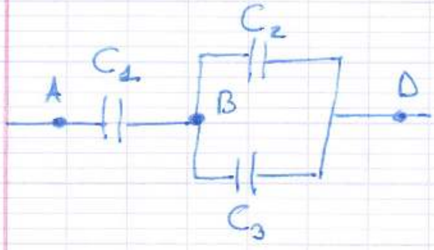
Régime variable :

I / Condensateur :

$$\mathcal{E}_{elec} = \frac{1}{2} C u \qquad \begin{cases} \mathcal{E}_{elec} : J \\ C : \text{Farad} \\ u : V \end{cases}$$

Association en parallèle / série

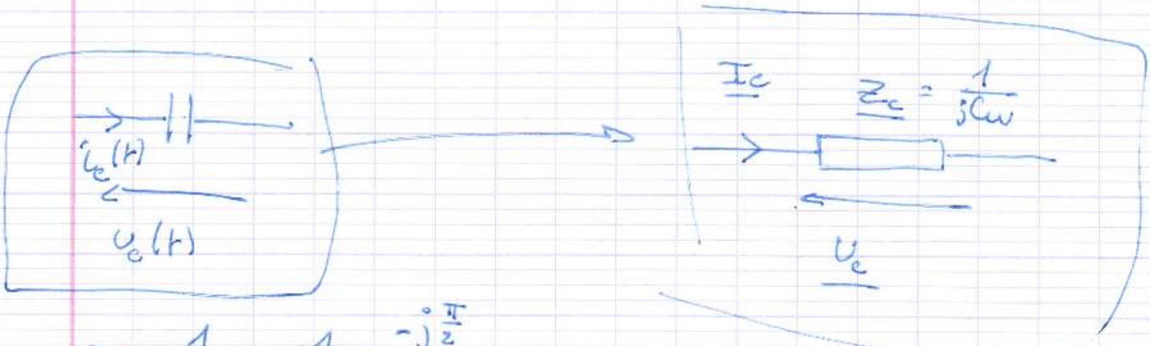


Entre les points B et D (associat° parallèle) :

$$C_{BD} = C_2 + C_3 .$$

Entre les points A et D (associat° série) :

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_{BD}} = \frac{C_1 + C_2 + C_3}{C_1(C_2 + C_3)} \text{ soit } \frac{C_1(C_2+C_3)}{C_1 + C_2 + C_3} .$$



$$\underline{Z_c} = \frac{1}{jC\omega} = \frac{1}{C\omega} e^{-j\frac{\pi}{2}}$$

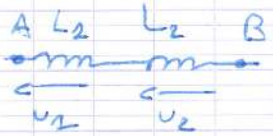
II / - Bobine :

$u = L\frac{di}{dt}$ $\begin{cases} u = V \\ L = \text{Henri} \\ i = A \end{cases}$

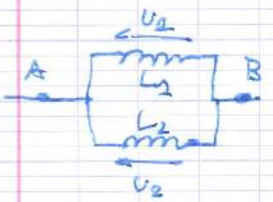
$i(t) = \frac{U}{L}t$

$\mathcal{E}_{mag} = \frac{1}{2}Li^2$ $\begin{cases} \mathcal{E}_{mag} = J \\ L = \text{Henri} \\ i = A \end{cases}$

Association de bobine :



$L = L_1 + L_2$.



