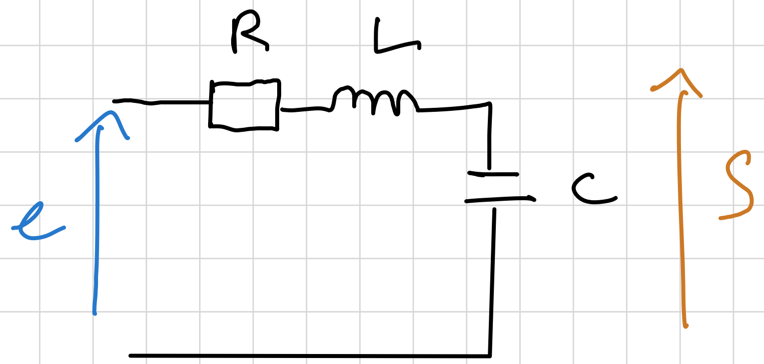
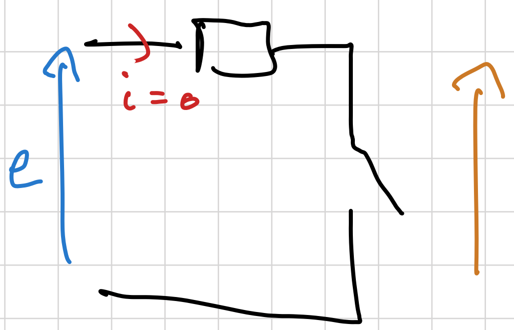
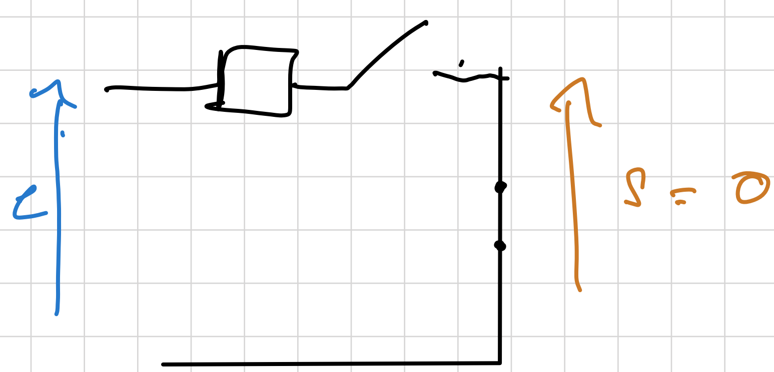
Mercredi 14 Juin

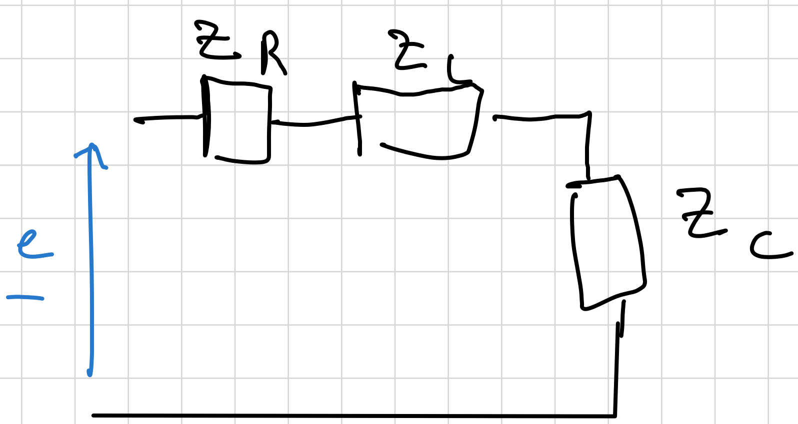


BF :



HF





Donc

$$s = \frac{\underline{Z_C}}{\underline{Z_C} + \underline{Z_R} + \underline{Z_L}} \underline{e}$$

$$Z_C = \frac{1}{jC\omega} \qquad Z_L = jL\omega$$

$$H = \frac{1}{jRC\omega - LC\omega^2 + 1}$$

BF : $\underline{H} \sim \frac{1}{1}$ HF : $\underline{H} \sim \frac{1}{LC\omega^2}$

