$$U_{LM} = \frac{1}{\frac{1}{xQ}\sqrt{1+Q^2\left(x-\frac{1}{x}\right)^2}}\,E_m$$

$$U_{LM} = \frac{1}{\sqrt{\frac{1}{x^2Q^2}+\left(1-\frac{1}{x^2}\right)^2}}\,E_m$$

$$U_{LM} = \frac{1}{\sqrt{\frac{X}{Q^2}+(1-X)^2}}\,E_m \quad \text{en posant } X = \frac{1}{x^2}$$

$U_{Lm}(max) = U_{Lm}(\omega_r)$ correspond à :

$$\frac{X}{Q^2}+(1-X)^2 \text{ minimal}$$

$$\frac{dB}{dX} = \frac{1}{Q^2} - 2(1-X)$$

$$= \frac{1}{Q^2} - 2 + 2X = 0$$

$\uparrow$

$\omega = \omega_r$

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

$$x_r = \frac{1}{\sqrt{1-\frac{1}{2Q^2}}} = \frac{\omega_r}{\omega_0}$$

$$\boxed{\omega_r = \frac{\omega_0}{\sqrt{1-\frac{1}{2Q^2}}} > \omega_0}$$

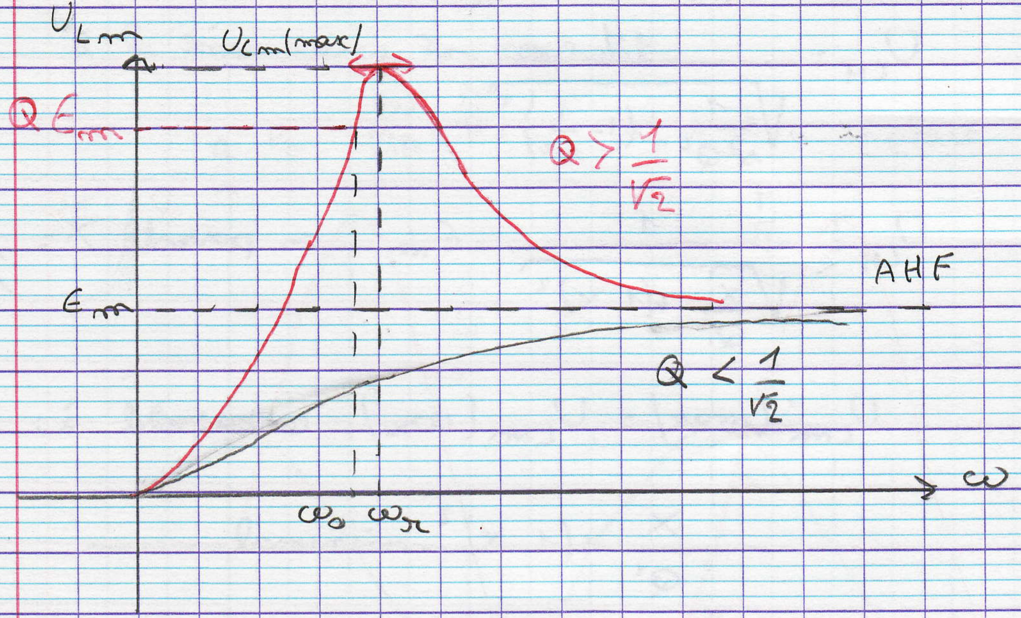
à condition que $\frac{1}{x^2} > 0$!!!