$\frac{1}{L} = \frac{1}{L_1} + \frac{1}{L_2}$

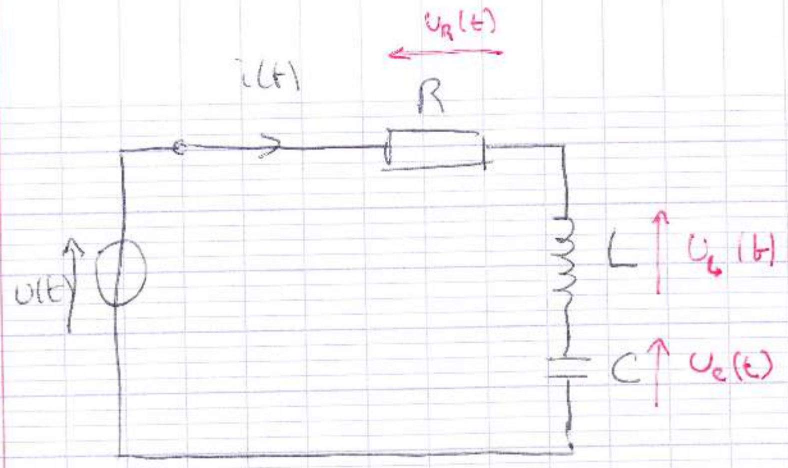
III / - Associations de dipoles linéaires

$i = C\frac{du_2}{dt}$

$u_1 = L\frac{di}{dt} + ri$

$u = u_1 + u_2 = L\frac{di}{dt} + ri + u_2$

6)



$U_R(t) = R.i(t)$ ⇒ la loi d'Ohm est applicable en instantanée (variable)

$U_L(t) = L.\frac{di(t)}{dt}$

$i_c(t) = C.\frac{du_c(t)}{dt}$ $\quad U_C(t) = \frac{q(t)}{C}$

$i(t) = \frac{dq(t)}{dt}$

$u(t) = R.i(t) + L\frac{di(t)}{dt} + u_c(t)$

$u(t) = R.\frac{dq(t)}{dt} + L\frac{d^2q(t)}{dt^2} + \frac{1}{C}.q(t)$

$u(t) = L.\frac{d^2q}{dt} + R\frac{dq}{dt} + \frac{1}{C}q(t).$

Equat° homogène $\quad Lr^2 + Rr + \frac{1}{C} = 0$

$\Delta = R^2 - \frac{4L}{C}$

$\Delta > 0$

$r_1 = \frac{-R + \sqrt{R^2 - \frac{4L}{C}}}{2L}$

$r_2 = \frac{-R - \sqrt{R^2 - \frac{4L}{C}}}{2L}$

$\Delta < 0$

$z_1 = \frac{-R + i\sqrt{\frac{4L}{C} - R^2}}{2L}$

$z_2 = \frac{-R - i\sqrt{\frac{4L}{C} - R^2}}{2L}$

$\Delta = 0$

$r_0 = \frac{-R}{2L}$

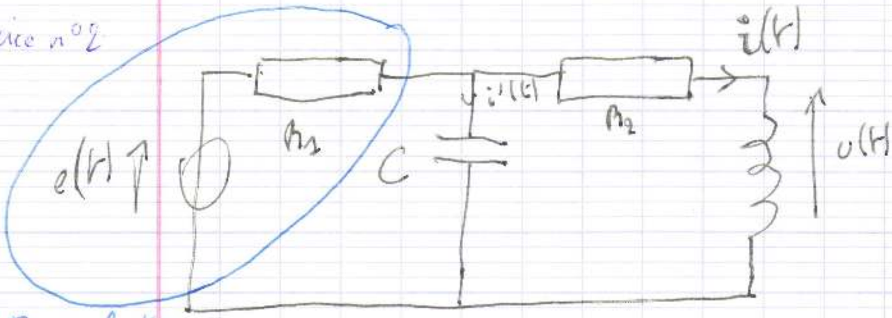
Electro
13/02

$$\boxed{u(t) = \frac{E}{\sqrt{1+(RC\omega)^2}} \sqrt{2} \sin(\omega t - \text{Arctan}(RC\omega))}$$

