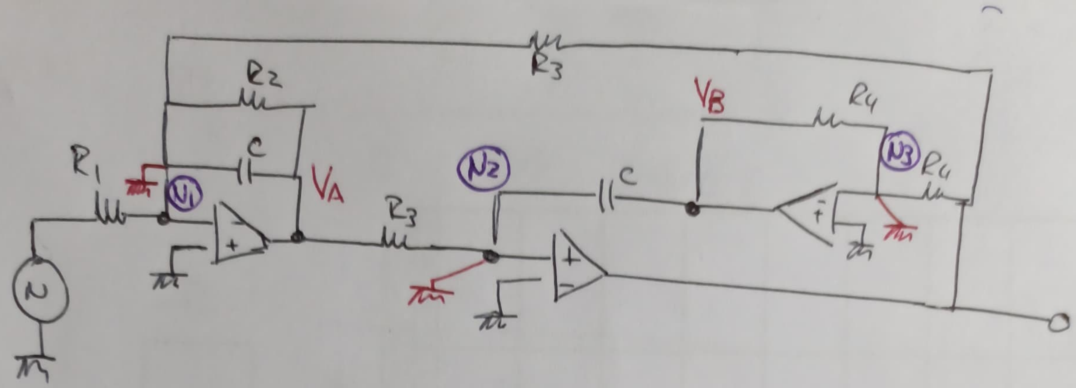


Trans ferencia

N1
$$-V_1\left(\frac{1}{R_1}\right) - V_A\left(\frac{1}{R_2} + \$C\right) - V_O\left(\frac{1}{R_3}\right) = \phi$$

N2
$$-V_A\left(\frac{1}{R_3}\right) - V_B\left(\$C\right) = \phi \Rightarrow V_B(\$C) = -V_A\left(\frac{1}{R_3}\right)$$

N3
$$-V_B\left(\frac{1}{R_4}\right) - V_O\left(\frac{1}{R_4}\right) \Rightarrow V_B = -V_O$$

$$\frac{V_A}{V_B} = -\$C.R_3$$

$$V_O(1/R_3) + V_A(1/R_2 + \$C) = \frac{V_1}{R_1}$$

$-V_O$

$$V_O(1/R_3) + V_B\frac{V_A}{V_B}(1/R_2 + \$C) = \frac{V_1}{R_1} \Rightarrow V_O(1/R_3) - V_O(-\$CR_3)(1/R_2 + \$C) = \frac{V_1}{R_1}$$

$$\Rightarrow V_O\left(\frac{1}{R_3} + \$CR_3\,\frac{\$C\cdot R_2+1}{R_2}\right) = \frac{V_1}{R_1}$$

$$V_O\,\frac{R_2 + \$C\cdot R_3^2(\$CR_2+1)}{R_3\cdot R_2} = \frac{V_1}{R_1}$$

$R.c =$
$\Omega\, s \quad s$

$$T(\$) = \frac{R3.R2}{R_1} \frac{1}{\$^2 \cdot C^2 \cdot R3^2 \cdot R2 + \$ \cdot C \cdot R3^2 + R2}$$

$$\left[\Omega \frac{1}{\cancel{\frac{1}{s^2}} \cdot \frac{s^2}{\cancel{\Omega^2}} \cdot \Omega^2 \cdot \Omega + \frac{1}{s} \cdot \frac{s}{\cancel{\Omega}} \cdot \Omega^2 + \Omega} = \right] = [\Omega] \cdot \left[\frac{1}{\Omega}\right]$$

Tiene lógicas las unidades

$$T(\$) = \frac{R3 \cdot R2}{R_1} \frac{1}{C^2 \cdot R3^2 \cdot R2} \frac{1}{\$^2 + \$ \; 1/_{C \cdot R2} + 1/_{C^2 \cdot R3^2}}$$

$$T(\$) = \frac{R3 . \cancel{R2}}{R_1 . \cancel{R2}} \frac{1/C^2 \cdot R3^2}{\$^2 + \$ \cdot 1/_{C \cdot R2} + 1/_{C^2 \cdot R3^2}}$$

$$\boxed{T(\$) = \underbrace{\frac{R3}{R_1}}_{K} \frac{\overbrace{1/C^2 R3^2}^{\omega_0^2}}{\$^2 + \$ \underbrace{1/_{C \cdot R2}}_{\frac{\omega_0}{q}} + \underbrace{1/_{C^2 \cdot R3^2}}_{\omega_0^2}}}$$

Si lo normalizo $\Omega\omega = \omega_0 = 1/_{C.R3} \Rightarrow C = 1F$
$R3 = 1\,\Omega$

$$T(\$) = K \frac{1}{\$^2 + \$ \; 1/q + 1} \quad ; \quad \omega_0^2 = \frac{1}{C^2 R_3^2} \Rightarrow \omega_0 = \frac{1}{C \cdot R_3}$$

$$\frac{\omega_0}{q} = \frac{1}{C.R_2} = \frac{1/C.R3}{q}$$

$$q = \frac{R2}{R3}$$

$$\frac{1}{\cancel{C}.R2} = \frac{1}{\cancel{C}.R3} \frac{1}{q} \Rightarrow \boxed{q = R2/R3}$$

