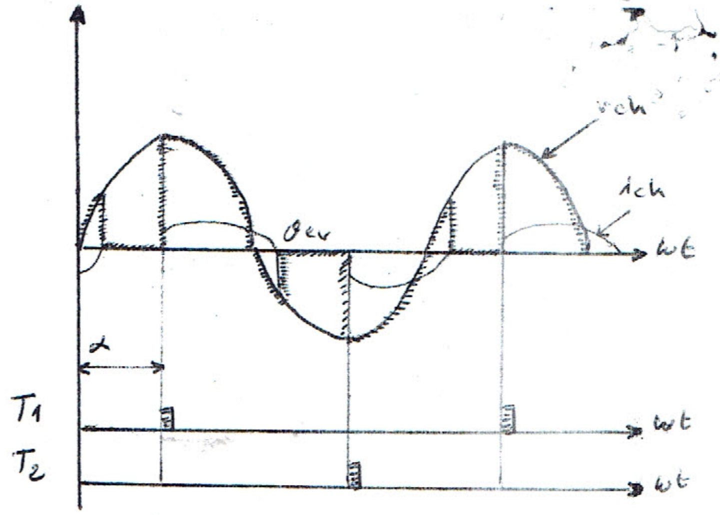
Exo 02

$V_s = 220\sqrt{2} \cdot \sin 314t$ (V), 50Hz

$R = 4\,\Omega$, $\omega L = 3\,\Omega$

$Z = 4 + jL\omega \Rightarrow Z = 4 + 3j = 5 \angle 36{,}86°$

$\varphi = 36{,}86°$



Pour $\alpha = 90°$: $(\alpha > \varphi)$

a/ Les allures de $v_{ch}(t)$, et $i_{ch}(t)$

b/ L'expression du courant $i_{ch}(t)$.

$v_{ch} = v_s \Rightarrow R\, i_{ch} + L \frac{di_{ch}}{dt} = V_m \sin \omega t$.

$$\Rightarrow \boxed{i_{ch}(t) = \frac{V_m}{Z} \sin(3\omega t - \varphi) + A \cdot e^{-t/\tau}}$$

avec : $Z = \sqrt{R^2 + (L\omega)^2} = 5\,\Omega$

$\varphi = tg^{-1} \frac{L\omega}{R} = 36{,}86°$

$\tau = L/R = \frac{\omega}{3 \cdot R} = \frac{3}{314} = 0{,}0023$

A = ?

$i_{ch}(\alpha/\omega) = 0 \Rightarrow \frac{V_m}{Z} \sin(\alpha - \varphi) + A \cdot e^{\alpha/\tau\omega} = 0$

$$\Rightarrow \boxed{A = -\frac{V_m}{Z} \cdot \sin(\alpha - \varphi) \cdot e^{\alpha/\tau\omega}}$$

donc :

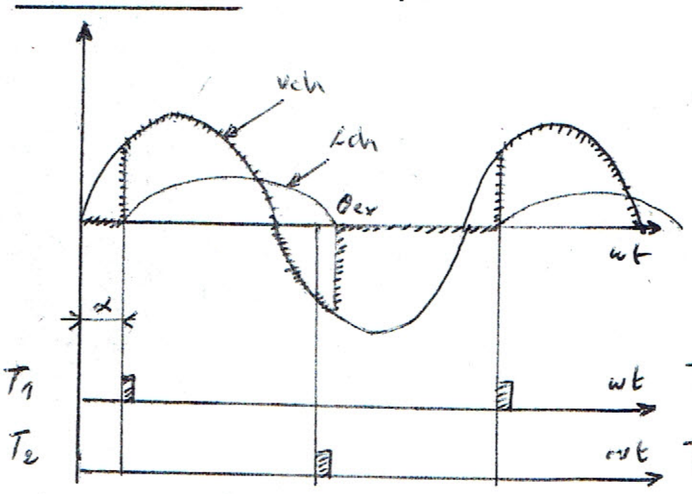
$$i_{ch}(t) = \frac{V_m}{Z}\left[\sin(\omega t - \varphi) - \sin(\alpha - \varphi) \cdot e^{\alpha/\tau\omega} \cdot e^{-t/\tau}\right]$$

$$\boxed{i_{ch}(t) = \frac{V_m}{Z}\left[\sin(\omega t - \varphi) - e^{-(t\omega - \alpha)/\tau\omega} \cdot \sin(\alpha - \varphi)\right]}$$

A.N : $A = -\frac{220\sqrt{2}}{5} \sin(90 - 36{,}86) \cdot e^{\frac{\pi/2}{314 \cdot 0{,}0023}}$