On obtient : $G_{dB} = 20 \log \left| \frac{\omega_0^2}{\omega^2} \right|$

$$\omega_0 = \frac{1}{\sqrt{LC}} \qquad Q = \frac{1}{R}\sqrt{\frac{L}{C}} \qquad RC = \frac{1}{Q} C \sqrt{\frac{L}{C}}$$

$$= \frac{1}{\omega_0 Q}$$

$$H = \frac{1}{1 - \frac{\omega^2}{\omega_0^2} + j\frac{\omega}{Q\omega_0}} = \frac{1}{1 - x^2 + j\frac{x}{Q}}$$

$$|H| = \frac{1}{\sqrt{(1-x^2)^2 + \frac{x^2}{Q^2}}}$$

Posons $X = x^2$.

$$f(X) = 1 + X^2 - 2X + \frac{X}{Q^2}$$

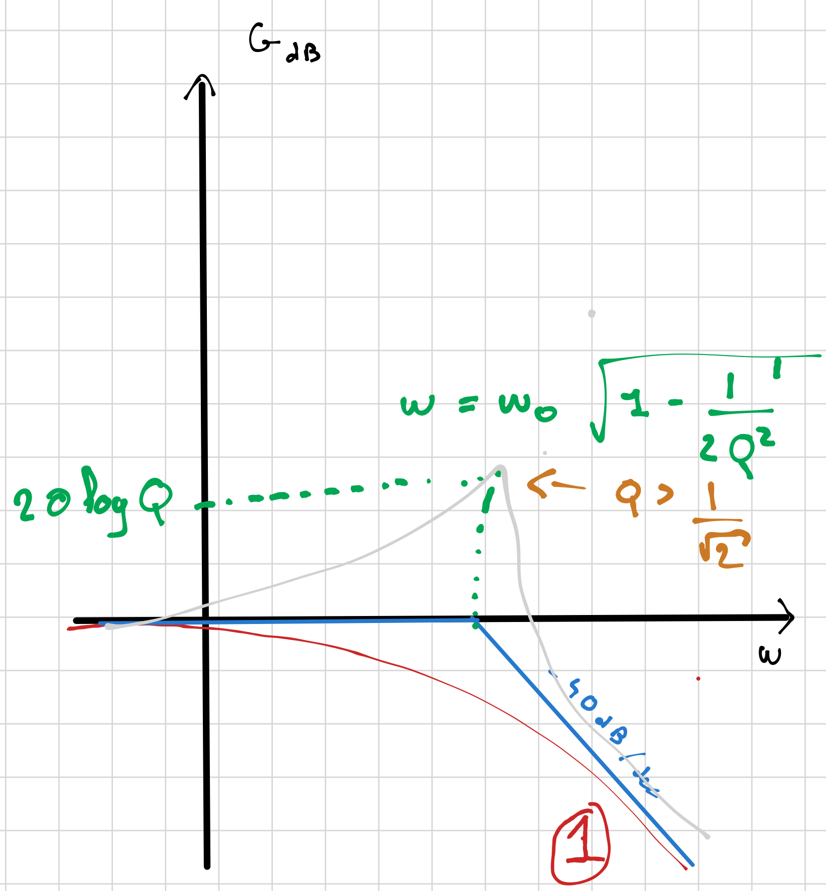
$$= X^2 + \left(\frac{1}{Q^2} - 2\right)X + 1$$

