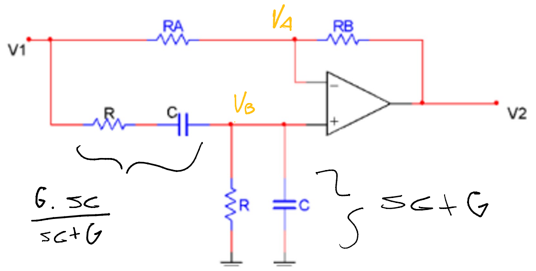
TP1-7B

A. Obtener la función transferencia $\frac{V_2}{V_1}$ ( módulo , fase y diagrama de polos y ceros).
B. Obtenga la función transferencia, pero **normalizada.** ¿Cuál sería en este caso la norma de frecuencia y qué interpretación circuital podría tener?
C. Simule la función transferencia normalizada (Python, Matlab, etc.).
D. Simule el circuito y obtenga la respuesta en frecuencia pedida en A, para los valores indicados a continuación.
E. ¿Qué utilidad podría tener este tipo de circuitos pasa-todo?

- R2/R1 = 1
- R3 = 1 kΩ
- C = 1 µF

- RA/RB = 5
- R = 1 kΩ
- C = 1 µF

B)




$$V_A\cdot(G_A+G_B) - V_1\cdot G_A - V_2\cdot G_B = 0$$

$$V_A = V_B = V_1\cdot\frac{s\cancel{C}G}{\cancel{C}(s+G/C)\cdot\left(\frac{sG}{(s+G/C)} + G+sC\right)}$$

$$\to V_A = V_1\cdot\frac{sG}{\cancel{(s+G/C)}\cdot\left(\frac{sG+sG+G^2/C+s^2C+sG}{\cancel{(s+G/C)}}\right)} = V_1\cdot\frac{sG}{[s^2C+s\cdot G\,3+G^2/C]}$$

$\hookrightarrow P_s$

$$= V_1\cdot\frac{sG}{P_s}(G_A+G_B) - V_1\cdot G_A - V_2 G_B = 0$$

$$= V_1\left(\frac{sG}{P_s}\cdot G_A + \frac{sG}{P_s}G_B - G_A\right) = V_2 G_B$$

$$M(s) = \frac{1}{G_B}\cdot\left(\frac{sG\cdot G_A + sG\cdot G_B - G_A\cdot P_s}{P_s}\right)$$

$$= \frac{1}{G_B}\cdot\left[\frac{-s^2C\cdot G_A + sG(\cancel{G_A}+G_B-\cancel{3}^{2}G_A) - G^2/C\cdot G_A}{s^2C+s\cdot G\,3+G^2/C}\right]$$

$$= -\frac{\cancel{C}\cdot G_A}{G_B\cdot\cancel{C}}\left[\frac{s^2 - s\frac{G}{CG_A}\cdot(G_B-2G_A)+\frac{G^2}{C^2}}{s^2+s\frac{3G}{C}+\frac{G^2}{C^2}}\right]$$

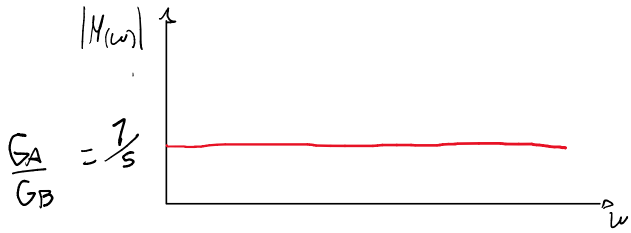
$$M(s) = -\frac{G_A}{G_B}\cdot\frac{s^2 - s\frac{G}{C}\cdot\frac{1}{\cancel{G_A}}\cdot\overbrace{(5\cancel{G_A}-2\cancel{G_A})}^{3} + G^2/C^2}{s^2+s\frac{G}{C}3+G^2/C^2}$$

