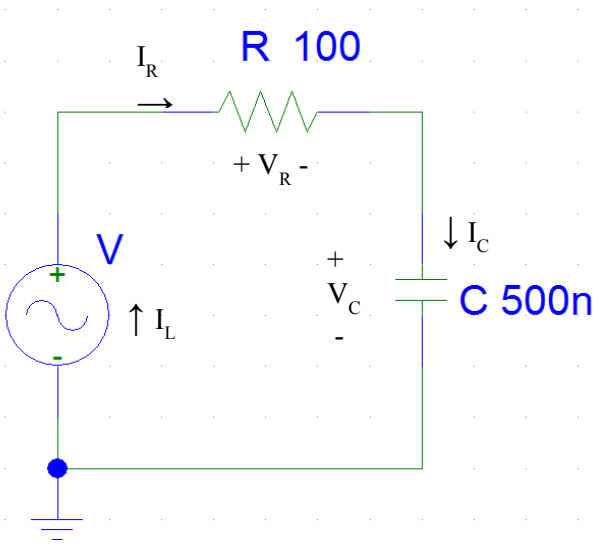
SERIE RC



ati:

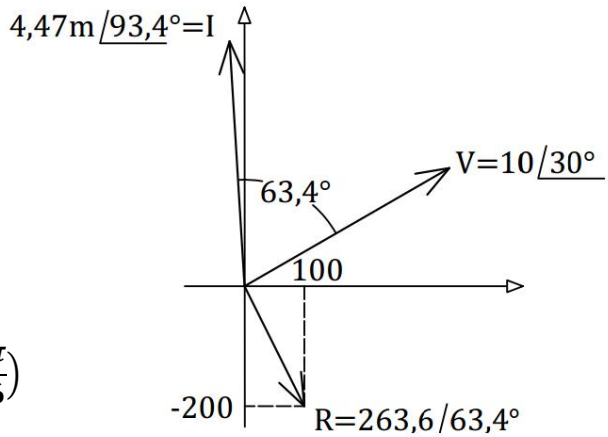
$\omega = 10k\,{}^{rad}/_{s}$

$V_{MAX} = 10V$

$\alpha_v = 30° = \frac{\pi}{6}\,\text{rad}$

Calcolo il periodo:

$$T = \frac{2\pi}{\omega} \cong 0{,}00062832 = 0{,}62832ms$$



Calcolo l'anticipo in secondi:

$$t_{\alpha_v} = \frac{a_v}{\omega} = \frac{{}^{\pi}/_{6}}{10 \cdot 10^3} = 0{,}0523 \cdot 10^{-3} = 0{,}0523ms$$

Verifico sul grafico la congruenza dei risultati.

Tensione del generatore:

$$v(t) = V_{MAX} \cdot sen(\omega t + \alpha_v) = \mathbf{10} \cdot sen\left(10 \cdot 10^3 t + \frac{\boldsymbol{\pi}}{\mathbf{6}}\right)$$

Oppure: $\bar{V} = 10\lfloor 30° = 10\lfloor {}^{\pi}/_{6}$

Dal circuito risulta:

$$\bar{V} = \bar{V}_R + \bar{V}_C = R\bar{I}_R + \frac{1}{j\omega C}\bar{I}_L \overset{\substack{I_L = I_R \\ \frac{1}{j} = -j}}{\longrightarrow} R\bar{I} - j\frac{1}{\omega C}\bar{I} = \left(R - j\frac{1}{\omega C}\right)\bar{I} = \dot{Z} \cdot \bar{I}$$

$\boldsymbol{\bar{V} = \dot{Z} \cdot \bar{I}}$	LEGGE DI OHM GENERALIZZATA

$\dot{Z} = R - j\frac{1}{\omega C}$	IMPEDENZA della serie R,C

$$\dot{Z} = 100 - j\frac{1}{(10 \cdot 10^3)(500 \cdot 10^{-9})} \cdot = 100 - j\frac{1}{5000 \cdot 10^{-6}} = 100 - j\frac{10^6}{5 \cdot 10^3} = 100 - j200$$

$$\left.\begin{aligned} |\dot{Z}| &= |100 - j200| = \sqrt[2]{100^2 + 200^2} = \sqrt[2]{50000} \cong 223{,}6 \\ \lfloor\dot{Z} &= \lfloor(100 - j200) = arctg\left(\frac{-200}{100}\right) = arctg(-2) = -63{,}4° \end{aligned}\right\} \Rightarrow \dot{Z} = 223{,}6\lfloor -63.4°$$