b/

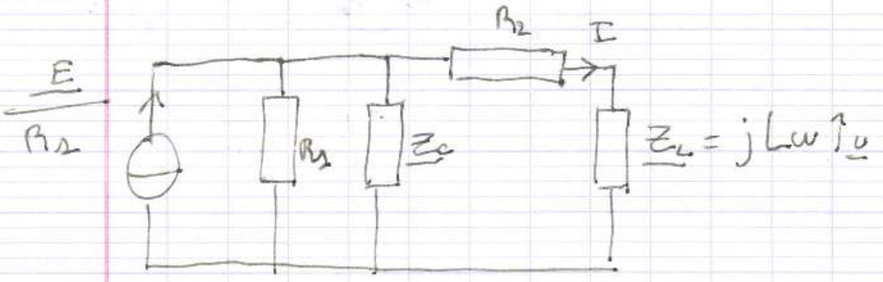
$$u(t) = \frac{5V}{\sqrt{1+(1{,}732\times10^{3} \times 10\times10^{-9}\,\omega)^2}} \sqrt{2} \sin(\omega t - \ldots$$

Exercice n°2



$e(t) = E_M \sqrt{2} \sin(\omega t)$

Equivalente Thevenin - Norton



Pont diviseur de courant.

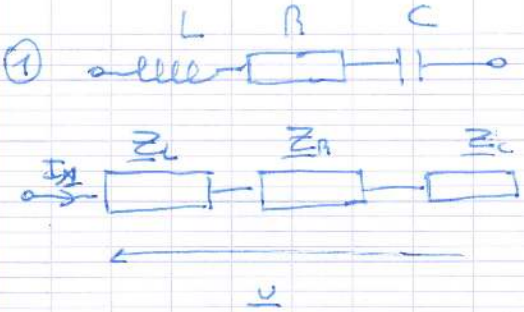
$$I = \frac{E}{R_1} \times \frac{\frac{1}{R_2 + jL\omega}}{\frac{1}{R_1} + jC\omega + \frac{1}{R_2 + jL\omega}} = \frac{\frac{E}{R_2 + jL\omega}}{R_1 jC\omega + \frac{R_1}{R_2 + jL\omega} + 1}$$

$$= \frac{E}{R_1 + R_2 - R_1 LC\omega^2 + j(R_1 R_2 C\omega + L\omega)}$$

$$I = \frac{E}{\sqrt{(R_1 + R_2 - R_1 LC\omega^2)^2 + (R_1 R_2 C\omega + L\omega)^2}} \qquad \varphi_I = \text{Arctan}\left(\frac{R_1 R_2 C\omega + L\omega}{R_1 + R_2 - R_1 LC\omega^2}\right)$$

Exercice n°3 :

(1)



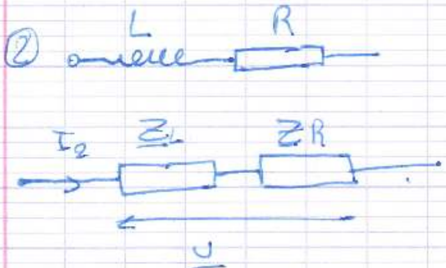
$\underline{Z}_1 = \underline{Z}_L + \underline{Z}_R + \underline{Z}_C$
$= R + j\left(L\omega - \frac{1}{C\omega}\right)$

$I_1 = \frac{U}{Z_1}$

Module $Z_1 = \sqrt{R^2 + \left(L\omega - \frac{1}{C\omega}\right)^2}$

$\underline{Z}_2 = R + jL\omega$

(2)



$I_2 = \frac{U}{Z_2}$

$|\underline{Z}_2| = Z_2 = \sqrt{R^2 + (L\omega)^2}$

(3)

$\underline{Z}_3 = j\left(\frac{-1}{C\omega}\right) = \frac{1}{jC\omega}$
$= j\left(-\frac{1}{C\omega}\right)$
$I_3 = \frac{U}{Z_3}$