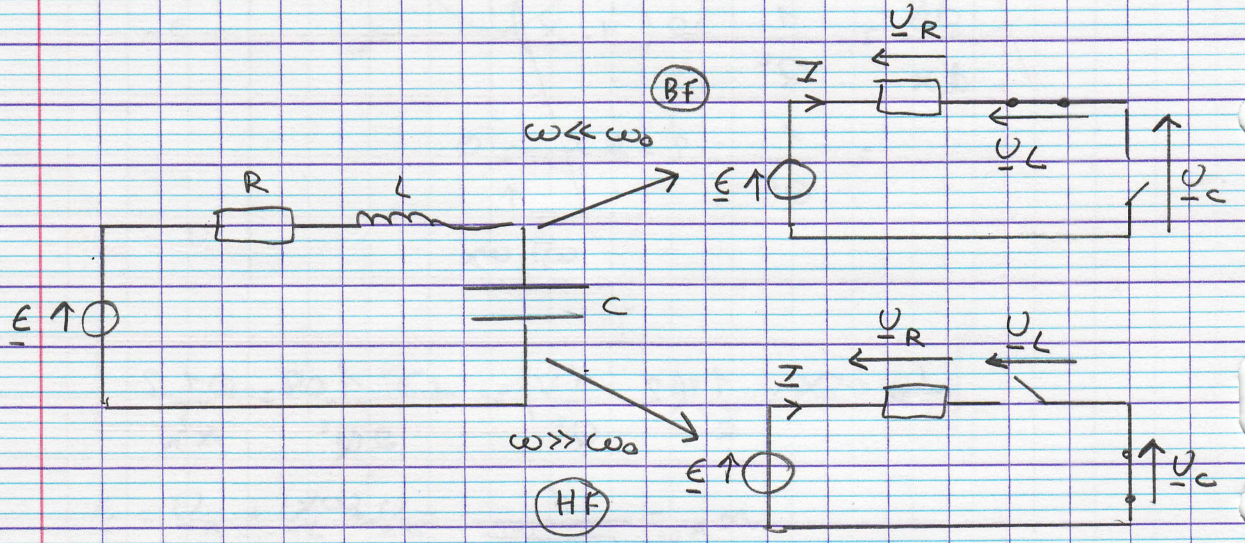
$1 - \frac{1}{2Q^2} > 0 \qquad Q > \frac{1}{2}$

$\exists$ résonance en tension pour u_L si $Q > \frac{1}{\sqrt{2}}$ alors la résonances a lieu pour $\omega_r > \omega_0$

sachant que $\omega_r \gtrsim \omega_0$

$$U_{Lm} = \frac{E_m}{\sqrt{\frac{1}{x^2Q^2} + \left(1-\frac{1}{x^2}\right)^2}} = \frac{Qx\,E_m}{\sqrt{1+Q^2\left(x-\frac{1}{x}\right)^2}}$$





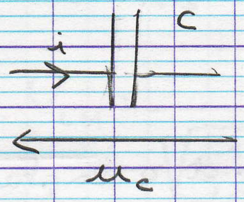
BF $\underline{I} \to 0 \Rightarrow \underline{U}_R \to 0$

$$\left.\begin{array}{l}\underline{E} = \underline{U}_R + \underline{U}_L + \underline{U}_C \\ \boxed{\underline{U}_L \to 0}\end{array}\right\} \boxed{\underline{U}_C \to \underline{E}}$$

HF $\underline{I} \to 0 \Rightarrow \underline{U}_R \to 0$

$$\left.\begin{array}{l}\underline{E} = \underline{U}_R + \underline{U}_L + \underline{U}_C \\ \boxed{\underline{U}_C \to 0}\end{array}\right\} \boxed{\underline{U}_L \to \underline{E}}$$

φ^N de surtension aux bornes du Condensateur :



$$u_c = U_{cm}\cos(\omega t + \varphi_c)$$

$$\rightarrow \underline{u}_c = U_{cm}\, e^{j(\omega t + \varphi_c)}$$

$$\rightarrow \underline{u}_c = \underline{U}_c\, e^{j\omega t} \quad \text{avec } \underline{U}_c = U_{cm}\, e^{j\varphi_c}$$

or $\underline{U}_c = \dfrac{1}{jc\omega}\,\underline{I} \quad (*)$

d'où $|\underline{U}_c| = \left|\dfrac{1}{jc\omega}\right|\,|\underline{I}|$

$$U_{cm} = \frac{1}{c\omega}\, I_m$$

Surtension pour $\omega = \omega_0$

on est à la résonance en courant

$$\begin{cases} I_m(\omega_0) = I_m(\max) = \dfrac{\mathcal{E}_m}{R} \\[2ex] \dfrac{1}{c\omega} = \dfrac{1}{c\omega_0} = QR \end{cases}$$