$$\boxed{H_{(s)} = -\frac{G_A}{G_B} \cdot \left( \frac{s^2 - s\,\frac{G}{C}\cdot 3 + G^2/C^2}{s^2 + s\,\frac{G}{C}\,3 + G^2/C^2} \right)}$$

$$\frac{G_B}{G_A} = 5$$

$$|H_{(j\omega)}| = \left| -\frac{1}{5} \cdot \left( \frac{-\omega^2 + G^2/C^2 - j\omega\,\frac{G}{C}\,3}{-\omega^2 + G^2/C^2 + j\omega\,\frac{G}{C}\,3} \right) \right|$$

$$= \frac{1}{5} \cdot \cancel{\frac{\sqrt{(G^2/C^2 - \omega^2)^2 + (-\omega\frac{G}{C}3)^2}}{\sqrt{(G^2/C^2 - \omega^2)^2 + (-\omega\frac{G}{C}3)^2}}} = \frac{1}{5}$$

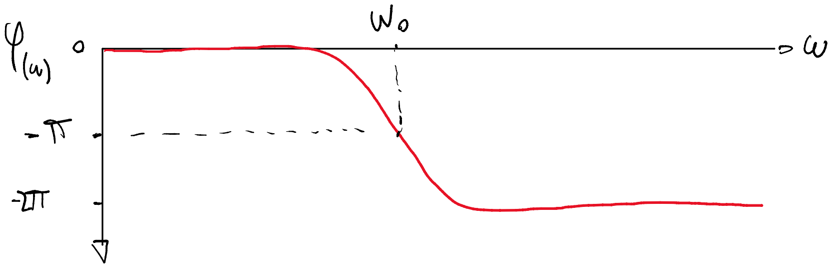



$$\varphi_{(\omega)} = \operatorname{arctg}\left( \frac{-\omega\,\frac{G}{C}3}{\left(\frac{G^2}{C^2} - \omega^2\right)} \right) - \operatorname{arctg}\left( \frac{\omega\,\frac{G}{C}3}{\left(\frac{G^2}{C^2} - \omega^2\right)} \right)$$

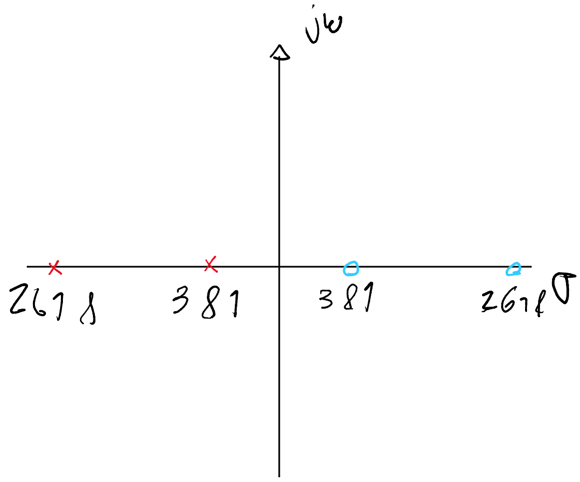
$\rightarrow$ $\omega = 0 \rightarrow \varphi_{(0)} = 0$

$\rightarrow$ $\omega = \frac{G}{C} \rightarrow \varphi\left(\frac{G}{C}\right) = -\frac{\pi}{2} - \frac{\pi}{2} = -\pi$

$\rightarrow$ $\varphi_{(\omega \to +\infty)} = \operatorname{arctg}\left( \frac{-\omega\, 1}{+\omega^2} \right) - \operatorname{arctg}\left( \frac{\omega}{-\omega^2} \right) = 0 - 0 = 0 = -2\pi$



Polos y Ceros :




Normalizado :

$$\boxed{M_{(s)} = -\frac{G_A}{G_B} \cdot \left(\frac{s^2 - s\,\frac{G}{C}\cdot 3 + G^2/C^2}{s^2 + s\,\frac{G}{C}\,3 + G^2/C^2}\right)}$$

↳ $\frac{\omega_0}{q} = \frac{G}{C}\cdot 3$ ; $\omega_0^{\cancel{2}} = \left(\frac{G}{C}\right)^{\cancel{2}}$