$Z_3 = \frac{1}{C\omega}$

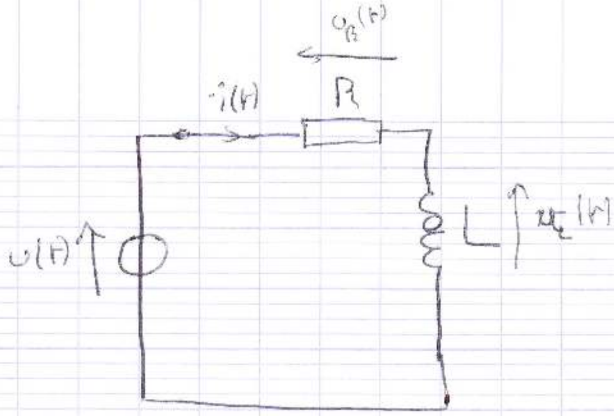
$Z_1^2 = Z_2^2 = Z_3^2$

$R^2 + \left(L\omega - \frac{1}{C\omega}\right)^2 = R^2 + (L\omega^2) = \left(\frac{1}{C\omega}\right)^2$

$R^2 + (L\omega)^2 - \frac{2L}{C} + \left(\frac{1}{C\omega}\right)^2 = R^2 + (L\omega)^2 = \left(\frac{1}{C\omega}\right)^2$

$LC\omega^2 = \frac{1}{2}$

$(C\omega)^2 \cdot R^2 = (L\omega)^2 (C\omega)^2 = 1$
$(RC\omega)^2 + L^2C^2\omega^4 = 1$



$u_R(t) = R.i(t)$

$u_L(t) = L.\frac{di(t)}{dt}$

$u(t) = U.\sqrt{2}\,\sin(\omega t) = U_n \cdot \sin(\omega t)$

$u(t) = R.i(t) + L\frac{di(t)}{dt}$

$i(t) = I_n \sin(\omega t + \varphi)$

$U_M.\sin(\omega t) = R.I_N \sin(\omega t + \varphi) + L.\omega \overset{I_N}{} \cos(\omega t + \varphi)$

$U_M.\sin(\omega t) = I_n(R\sin(\omega t + \varphi) + L\omega\cos(\omega t + \varphi))$

$I_N = \frac{U_M.\sin(\omega t)}{R\sin(\omega t + \varphi) + L\omega\cos(\omega t + \varphi)}$

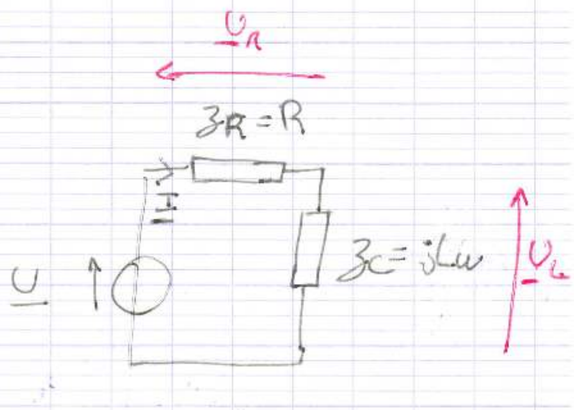
$U_M \sin(\omega t) = R.I_N.\sin(\omega t)\cos(\varphi) - L\omega.I_N.\sin(\varphi)\sin(\omega t)$
$\quad + R.I_N.\sin(\varphi)\cos(\omega t) + L\omega I_N \cos(\varphi).\cos(\omega t)$

$$\begin{cases} U_M = R.I_N\cos(\varphi) - L\omega I_N \sin(\varphi) \\ 0 = R.I_N.\sin(\varphi) + L\omega.I_N.\cos(\varphi) \end{cases}$$

$\tan\varphi = \frac{-L\omega}{R}$

2e méthode

$\underline{U} = Ue^{j\varphi_u} = U$



$\underline{U} = R.\underline{I} + jL\omega\,\underline{I}$

$\underline{U} = (R + jL\omega).\underline{I}$

$\underline{I} = \frac{\underline{U}}{R + jL\omega} = \frac{U.e^{j0}}{\sqrt{R^2 + (L\omega)^2}\,e^{j\text{Arctan}\left(\frac{L\omega}{R}\right)}}$