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

$$\rightarrow U_{cm}(\omega_0) = QR\,\frac{\mathcal{E}_m}{R}$$

$$\boxed{U_{cm}(\omega_0) = Q\,\mathcal{E}_m}$$

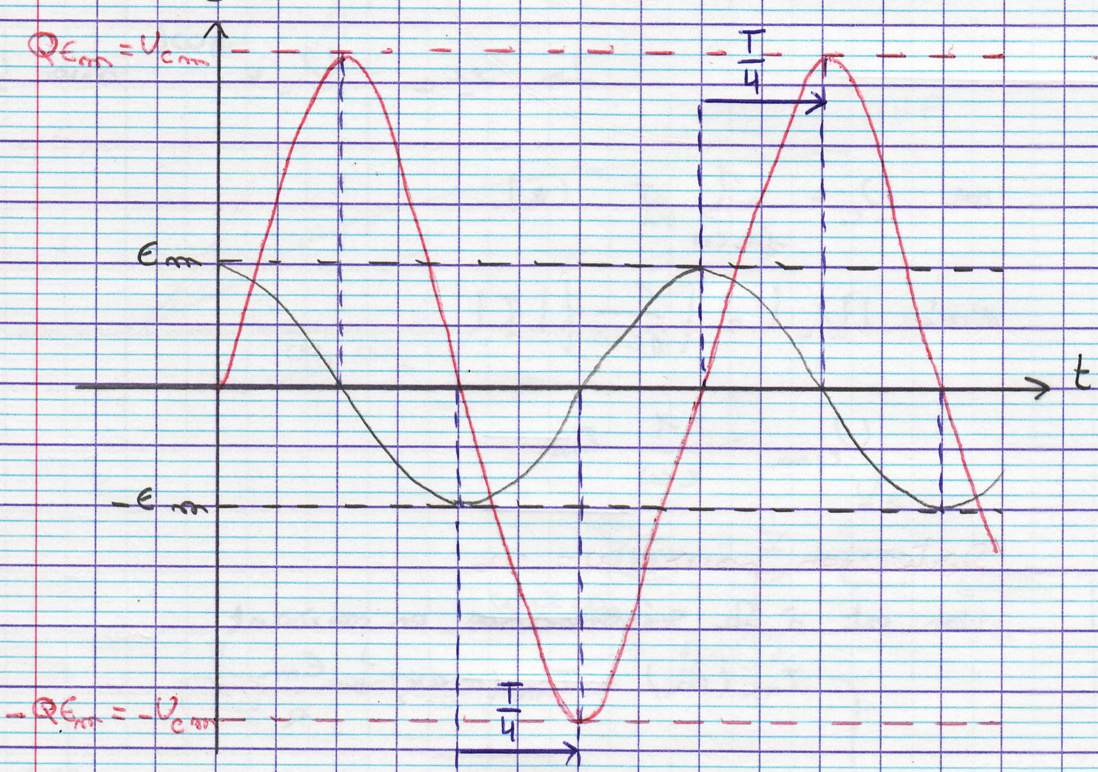
$$(*) \rightarrow \arg(\underline{U}_c) = \arg\left(\frac{1}{jc\omega}\right) + \arg(\underline{I})$$

$$\varphi_c = -\frac{\pi}{2} + \varphi_i$$

en $\omega = \omega_0$ $\quad \varphi_i = 0$ $\quad$ i en phase avec e à la résonance
$x = 1$ $\quad$ en intensité

à la résonance en courant :

$e \quad u_C \quad u_R = Ri = e \quad u_R$ i et e en phase



u_C est en quadrature retard de phase p/r à e(t)

$$\boxed{\text{Si } Q = 80 \quad \mathcal{E}_m = 1V \quad U_{Cm} = 80V\,!}$$

$$\underline{\mathcal{E}} = \underline{U}_R + \underline{U}_L + \underline{U}_C$$
$$= \underline{U}_R + \mathcal{E}_m Q \left(e^{j\varphi_L} + e^{j\varphi_C}\right)$$
$$= \underline{U}_R + \mathcal{E}_m Q \left(j - j\right)$$

$$\boxed{u_C + u_L = 0 \ \forall t \text{ pour } \omega = \omega_0}$$

$\omega = \omega_0 \quad \varphi_C = -\frac{\pi}{2} \quad \varphi_L = \frac{\pi}{2}$

$$\underline{\mathcal{E}} = \mathcal{E}_m$$

$\forall t \quad u_R = e \quad$ car $\quad \underline{U}_R = R I_m e^{j\varphi_i} = R I_m$

$\varphi_i = 0$

↳ cf Polycop : φ^N de résonance en tension aux bornes de C.