$$f'(X) = 2X + \frac{1}{Q^2} - 2.$$

$f'(X) = 0$ pour $X = 1 - \frac{1}{2Q^2}$

Si $1 - \frac{1}{2Q^2} > 0$ alors

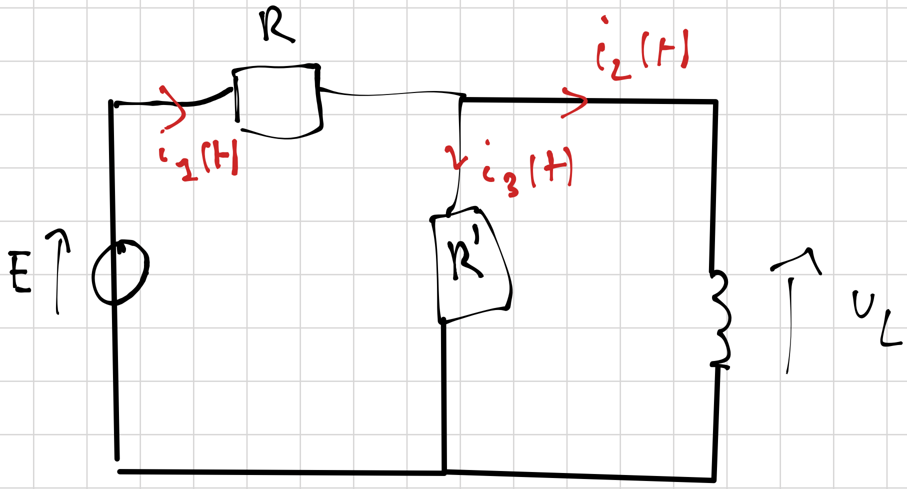
X	0		$1 - \frac{1}{2Q^2}$		$+\infty$
$f'(X)$		$-$	0	$+$	
$f(X)$		$\searrow$		$\nearrow$	



Électrocinétique

Exercice 2 :

Schéma :



1) $u_L = L \dfrac{di_2}{dt}$

$E = i_1 R + u_L$

$\hookrightarrow i_1 = \dfrac{E}{R} - \dfrac{L}{R}\dfrac{di_2}{dt}$

$R' i_3 = L \dfrac{di_2}{dt}$

$R'(i_1 - i_2) = L \dfrac{di_2}{dt}$

Alors :

$$\frac{R'}{R} E = \left(L + \frac{R'L}{R}\right)\frac{di_2}{dt} + R' i_2 .$$

$$\Leftrightarrow \frac{R' E}{L(R+R')} = \frac{di_2}{dt} + \frac{1}{\tau} i_2 \quad \text{avec} \quad \tau = \frac{L(R+R')}{RR'}$$

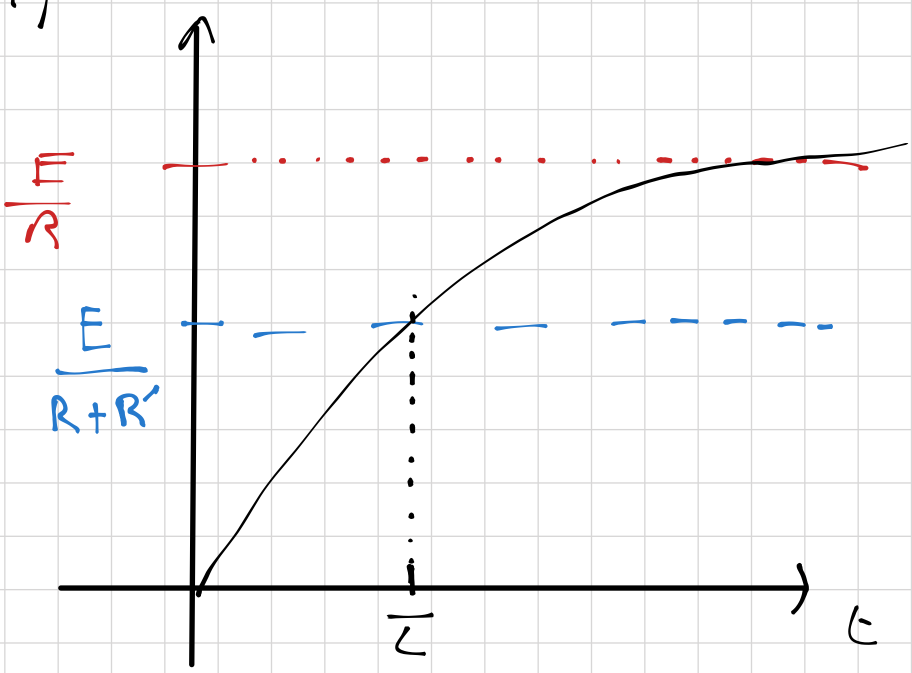
$$i_2(t) = A e^{-\frac{1}{\tau}t} + \frac{E}{R}$$