$= -62{,}22 \sin(53{,}14)\, e^{217{,}39}$

Pour $\alpha = 30°$: $(\alpha < \varphi)$



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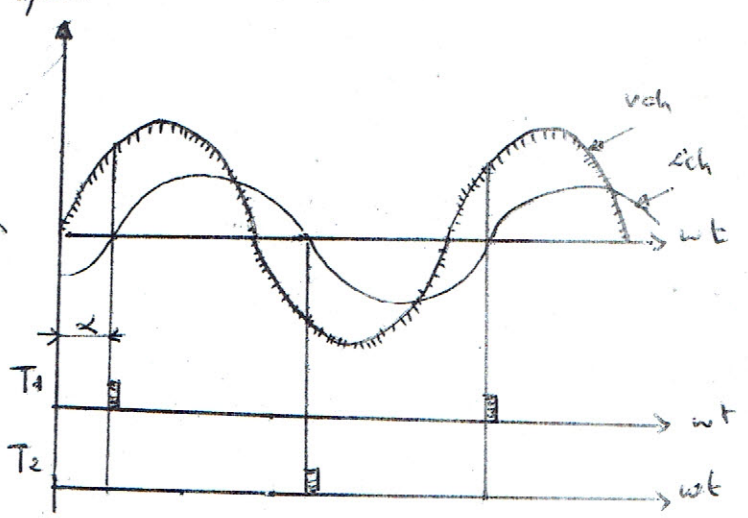
pour $\alpha = 36{,}86°$ $(\alpha = \varphi)$



$\Rightarrow A = 0$ $\quad \varphi = \alpha$

$\Rightarrow i_{ch}(t) = \frac{V_m}{Z} \sin(\omega t - \varphi)$

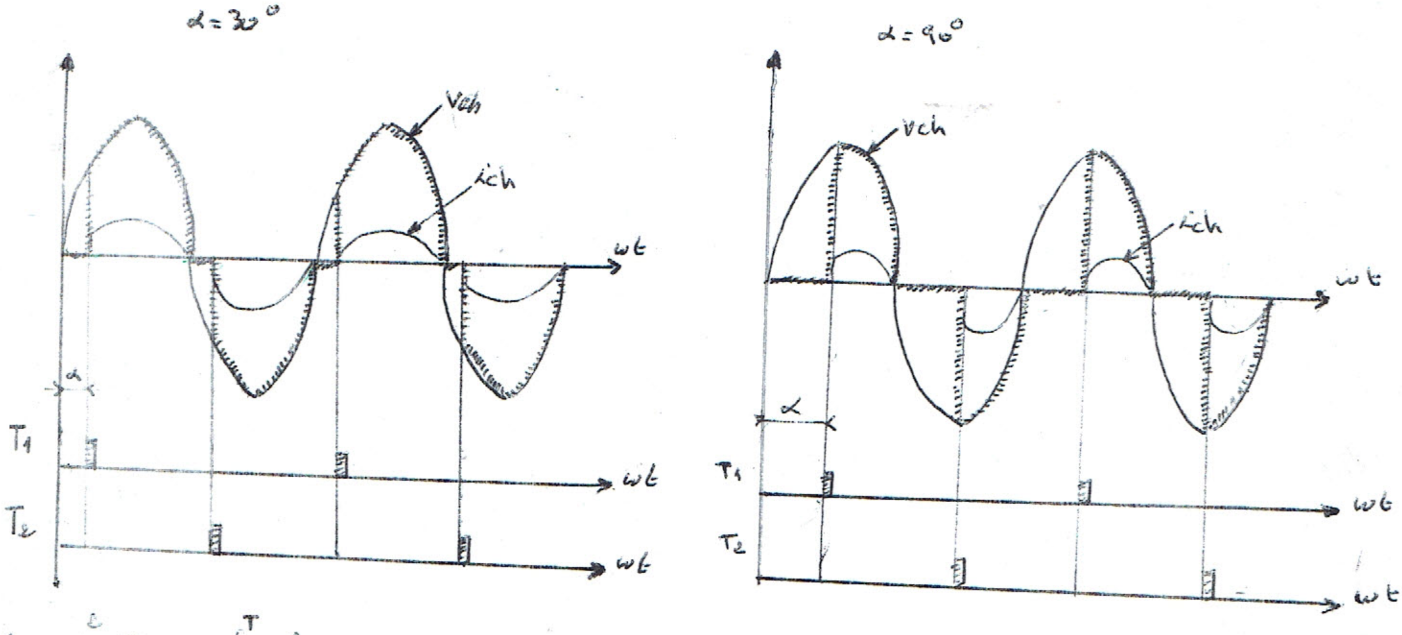
Série d'exercice N° 4 :

Exercice 1 :

$V_S = 220\sqrt{2} \cdot \sin 314t$ (V)

$R = 4\,\Omega$.

