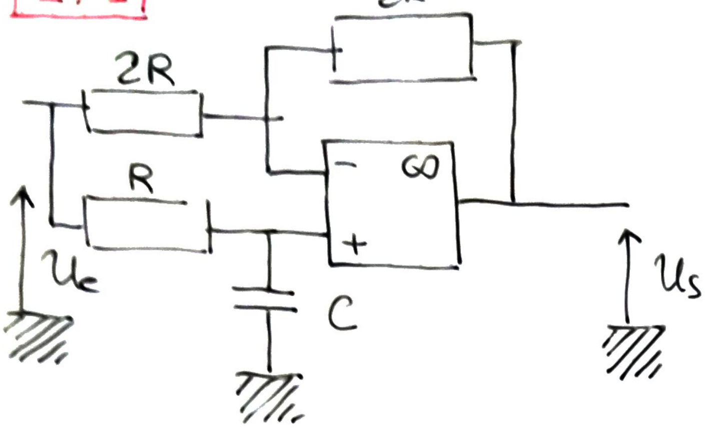
EXP AOP 2

$\boxed{1/1}$



$$V_- = V_+ \iff \frac{\frac{u_s}{2R} + \frac{u_e}{2R}}{\frac{1}{2R} + \frac{1}{2R}} = \frac{\frac{0}{\frac{1}{jC\omega}} + \frac{u_e}{R}}{jC\omega + \frac{1}{R}}$$

$$\iff \frac{u_s + u_e}{2} = \frac{u_e}{jx + 1}$$

$$\iff u_s = u_e\left(\frac{2}{jx+1} - 1\right)$$

$$\iff \frac{u_s}{u_e} = \underline{H} = \frac{1 - jx}{1 + jx}$$

$\boxed{1/2}$

$$20 \log |\underline{H}| = 20 \cdot \log \frac{\sqrt{x^2 + (-1)^2}}{\sqrt{x^2 + 1^2}}$$

$$= 20 \log 1$$

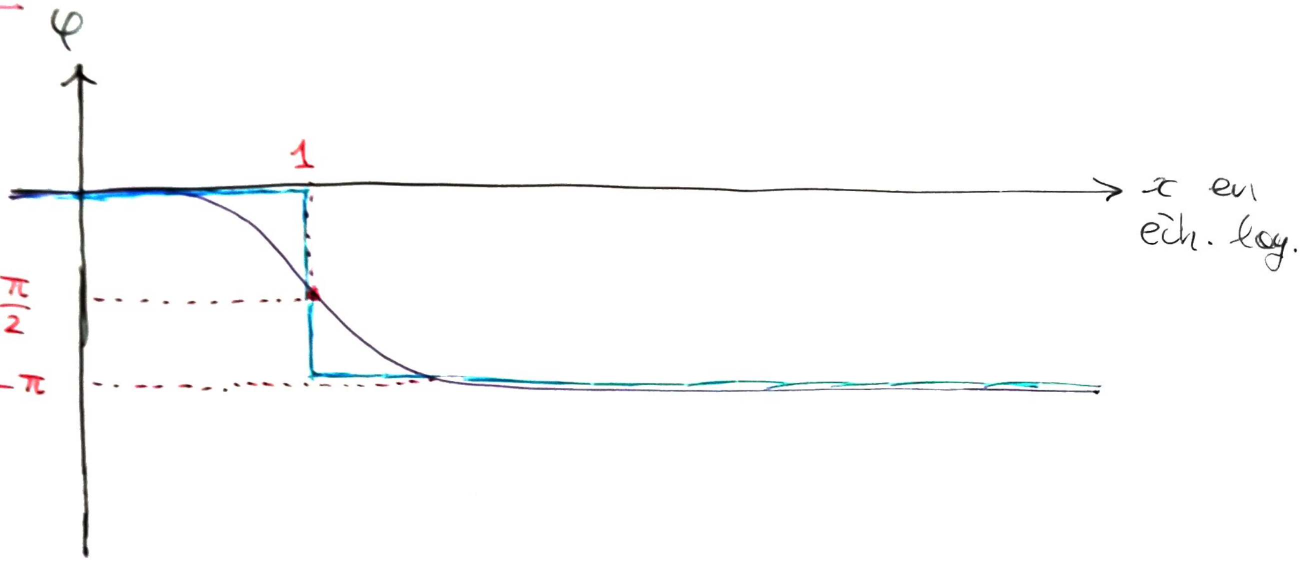
$$= 0 \text{ dB}$$

Posons $\psi := \arg(1 + jx)$ et $\varphi = \arg \underline{H}$

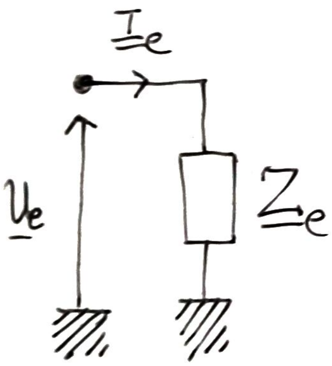
$$\varphi = \arg(1 - jx) - \psi = -\psi - \psi = -2\psi$$

$$= -\varphi + \arg(\overline{1+jx})$$
$$= -\varphi - \varphi$$
$$= -2\varphi$$
$$= -2 \arctan x$$

