Exercice N° 1

1°/ $\varphi_u - \varphi_i = \frac{\pi}{6}$ rad > 0 $\longrightarrow$ $\boxed{\text{Circuit inductif}}$

2°/ a) $|\varphi_{u_{D_1}} - \varphi_{u_{D_2}}| = \frac{2\pi}{T} \cdot \frac{T}{6} = \frac{\pi}{3}$ rad or u_{D_1} en retard sur u_{D_2} $\Rightarrow$ $\varphi_{u_{D_1}} - \varphi_{u_{D_2}} = -\frac{\pi}{3}$ rad

b) • $u_{D_2} = U_{D_2m} \sin(\omega t + \varphi_{u_{D_2}})$ or $u_{D_2} = Ri$

$\Rightarrow \varphi_{u_{D_2}} = \varphi_i = 0$

$\Rightarrow \boxed{u_{D_2}(t) = 4\sqrt{2} \sin(500\pi t)}$

• $\boxed{u_{D_1}(t)} = U_{D_1m} \sin(\omega t + \varphi_{u_{D_1}}) = \boxed{18{,}4\sqrt{2} \sin\left(500\pi t - \frac{\pi}{3}\right)}$

c) • $\varphi_{u_{D_1}} - \underbrace{\varphi_{u_{D_2}}}_{=0} = -\frac{\pi}{3}$ $\Rightarrow$ $\varphi_{u_{D_1}} = -\frac{\pi}{3}$; $\varphi_i = 0$

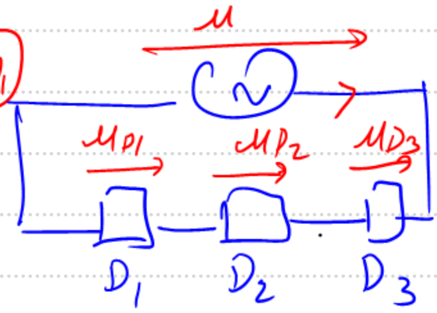
$\Rightarrow u_{D_1}$ en retard de $\frac{\pi}{3}$ sur $i(t)$

• Circuit inductif

Possibilité pour D_1	Reponse et justification
resistor	Non, car les courbes ne sont pas en phase.
bobine ou association résistor-bobine	Non, car u_{D_1} n'est pas en avance sur $i(t)$
Condensateur	Non, car $\varphi_{u_{D_1}} - \varphi_i \neq -\frac{\pi}{2}$
association bobine condensateur	Non, car pour un circuit inductif $\varphi_{u_{D_1}} - \varphi_i > 0$

$\boxed{\text{Donc } D_1 \longrightarrow \text{Association resistor-Condensateur}}$

3°/ a)



Loi des mailles donne :