$\underline{U}_R = R.\underline{I}$

$\underline{U}_L = Z_L.\underline{I} = jL\omega \times \underline{I}$

$$I = \frac{U}{\sqrt{R^2+(L\omega)^2}} \qquad \varphi = -\text{Arctan}\left(\frac{L\omega}{R}\right)$$

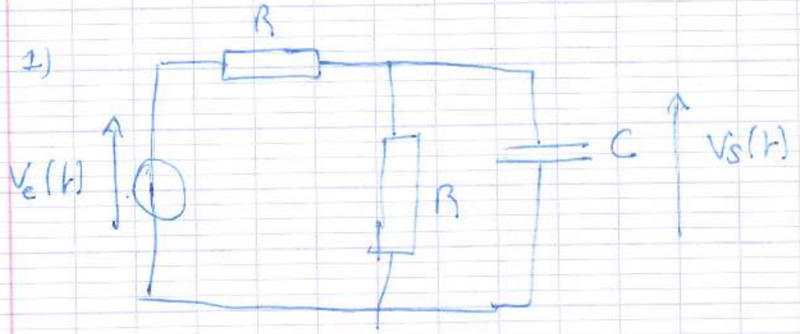
$$\underline{I} = I . e^{j\varphi} = \frac{U}{\sqrt{R^2+(L\omega)^2}} \, e^{-j\,\text{Arctan}\left(\frac{L\omega}{R}\right)}$$

$$i(t) = I\sqrt{2} \, . \sin(\omega t + \varphi)$$
$$= \frac{U}{\sqrt{R^2+(L\omega)^2}} \, . \sqrt{2} \, . \sin\left(\omega t - \text{Arctan}\left(\frac{L\omega}{R}\right)\right)$$

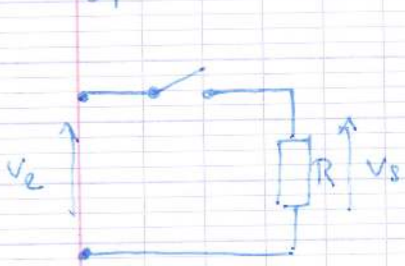
Le Filtrage

Exercice n°1 :

1)



BF

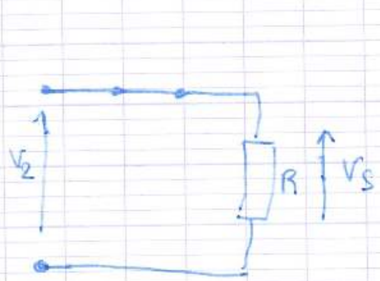


$i_s = 0A$

donc $V_s = 0V$

$A(\omega \to 0) = \frac{0}{V_e} = 0$

HF



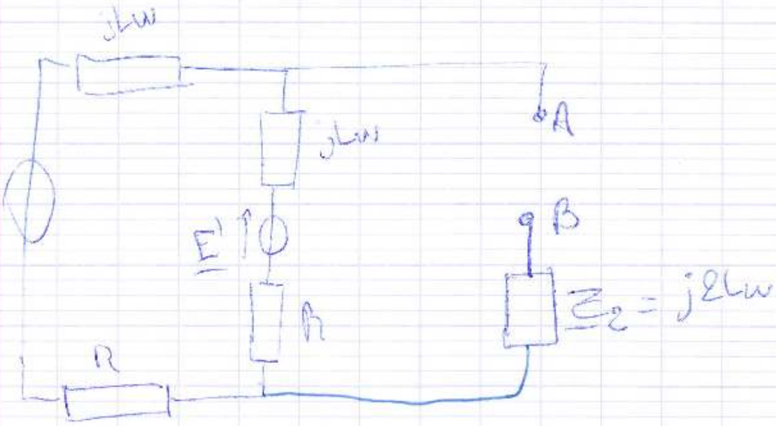
$V_s = V_e$.