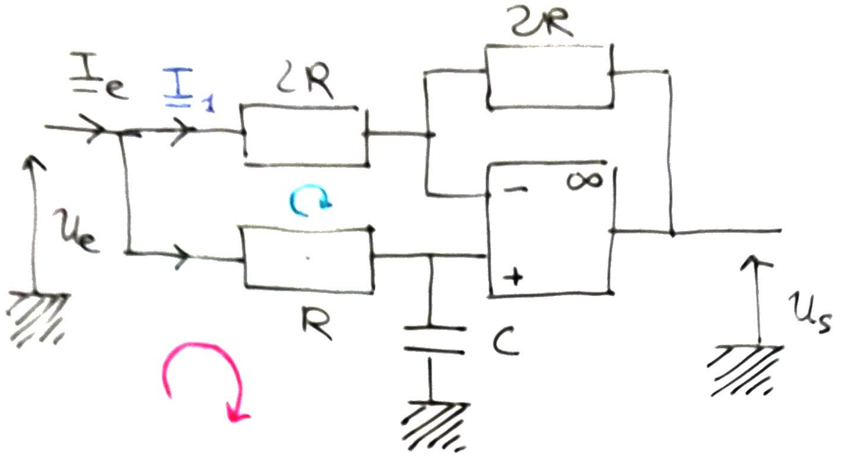
$\boxed{1/3}$



$\boxed{1/4}$ Vu de l'entrée, le montage est équivalent à



$$\underline{U}_e = \underline{Z}_e \, \underline{I}_e$$



Maille

$$2R\underline{I}_1 + R(\underline{I}_e - \underline{I}_1) = 0$$

$$\Leftrightarrow \quad -2\cancel{R}\underline{I}_1 = \cancel{R}(\underline{I}_e - \underline{I}_1)$$

$$\Leftrightarrow \underline{I}_e = 3\underline{I}_1$$

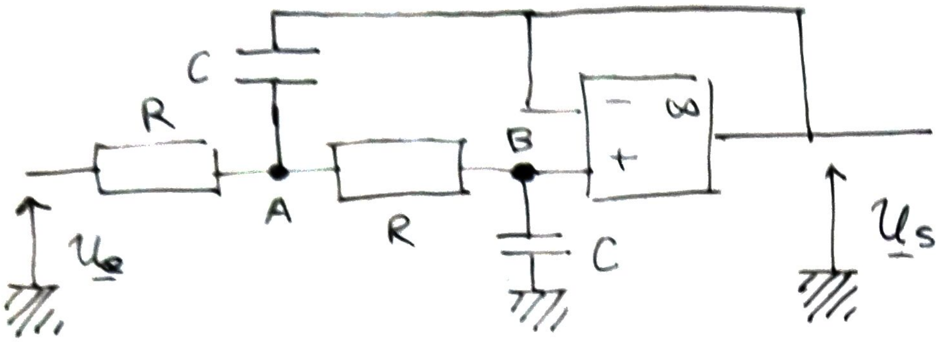
Maille

$$\underline{U}_e - \left(R + \frac{1}{jC\omega}\right)(\underline{I}_e - \underline{I}_1) = 0$$

$$\underline{U}_e = \left(R + \frac{1}{jC\omega}\right)\left(\frac{2}{3}\underline{I}_e\right)$$

$$= \underbrace{\frac{2}{3}\left(R + \frac{1}{jC\omega}\right)}_{Z_e}\underline{I}_e$$

3/1



$$V_+ = V_B = \frac{0\, jC\omega + \frac{V_A}{R}}{jC\omega + \frac{1}{R}} = V_- = \boxed{\frac{V_A}{jRC\omega + 1} = \underline{U}_s}$$

$$V_A = \frac{\frac{\underline{U}_e}{R} + \frac{V_B}{R} + jC\omega \underline{U}_s}{\frac{1}{R} + \frac{1}{R} + jC\omega}$$

$$= \frac{\underline{U}_e + V_B + jRC\omega \underline{U}_s}{2 + jRC\omega}$$

$$= \frac{\underline{U}_e + \underline{U}_s + jRC\omega \underline{U}_s}{2 + jRC\omega}$$

$$= \frac{\underline{U}_e + \underline{U}_s(1 + jRC\omega)}{2 + jRC\omega}$$

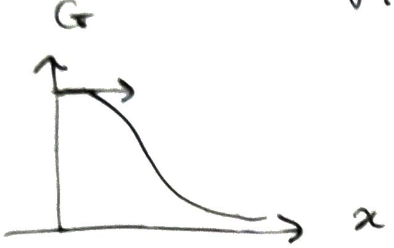
$$(1 + jRC\omega)\underline{U}_s = \frac{\underline{U}_e + \underline{U}_s(1 + jRC\omega)}{2 + jRC\omega}$$

$$\underline{U}_s\big((1 + jRC\omega)(2 + jRC\omega) - (1 + jRC\omega)\big) = \underline{U}_e$$

$$\Leftrightarrow \underline{H} = \frac{1}{(1 + jRC\omega)(2 + jRC\omega) - (1 + jRC\omega)} = \frac{1}{(1 + jx)^2}$$

3/2

$$|\underline{H}| = \frac{1}{\sqrt{1^2+x^2}^{\,2}} = \frac{1}{1+x^2} = G$$



~ passe-bas

On recherche

$$G(x_c) = \frac{\max G}{\sqrt{2}}$$

$$\Leftrightarrow G(x_c) = \frac{1}{\sqrt{2}}$$

$$\Leftrightarrow \frac{1}{1+x_c^2} = \frac{1}{\sqrt{2}}$$

$$\Leftrightarrow 1 + x_c^2 = \sqrt{2}$$

$$\Leftrightarrow x_c = \sqrt{\sqrt{2}-1}$$

3/4