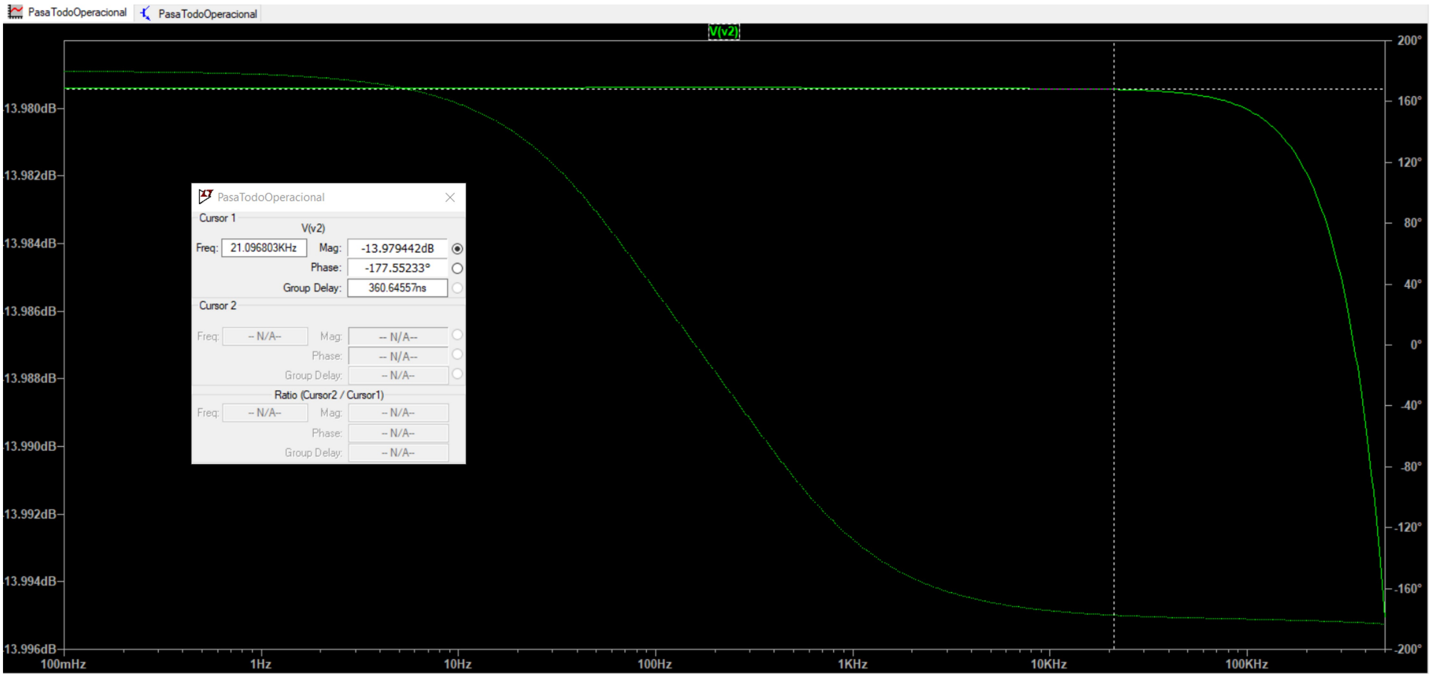
↳ $\frac{\cancel{\omega_0}}{q} = \cancel{\omega_0}\cdot 3 \to \boxed{q = 1/3}$

Fijo

$$\omega_0 = \frac{G}{C} \to \omega_0 = 1 = \frac{G \to 1}{C \to 1}$$

$$\boxed{H_{(s)} = -\frac{G_A}{G_B} \cdot \left( \frac{s^2 - s \cdot 3 + 1}{s^2 + s\,3 + 1} \right)}$$

## Simulacion




$$-13{,}97\,dB \equiv \left[\frac{1}{5}\right]_{Veces}$$