$A(\omega \to +\infty) = \frac{V_s}{V_e}$

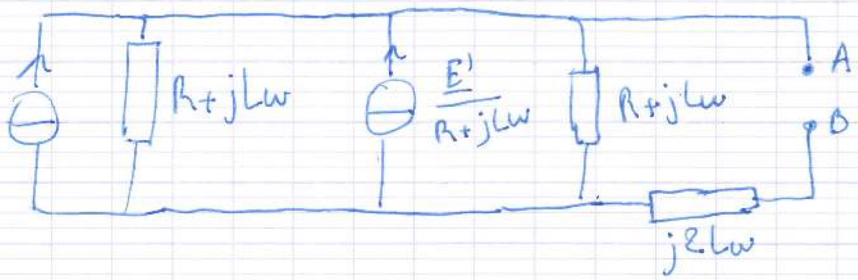
Filtre passe haut

$$(RC\omega)^2 = \frac{3}{4} \Leftrightarrow RC\omega = \frac{\sqrt{3}}{2}.$$

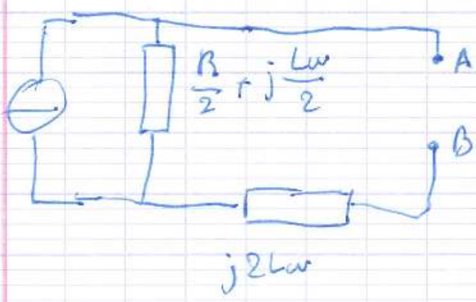
Exercice n°5 :



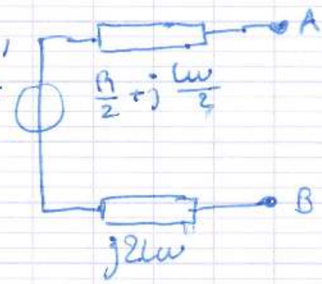
$\dfrac{\underline{E}}{R+jL\omega}$



$\dfrac{\underline{E}+\underline{E}'}{R+jL\omega}$



$\dfrac{\underline{E}}{2} + \dfrac{\underline{E}'}{2}$



$$\underline{E} = \frac{E}{\sqrt{2}} \cdot e^{j0} \qquad e(t) = E \cdot \cos(\omega t)$$

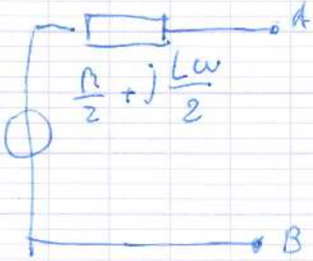
$$\underline{E}' = \frac{E}{\sqrt{2}} \cdot e^{-j\frac{\pi}{2}} = \frac{E}{\sqrt{2}} \cdot (-j) \qquad e'(t) = E \cdot \sin(\omega t)$$

forme trigo

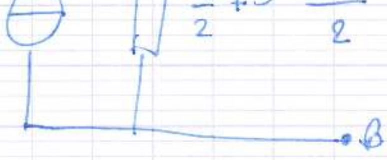
$$= E \cdot \cos\left(\omega t - \frac{\pi}{2}\right)$$

$$\underline{E} + \underline{E}' = \frac{E}{\sqrt{2}}(1-j)$$

$\dfrac{E}{2\sqrt{2}}(1-j)$



$$\frac{\frac{E}{2\sqrt{2}} \cdot (1-j)}{\frac{R}{2} + j\,\frac{5L\omega}{2}}$$



$$\underline{V} = \frac{\frac{\underline{E_1}}{\underline{Z_c}} + \frac{\underline{E_2}}{\underline{Z_{R_2}}}}{\frac{1}{\underline{Z_c}} + \frac{1}{\underline{Z_{R_2}}} + \frac{1}{\underline{Z_R} + \underline{Z_c}}} = \frac{\underline{E_1} \cdot jC\omega + \frac{\underline{E_2}}{R_2}}{jC\omega + \frac{1}{R_2} + \frac{1}{R + jL\omega}}$$

$$\frac{1}{\underline{Z_c}} = jC\omega$$