a/ Les allures $V_{ch}(t)$ et $i_{ch}(t)$



b/ $\cdot\ V_{ch\,eff}^2 = \frac{1}{T}\int_0^T v_{ch}^2(t)\cdot dt$

$= \frac{1}{2\pi}\left[\int_{\alpha}^{\pi} V_m^2 \cdot \sin^2\theta \cdot d\theta + \int_{\pi+\alpha}^{2\pi} V_m^2 \sin^2\theta \cdot d\theta\right]$

$= \frac{1}{2\pi}\times 2 \cdot \int_{\alpha}^{\pi} V_m^2 \cdot \sin^2\theta \cdot d\theta$; avec : $\sin^2\theta = \frac{1-\cos^2\theta}{2}$

$= \frac{V_m^2}{\pi}\cdot\frac{1}{2}\int_{\alpha}^{\pi} 1 - \cos^2\theta \cdot d\theta$

$= \frac{V_m^2}{2\pi}\left[\theta - \frac{1}{2}\sin 2\theta\right]_{\alpha}^{\pi} = \frac{V_m^2}{2\pi}\left[\pi - \alpha\right] + \frac{V_m^2}{2\pi}\left[\frac{1}{2}\sin 2\alpha\right]$

$= \frac{V_m^2}{2\pi}\left[\pi - \alpha + \frac{1}{2}\sin 2\alpha\right] = \frac{V_m^2}{2}\left[1 - \frac{\alpha}{\pi} + \frac{1}{2\pi}\sin 2\alpha\right]$

$\Rightarrow \boxed{V_{ch\,eff}^2 = \frac{V_m^2}{2}\left[1 - \alpha/\pi + \frac{1}{2\pi}\sin 2\alpha\right]}$

Pour $\alpha = 30°$ $\Rightarrow$ $V_{ch\,eff}^2 = \frac{(220\sqrt{2})^2}{2}\left[1 - \frac{0,52}{3,14} + \frac{1}{2\pi}\sin(60)\right] \Rightarrow \boxed{V_{ch\,eff} = 218,39\ \text{V}}$

Pour $\alpha = 90°$ $\Rightarrow$ $V_{ch\,eff}^2 = (220)^2\left[1 - \frac{3,14}{2\cdot 3,14} + \frac{1}{2\pi}\sin 180°\right] \Rightarrow \boxed{V_{ch\,eff} = 155,56\ \text{V}}$

Pour $\alpha = 180°$ $\Rightarrow$ $V_{ch\,eff}^2 = (220)^2\left[1 - \frac{3,14}{3,14} + \frac{1}{2\pi}\sin(2\times 180)\right] = \boxed{V_{ch\,eff} = 0\ \text{V}}$

c/ La puissance :

$\boxed{P_{ch} = \frac{V_{ch\,eff}^2}{R}}$

AN: Pour $\alpha = 30°$ $\Rightarrow$ $P_{ch} = \frac{(218,39)^2}{4} = 11,923$ KW

Pour $\alpha = 90°$ $\Rightarrow$ $P_{ch} = 155,56/4 = 6,049$ KW

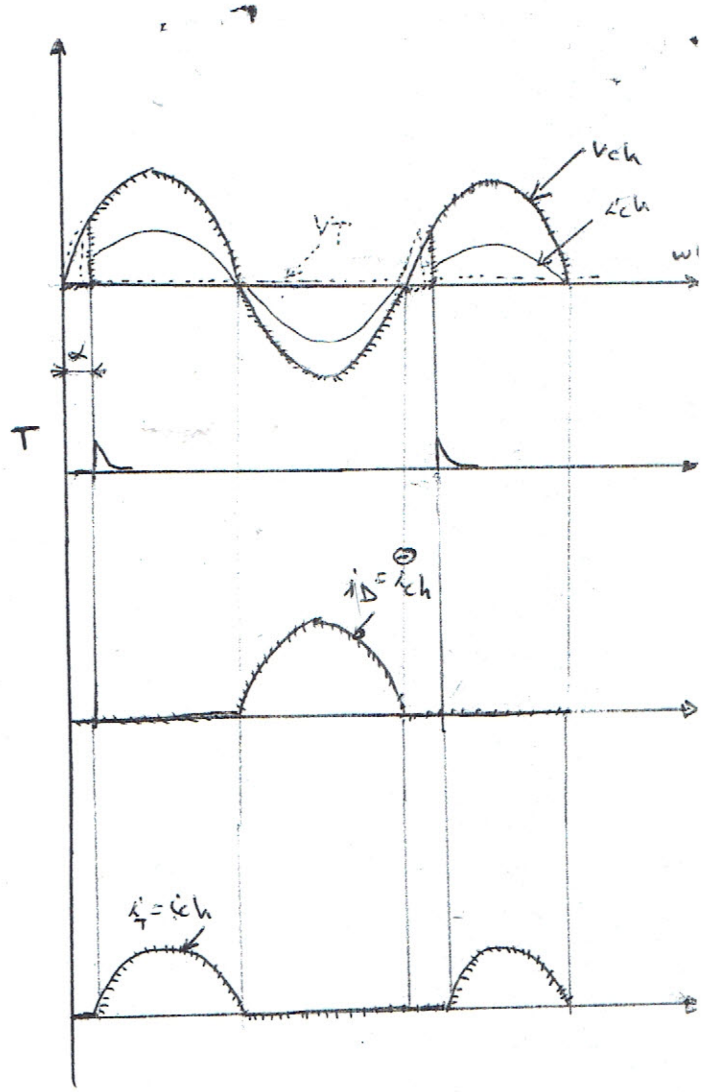
Pour $\alpha = 180°$ $\Rightarrow$ $P_{ch} = 0$ KW.