(#2)

$\Rightarrow$ Si $Q = 10$ ∴ $Q = \frac{R2 \rightarrow 10}{R3 \rightarrow 1}$

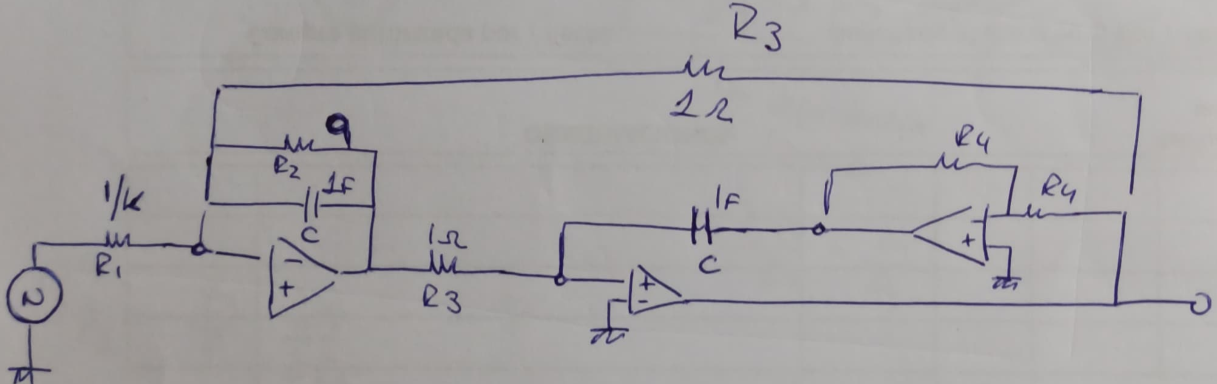
$\omega = 2\pi F$

$\Rightarrow$ $\boxed{\begin{array}{l|l} \omega_0 = 1 & C = 1F \\ Q = 10 & R3 = 1\Omega \\ & R2 = 10\,\Omega \end{array}}$

$T(0) = 20\ dB$; $20\ dB = 20 \log((10))$

$T(0) = T(s)\Big|_{s=0} = k = \frac{R3 \rightarrow 1}{R_1 \rightarrow 0{,}1}$

$\Rightarrow$ $\boxed{K = 10 \ ∴ \ R1 = 0{,}1}$



L

$$S_{c}^{\omega o} = \frac{c}{\omega o}\frac{\partial \omega o}{\partial c}; \quad \omega o = \frac{1}{cR3}$$

$$= \frac{c}{\omega o}\frac{\partial}{\partial c}\left(\frac{1}{cR3}\right)$$

$$= \frac{c}{\omega o}(-)\overbrace{\frac{1}{R3}\frac{1}{c^{2}}}^{\omega o} = -\frac{\omega o}{\omega o} = -1$$

$$\Rightarrow \boxed{S_{c}^{\omega o} = -1} \rightarrow$$ ~~Quiere decir que la dependencia es en sentido opuesto~~ ~~$\uparrow c \Rightarrow \downarrow \omega o$~~ ~~$\downarrow c \Rightarrow \uparrow \omega o$~~

↳ dependencia inversamente lineal

Recordar que

$$\underbrace{S_{c}^{\omega o}}_{-1} \cdot \frac{\Delta c}{c} = \frac{\Delta \omega o}{\omega o}$$

$$-\frac{\Delta c}{c} = \frac{\Delta \omega o}{\omega o}.$$

$$S_{R2}^{\varphi} = \frac{R2}{\varphi}\frac{\partial \varphi}{\partial R2}; \quad \varphi = \frac{R2}{R3}$$

$$= \frac{R2}{\varphi}\frac{\partial}{\partial R2}\left(\frac{R2}{R3}\right)$$

$$= \frac{R2}{\varphi}\overbrace{\frac{1}{R3}}^{\varphi/R2} = 1 \Rightarrow \boxed{S_{R2}^{\varphi} = 1} \Rightarrow$$ ~~es una dependencia~~

↳ dependencia lineal

$$\frac{\Delta R2}{R2} = \frac{\Delta \varphi}{\varphi}$$

$$S_{R3}^{\varphi} = \frac{R3}{\varphi}\frac{\partial \varphi}{\partial R3}$$

$$= \frac{R3}{\varphi}\frac{\partial}{\partial R3}\left(\frac{R2}{R3}\right)$$

$$\frac{\cancel{R3}}{\cancel{\varphi}}(-)\overbrace{\frac{R2}{R3^{\cancel{2}}}}^{\varphi} \Rightarrow \boxed{S_{R3}^{\varphi} = -1}$$

Hacer un FPB

Si tomamos la salida en VA capaz nos pone un cero en la transferencia...