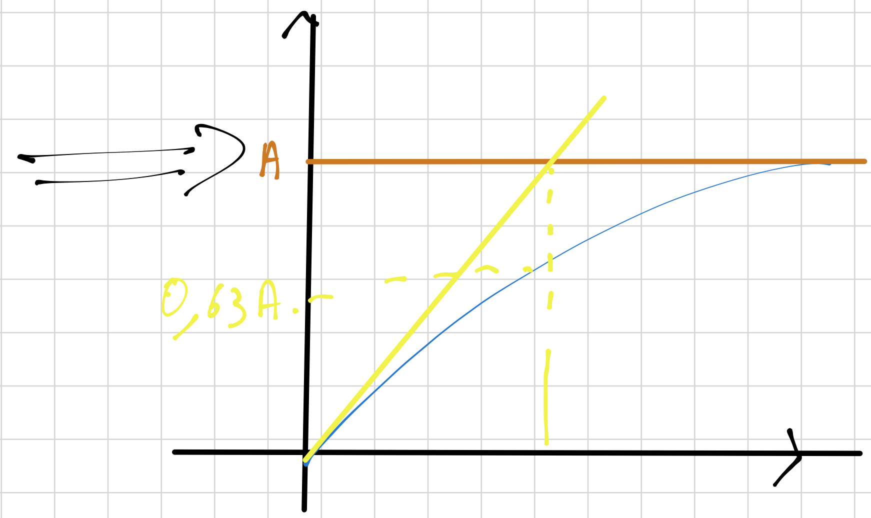
$$U_L = L\frac{di_2}{dt} = i_3 R' \quad \text{alors} \quad i_3(t) = \frac{L}{R'}\frac{di_2}{dt}$$

$$= \frac{LE}{R'R\tau} e^{-\frac{1}{\tau}t}$$

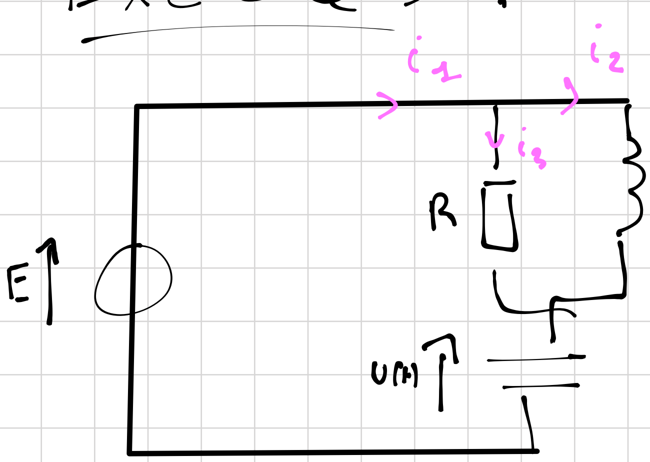
$$= \frac{E}{R+R'} e^{-\frac{1}{\tau}t}$$

4)





Exercice 3 :



$U_R = R \times i_3$

$U_L = L \times \frac{di_2}{dt}$

$i_1 = C \times \frac{du}{dt}$

$$i_1 = i_2 + i_3$$

$$\frac{di_1}{dt} = \frac{di_2}{dt} + \frac{di_3}{dt}$$

$$\Rightarrow C \times \frac{d^2 u}{dt} = \frac{e-u}{L} - \frac{1}{R}\frac{du}{dt}$$

$$\frac{d^2 u}{dt} + \frac{1}{RC}\frac{du}{dt} = \frac{e-u}{LC}$$

$$\Rightarrow \frac{d^2 u}{dt} + \frac{1}{RC}\frac{du}{dt} + \frac{1}{LC}u = \frac{e}{LC}$$