$u_{D_1}(t) + u_{D_2}(t) + u_{D_3}(t) = \boxed{u(t)}$

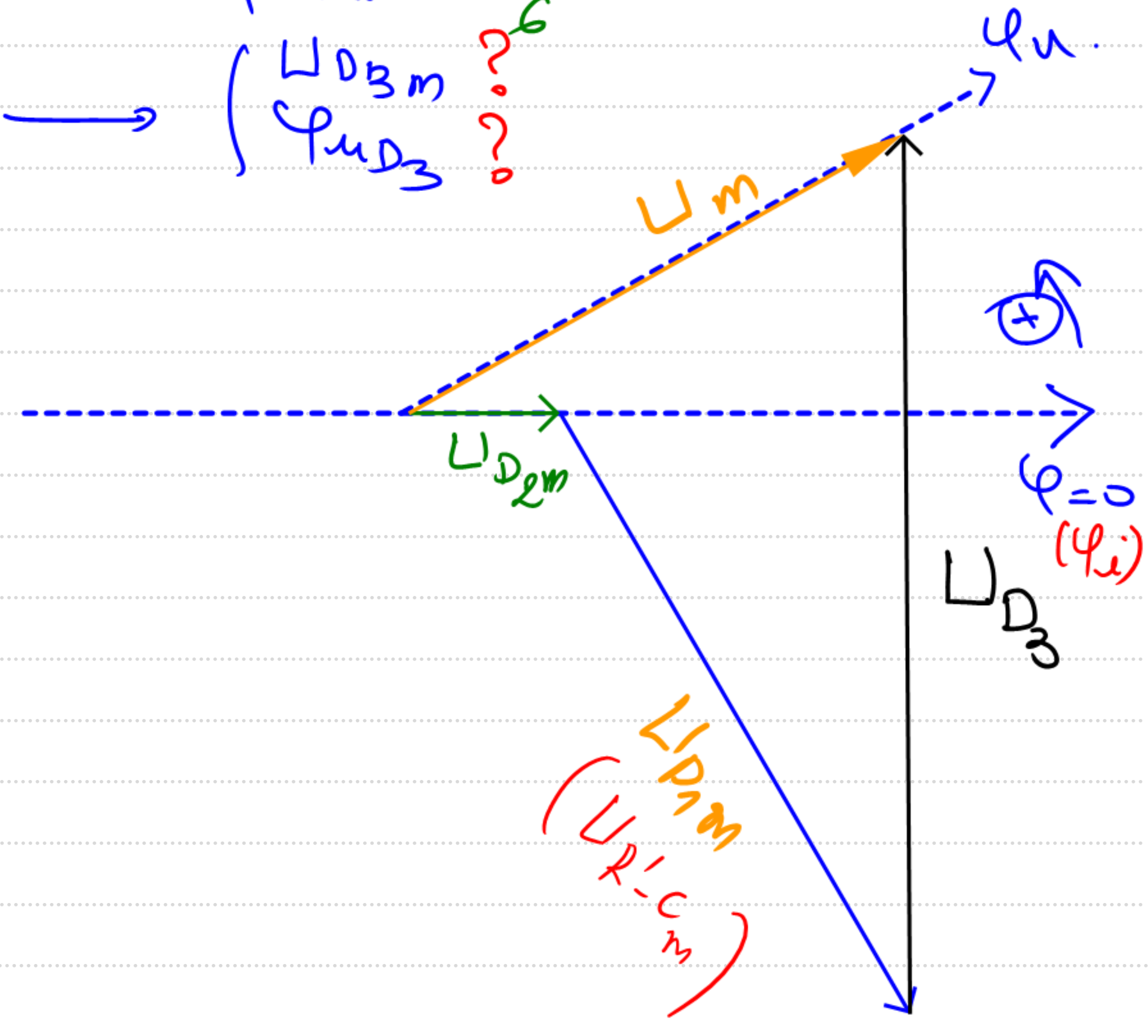
b)

$u_{D_1}(t)$ $(R'-C)$ $\longrightarrow$ $\begin{cases} U_{D_1m} = 18{,}4\sqrt{2}\,V \longrightarrow 9{,}2\,cm \\ \varphi_{u_{D_1}} = -\dfrac{\pi}{3} \end{cases}$

$u_{D_2}(t) \longrightarrow \begin{cases} U_{D_2m} = 4\sqrt{2} \longrightarrow 2\,cm. \\ \varphi_{u_{D_2}} = \varphi_i = 0 \end{cases}$

$u(t) \longrightarrow \begin{cases} U_m = 15\sqrt{2} \to 7{,}5\,cm \\ \varphi_u = \dfrac{\pi}{6} \end{cases}$

$u_{D_3} \longrightarrow \begin{cases} U_{D_3m} \ ? \\ \varphi_{u_{D_3}} \ ? \end{cases}$



c) D'après la construction D_3 est nécessairement bobine inductive

$(\varphi_{u_{D_3}} - \varphi_i = \frac{\pi}{2})$

$\varphi_{u_{D_3}} - \varphi_i = \frac{\pi}{2}$ rad

B m r une bobine inductive

$u_B = L\frac{di}{dt}$

$\hookrightarrow \varphi_{u_B} = \varphi_i + \frac{\pi}{2}$

d) $D_1 \longrightarrow R'$ et C

- $R'I_m \longrightarrow 4,5\ cm \Rightarrow R'I_m = 9\sqrt{2}\ V \Rightarrow R' = \frac{9\sqrt{2}}{0,1\sqrt{2}} \Rightarrow \boxed{R' = 90\ \Omega}$
- $\frac{I_m}{C\omega} \longrightarrow 8\ cm \Rightarrow \frac{I_m}{C\omega} = 16\sqrt{2}\ V \Rightarrow \boxed{C = 3,98\ 10^{-6}\ F}$