Exercice 3 :

$V_s = V_m \sin 314 \cdot t$ (V)

$V_s = 100\sqrt{2} \cdot \sin 314\, t$ (V)

$V_m = 100\sqrt{2}$, $R = 2\,\Omega$, $\alpha = 30$



a/

$(0 - 30°) \Rightarrow \boxed{V_{ch} = 0}$, $\boxed{i_{ch} = 0}$, T_1 (OFF), D (OFF)

$(30 - 180) \Rightarrow \boxed{V_{ch} = V_s}$

$\Rightarrow V_{ch} = V_s = R \cdot i_{ch} \Rightarrow \boxed{i_{ch} = V_s / R}$

$(0 - 30) \Rightarrow V_s = V_T + \cancel{V_{ch}}^{\,0}$

$\Rightarrow \boxed{V_T = V_s}$, $\boxed{i_T = 0}$

$\boxed{V_D = -V_s}$ $\boxed{i_D = 0}$

$(30 \div 180) \Rightarrow V_s = \cancel{V_T}^{\,0} + V_{ch}$

$\Rightarrow \boxed{V_T = 0}$ $\boxed{i_T = i_{ch}}$

$\boxed{V_D = 0}$ $\boxed{i_D = 0}$

$(180 + 360°)$: $\boxed{V_{ch} = V_s}$, $\boxed{i_{ch} = \frac{V_{ch}}{R}}$

$V_s = \cancel{V_D}^{\,0} + V_{ch}$

$\boxed{V_D = 0}$ $\boxed{i_D = -i_{ch}}$

$\boxed{V_T = 0}$ $\boxed{i_T = 0}$

b/ $V^2_{ch\,eff} = \frac{1}{T}\int_0^T V_{ch}(t) \cdot dt$

$= \frac{1}{2\pi}\left[\int_\alpha^\pi V_m^2 \cdot \sin^2\theta \cdot d\theta + \int_\pi^{2\pi} V_m^2 \cdot \sin^2\theta \cdot d\theta\right]$

$= \frac{V_m^2}{2\pi}\left[\int_\alpha^\pi \sin^2\theta \cdot d\theta + \int_\pi^{2\pi} \sin^2\theta \cdot d\theta\right]$

$= \frac{V_m^2}{2\pi}\left[\int_\alpha^\pi \left(\frac{1 - \cos 2\theta}{2}\right) d\theta + \int_\pi^{2\pi} \left(\frac{1 - \cos 2\theta}{2}\right) d\theta\right]$

$= \frac{V_m^2}{4\pi}\left[\theta - \frac{1}{2}\sin 2\theta\right]_\alpha^\pi + \frac{V_m^2}{4\pi}\left[\theta - \frac{1}{2}\sin 2\theta\right]_\pi^{2\pi}$

$= \frac{V_m^2}{4\pi}\left[\pi - \alpha + \frac{1}{2}\sin 2\alpha\right] + \frac{V_m^2}{4\pi}\left[2\pi - \pi\right]$

$V^2_{ch\,eff} = \frac{V_m^2}{4\pi}\left[\cancel{\pi} - \alpha + \frac{1}{2}\sin 2\alpha + 2\pi - \cancel{\pi}\right] = \frac{V_m^2}{4\pi}\left[-\alpha + \frac{1}{2}\sin 2\alpha + 2\pi\right]$

A.N : $V_{cheff}^2 = \frac{(100.\sqrt{2})}{4\pi} \cdot \left[-\pi/6 + 1/2 \sin 2\omega + 2\pi \right] \Rightarrow \boxed{V_{cheff} \simeq 99V}$

:- La puissance :

$$P_{ch} = \frac{V_{cheff}^2}{R} = \frac{99^2}{2} \simeq \boxed{4,9 \text{ Kw}}$$

Exercice 4 :

Voir série N°1 , Exercice 6.