On a : $\omega_0^2 = \frac{1}{LC} \Rightarrow \omega_0 = \frac{1}{\sqrt{LC}}$

$$\frac{\omega_0}{Q} = \frac{1}{RC}$$

$$\Rightarrow Q = R \times \sqrt{\frac{C}{L}} .$$

$$\frac{d^2 u}{dt^2} + \frac{\omega_0}{Q}\frac{du}{dt} + \omega_0^2 u = 0$$

$$X^2 + \frac{\omega_0}{Q} X + \omega_0^2$$

$$\Delta = \frac{\omega_0^2}{Q^2} - 4\omega_0^2$$

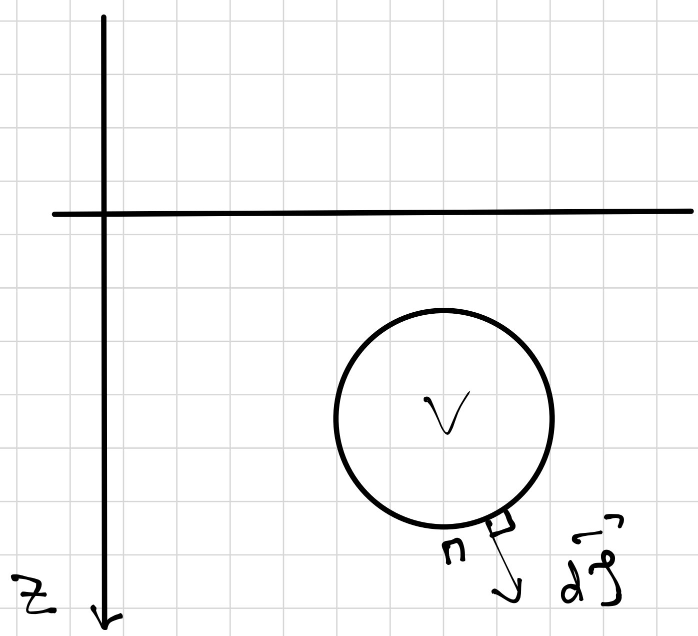
$$= 4\omega_0^2 \left(\frac{1}{4Q^2} - 1 \right)$$

$\boxed{Q > \frac{1}{2} : \text{pseudo-périodique}}$

$$X = \frac{-\frac{\omega_0}{Q} \pm j\, 2\omega_0 \sqrt{1 - \frac{1}{4Q^2}}}{2} = \underbrace{\frac{-\omega_0}{2Q}}_{-\frac{1}{\tau}} \pm \underbrace{j\, \omega_0 \sqrt{1 - \frac{1}{4Q^2}}}_{\Omega}$$

$$u = A e^{x_1 t} + B e^{x_2 t}$$
$$= e^{-\frac{t}{\tau}} \left(A e^{j\Omega t} + B e^{-j\Omega t} \right)$$
$$= U_0 e^{-\frac{t}{\tau}} \cos(\Omega t + \varphi)$$

Rappel : Poussé Archimède

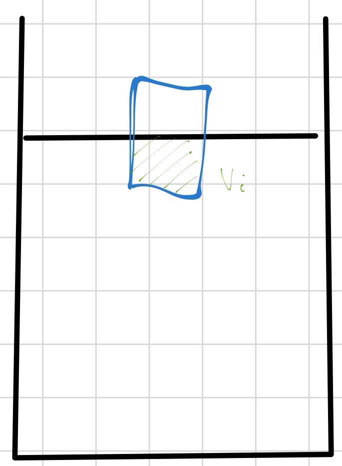


$$\vec{F} = \iint_S -P(M)\, d\vec{S}.$$

$$\vec{F} = -\rho_{fluide}\, \vec{g}\, V_{immergé}$$

$$P = \rho_{objet}\, V_{objet}\, \vec{g}$$

$$\frac{dP}{dz} = \rho g$$



V = Volume total

On cherche V_i

PFD : $m\vec{a} = 0 = mg\vec{z} - V_i \rho_{eau} g \vec{z}$.

$$0 = \rho_g V - V_i \rho_{eau}$$

alors $V_i = \dfrac{\rho_g V}{\rho_{eau}}$

Convertion de la masse :

$$\rho_g V = \rho_{eau} V_f$$

$$V_f = \frac{\rho_g}{\rho_{eau}} V = V_i$$