$\frac{V_A}{V_1}$; $V_A = -V_B \cdot sC \cdot R_3$

$V_A = V_O \cdot sC \cdot R_3$

$\Rightarrow -V_A\left(\frac{1}{R_2}+sC\right) - V_A\left(\frac{V_O}{V_A}\right)\cdot\frac{1}{R_3} = \frac{V_1}{R_1}$

$-V_A\left(\frac{1}{R_2}+sC\right) - V_A \frac{1}{sC\cdot R_3}\frac{1}{R_3} = \frac{V_1}{R_1}$

$-V_A\left[\frac{1+sC\cdot R_2}{R_2}+\frac{1}{sC R_3^2}\right]=\frac{V_1}{R_1}$

$-V_A\left(\frac{sCR_3^2(1+sCR_2)+R_2}{s\cdot C\cdot R_2\cdot R_3^2}\right)=\frac{V_1}{R_1}$

$-V_A \frac{s^2\cdot C^2\cdot R_2\cdot R_3^2+s\cdot C\cdot R_3^2+R_2}{s\cdot C\cdot R_2 R_3^2}=\frac{V_1}{R_1}$

$\frac{V_A}{V_1} = -\frac{1}{R_1}\frac{s\cdot C\cdot R_2\cdot R_3^2}{s^2\cdot C^2\cdot R_2\cdot R_3^2+s\cdot C\cdot R_3^2+R_2}$

$= -\frac{1}{R_1}\underbrace{\frac{C\,\overset{q}{R_2}\,R_3^2}{C^2 R_2 R_3^2}}_{\omega_0}\frac{s}{s^2+s\frac{1}{CR_2}+\frac{1}{C^2R_3^2}}$; $F_{P_b} = \frac{s\frac{\omega_0}{q}}{s^2+\frac{\omega_0}{q}s+\omega_0^2}$

$\frac{\cancel{C}\cdot R_2\cdot R_3^2}{\cancel{C}\cdot C\cdot R_2\cdot \cancel{R_3}\cdot R_3}$; $\omega_0=\frac{1}{C\cdot R_3}$; $\frac{\omega_0}{q}=\frac{1}{CR_2}=\frac{1}{CR_3}\frac{1}{q}$

$q = R_2/R_3$

$\frac{\omega_0}{q}\cdot R_2 = \cancel{\frac{R_2}{R_3}R_2}\ \frac{1}{C\cdot R_3}\cdot R_2\ \frac{R_3}{R_2} \Rightarrow \omega$

=> Opero para expresarlo como t2l

$$\cancel{\frac{V_A}{V_1} = -\frac{1}{R_1} \frac{C \cdot R_3^2}{C \cdot R_2}} \quad \omega$$

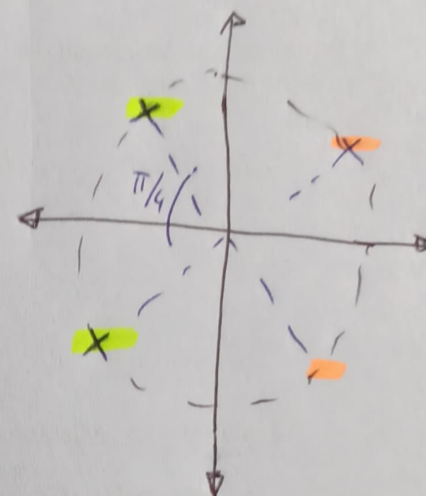
FILTRO PASA BANDA

$$\frac{V_A}{V_1} = -\frac{R_2}{R_1} \qquad \frac{\$ \cdot \omega_0/q}{\$^2 + \$ \cdot \omega_0/q + \omega_0^2} = \boxed{-\frac{R_2}{R_1} \frac{\$ \frac{1/C R_3}{R_2/R_3}}{\$^2 + \$ \, 1/C \cdot R_2 + 1/C^2 \cdot R_3^2}}$$

BUTTER

$$|T(j\omega)|^2 = \frac{1}{1+\underbrace{\varepsilon^2}_{1}\cdot\omega^{2n}} \;;\quad n=2 \Rightarrow \frac{1}{1+\omega^{2\cdot 2}}$$

$$\Rightarrow |T(j\omega)|^2\Big|_{\omega=\frac{\$}{j}} = \frac{1}{1+\$^4} \Rightarrow$$



Inestable

Estable

$$|T(\$)|^2 = T(\$)\cdot T(-\$)$$

$$T(\$) = \frac{1}{\$^2+\$\,1/Q+1} = \frac{1}{\$^2+\$\cdot\underbrace{2\cos\varphi}+1} \equiv \frac{1}{\$^2+\$\,1/Q+1}$$

$Q \to R2/R3$

$$\Rightarrow 2\cdot\cos(\pi/4) = \frac{R3}{R_2} \to 1\Omega$$

$$R_2 = \frac{1}{2\cos(\pi/4)}$$

YA había hecho un gráfico en la hoja #3 que indicaban que el Q depende de R_2 ←

$$\boxed{R_2 = \frac{\sqrt{2}}{2}}$$