$D_3 \longrightarrow L$: $L\omega I_m \longrightarrow 11,7\ cm \Rightarrow L\omega I_m = 23,4\sqrt{2}\ V \Rightarrow \boxed{L = 0,148\ H}$

e) $\boxed{u_{D_3}(t) = 23,4\sqrt{2}\sin(500\pi t + \frac{\pi}{2})}$

f) $\mathcal{P}_m = (R+R')I^2 = 130 \times (0,1)^2 \Rightarrow \boxed{\mathcal{P}_m = 1,3\ W}$

II) 1°) I atteint sa valeur la plus élevé

$\rightarrow$ Etat de résonance d'intensité

2°) $\boxed{\varphi_u - \varphi_{u_E} = \frac{\pi}{2}\ rad}$

or à la résonance d'intensité $\varphi_u - \varphi_i = 0$

et $\varphi_u - \varphi_{u_C} = \frac{\pi}{2} \Rightarrow u_E(t) = u_C(t)$

3°/ $N_2 = N_0 = \dfrac{1}{2\pi\sqrt{LC}} \Rightarrow \boxed{N_2 = 205{,}46\,Hz}$

4°/ $I_2 = \dfrac{U}{Z_r} = \dfrac{U}{R_{Tot}} \Rightarrow \boxed{I_2 = \dfrac{15}{130} = 0{,}115\,A}$

5°/ $\dfrac{U_{Cm}}{U_m} = \dfrac{19{,}5\sqrt{2}}{15\sqrt{2}} = 1{,}3 = Q > \boxed{1}$ → apparition d'une surtension aux bornes du condensateur (et la bobine)

Exercice N°2

1°/ a) $U_R = RI \Rightarrow \boxed{I = \dfrac{U_R}{R} = 0{,}05\,A}$

b) $U_C = \dfrac{I}{C\omega} \Rightarrow \boxed{C = \dfrac{I}{U_C\,\omega} = 5{,}2\cdot 10^{-6}\,F}$

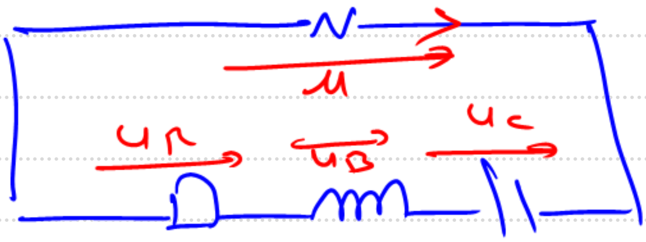
c) $U_C > U_B \Rightarrow Z_C > Z_B.$

$$\frac{1}{C\omega} > \sqrt{r^2 + (L\omega)^2}$$

$$\left(\frac{1}{C\omega}\right)^2 > r^2 + (L\omega)^2$$

$$\Rightarrow \frac{1}{C\omega} > L\omega$$ → circuit capacitif

2°)



