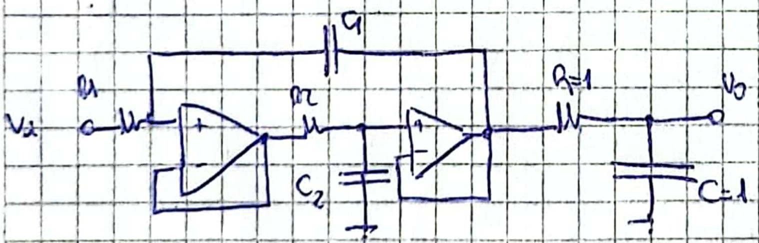
$L = 1 \cdot \frac{\Omega_z}{\Omega_w} \rightarrow L = \frac{847\Omega}{11805 \frac{rad}{seg}} = 71,75\ mHy$

$C = 100nF = 1 \cdot \frac{1}{\Omega_z \cdot \Omega_w} \rightarrow \Omega_z = \frac{1}{100nF \cdot \Omega_w} = \frac{1}{100nF \cdot 11805 \frac{rad}{seg}} = \boxed{847\Omega}$

Calculo

Modifico Circuito para no usar inductores

↳ Implemento pasa bajos bicuadrado



$\omega_0 = \frac{1}{\sqrt{R_1 R_2 C_1 C_2}} \rightarrow R_1 R_2 C_1 C_2 = 1$

$Q = \sqrt{\frac{R_1 C_1}{R_2 C_2}} = 1 \rightarrow R_1 C_1 = R_2 C_2$

$R_1 = 1 \quad R_2 = 1$

$C_1 = 1 \quad C_2 = 1$

→ Mismos valores que antes

NOTA

Cálculo del sistema con método partir de Fuoncar:

$$|H(jw)|^2 = \frac{1}{1+\xi^2 \cdot w^{2n}} \qquad n=3 \qquad \xi = 0{,}5088$$

Cambio de Dominio

reemplazo n=3

$$|H(jw)|^2 \Big|_{w=\frac{p}{j}} = \frac{1}{1+\xi^2 \cdot \left(\frac{p}{j}\right)^{2n}} = \frac{1}{1-\xi^2 \cdot p^6} = H(p)\cdot H(-p) =$$

$$\rightarrow \frac{1}{1-\xi^2 p^6} = \frac{1}{(p^3 a + p^2 b + p c + d)} \cdot \frac{1}{(-p^3 a + p^2 b - p c + d)}$$

Por igualación Términos

$1 = d \qquad -a^2 = -\xi^2 \rightarrow a = \xi$

$0 = b^2 - 2ac \rightarrow b^2 = 2ac$

$0 = c^2 - 2bd \rightarrow c^2 = 2bd$

Resuelvo sistema ecuaciones

$$b = \sqrt{2ac} \rightarrow c^2 = 2\sqrt{2ac}\cdot \cancel{d}^{=1} \rightarrow c^4 = 8ac \rightarrow c = \sqrt[3]{8a} \rightarrow c = 2\xi^{1/3}$$

$$\rightarrow b = \sqrt{2\xi \cdot 2\xi^{1/3}} = 2\sqrt{\xi^{4/3}} = 2\xi^{2/3}$$

$$H(p) = \frac{1/\xi}{p^3 \frac{\xi}{\xi} + p^2 \frac{2\xi^{2/3}}{\xi} + p\frac{2\xi^{1/3}}{\xi} + \frac{1}{\xi}} = \frac{1/\xi}{p^3 + p^2 \cdot 2\cdot \xi^{-1/3} + p\cdot 2 \cdot \xi^{-2/3} + 1/\xi}$$

$$H(p) = \frac{1}{(p+1{,}25)} \cdot \frac{1{,}9654}{(p+0{,}6263+1{,}0848j)\cdot(p+0{,}6263-1{,}0848j)}$$

$= 1{,}2526 \cdot 1{,}569$

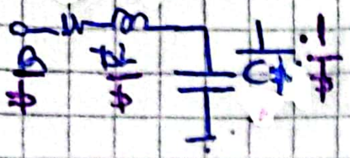
$$= \frac{1}{p+1{,}2526} \cdot \frac{1{,}9654}{p^2+p\cdot 1{,}2526+1{,}569} = \frac{1{,}2526}{p+1{,}2526} \cdot \frac{1{,}569}{p^2+p\,1{,}2526+1{,}569}$$

$1{,}2526^2$

Aproximo

$$H(p) = \frac{1}{p+1} \cdot \frac{1}{p^2+p\cdot 1+1} \rightarrow$$ Misma Transferencia que antes

Reemplazar RLC por girador para no usar bobina



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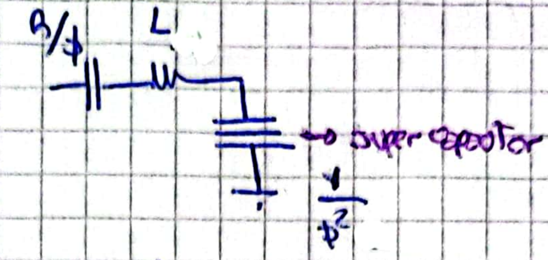
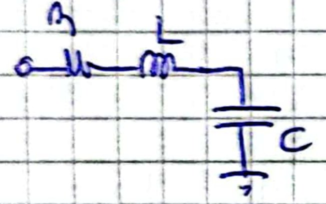
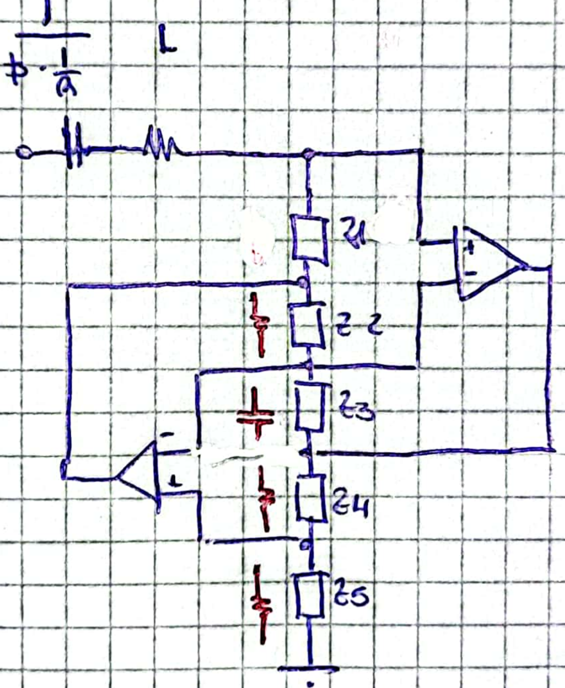


$$H(p) = \frac{\frac{1}{pC}\cdot\frac{1}{p}}{\frac{R}{p} + \frac{pL}{p} + \frac{1}{pC}\cdot\frac{1}{p}} \equiv \frac{\frac{1}{p^2}}{\frac{R}{p} + L + \frac{1}{p^2 C}}$$



$R = L = C = 1$

≡



$$Z = \frac{Z_1 . Z_3 . Z_5}{Z_2 . Z_4} = \frac{1}{p^2 . C}$$

$Z_1 = pC_1 \qquad Z_3 = p . C_2$

$Z_5 = Z_4 = Z_2 = R_1$

$R = 1 \qquad L = 1 \qquad C_1 = C_2 = 1 \qquad R_1 = 1$