Loi des mailles $u_R(t) + u_B(t) + u_C(t) - u(t) = 0$

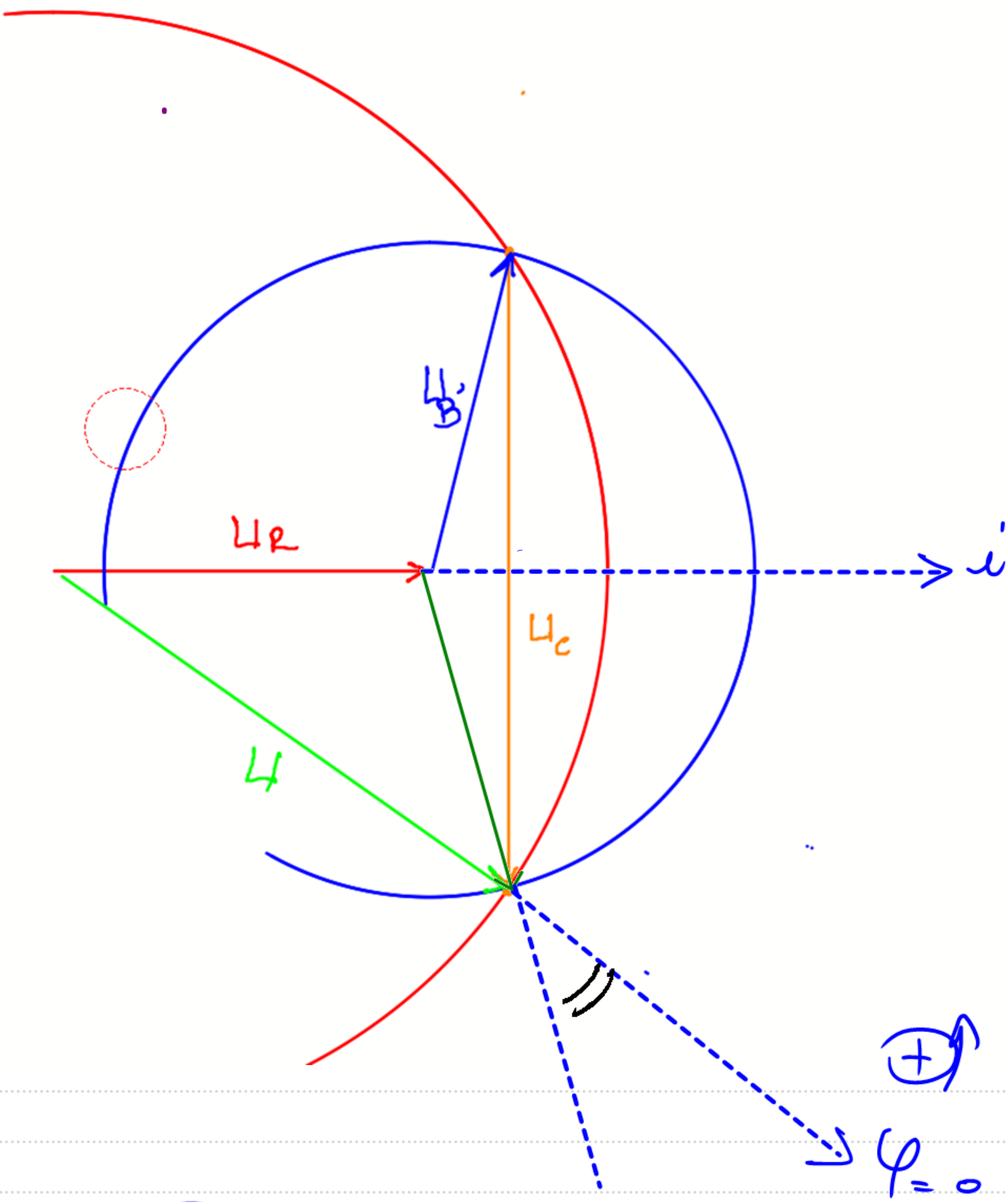
$\Rightarrow (R+r)\,i(t) + L\dfrac{di(t)}{dt} + \dfrac{1}{C}\int i(t)\,dt = u(t)$

2°) a) $u_R(t) \longrightarrow \begin{cases} U_R = 6\,V \\ \varphi_i\ ? \end{cases}$

$u_B(t) \longrightarrow \begin{cases} U_B = 5{,}2\,V \\ \varphi_{u_B} \end{cases}$

$u_C(t) \longrightarrow \begin{cases} U_C = 10\,V \\ \varphi_{u_C} \end{cases}$

$u(t) \longrightarrow \begin{cases} U = 8{,}9\,V \\ \varphi_u = 0 \end{cases}$



(b) $rI = 1{,}3\,V$

$$r = \frac{1{,}3}{0{,}05} = 26\,\Omega$$

$L\,\omega\,I_m = 5\,V \Rightarrow L = 0{,}1\,H$

(c) $i(t) = I_m \sin(\omega t + \varphi_i)$

$$\varphi_i = 35^\circ = \frac{35\pi}{180} = 0{,}61\,rad$$

$$i(t) = 0{,}05\sqrt{2}\,\sin(910\,t + 0{,}61)$$

d) $u_{BC}(t) = U_{BC_m}\sin(910\,t + \varphi_{u_{BC}})$

$$\varphi_{u_{BC}} = -38° = -\frac{38\pi}{180}$$

$$u_{BC}(t) = 5{,}2\sqrt{2}\sin(910\,t - 0{,}66)$$

4) $\mathcal{P}_m = (R + r)\,I^2 = 0{,}37\ W$