Note Z e V posso calcolare I:

$$\bar{I} = \frac{\bar{V}}{\dot{Z}} \rightarrow \begin{cases} |\bar{I}| = \dfrac{|\bar{V}|}{|\dot{Z}|} \rightarrow Modulo\ di\ \bar{I} \\ \lfloor\bar{I} = \lfloor\bar{V} - \lfloor\dot{Z} \rightarrow Fase\ \bar{I} \end{cases} (*) \qquad \begin{cases} |\bar{I}| = \dfrac{10}{223{,}6} \cong 0{,}0447 = \mathbf{44{,}7}\boldsymbol{mA} \\ \lfloor\bar{I} = 30° - (-63{,}4°) = \mathbf{93{,}4}° \end{cases}$$

Quindi

$\bar{I} = 44{,}7m\lfloor 93{,}4° \cong 44.7m\lfloor 1{,}63rad$

$$i(t) = I_{MAX} \cdot sen(\omega t + \alpha_i) = \mathbf{44{,}7 \cdot 10^{-3}} \cdot sen(10 \cdot 10^3 t + \mathbf{1{,}63})$$

Posso anche calcolare V_R e V_C:

$\bar{V}_R = R \cdot \bar{I} = 100 \cdot \bar{I}$

$$\begin{cases} |\bar{V}_R| = |R| \cdot |\bar{I}| = 100 \cdot 44{,}7m = \mathbf{4,47}V \\ \lfloor \bar{V}_R = \lfloor R + \lfloor \bar{I} = 0° + 93{,}4° = \mathbf{93,4}° \ (in\ fase\ con\ \bar{I}) \end{cases} \quad (**)$$

$\bar{V}_R = 4{,}47\lfloor 93{,}4° = 4{,}47\lfloor 2{,}93rad$

$v_R(t) = V_{RMAX} \cdot sen(\omega t + \alpha_{v_R}) = \mathbf{4,47} \cdot sen(10 \cdot 10^3 t + \mathbf{2,93})$

$\bar{V}_C = \frac{1}{j\omega C}\bar{I} = -j\frac{1}{10k \cdot 500n} \cdot \bar{I} = -j200 \cdot \bar{I}$

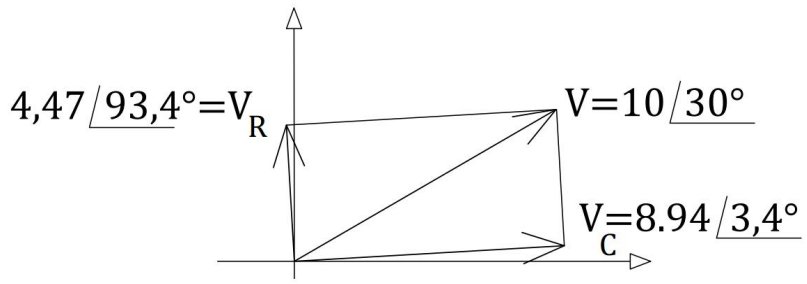
$$\begin{cases} |\bar{V}_C| = \left|\frac{1}{j\omega C}\right| \cdot |\bar{I}| = |-j200| \cdot 44{,}7m = 200 \cdot 44{,}7m = \mathbf{8,94}V \\ \lfloor \bar{V}_C = \left\lfloor -j\frac{1}{\omega C} + \lfloor \bar{I} = -90° + 93{,}4° = \mathbf{3,4}° \ (90°\ in\ ritardo\ su\ \bar{I}) \end{cases} \quad (**)$$

$\bar{V}_C = 22{,}35\lfloor 0{,}4° = 22{,}35\lfloor 59mrad$

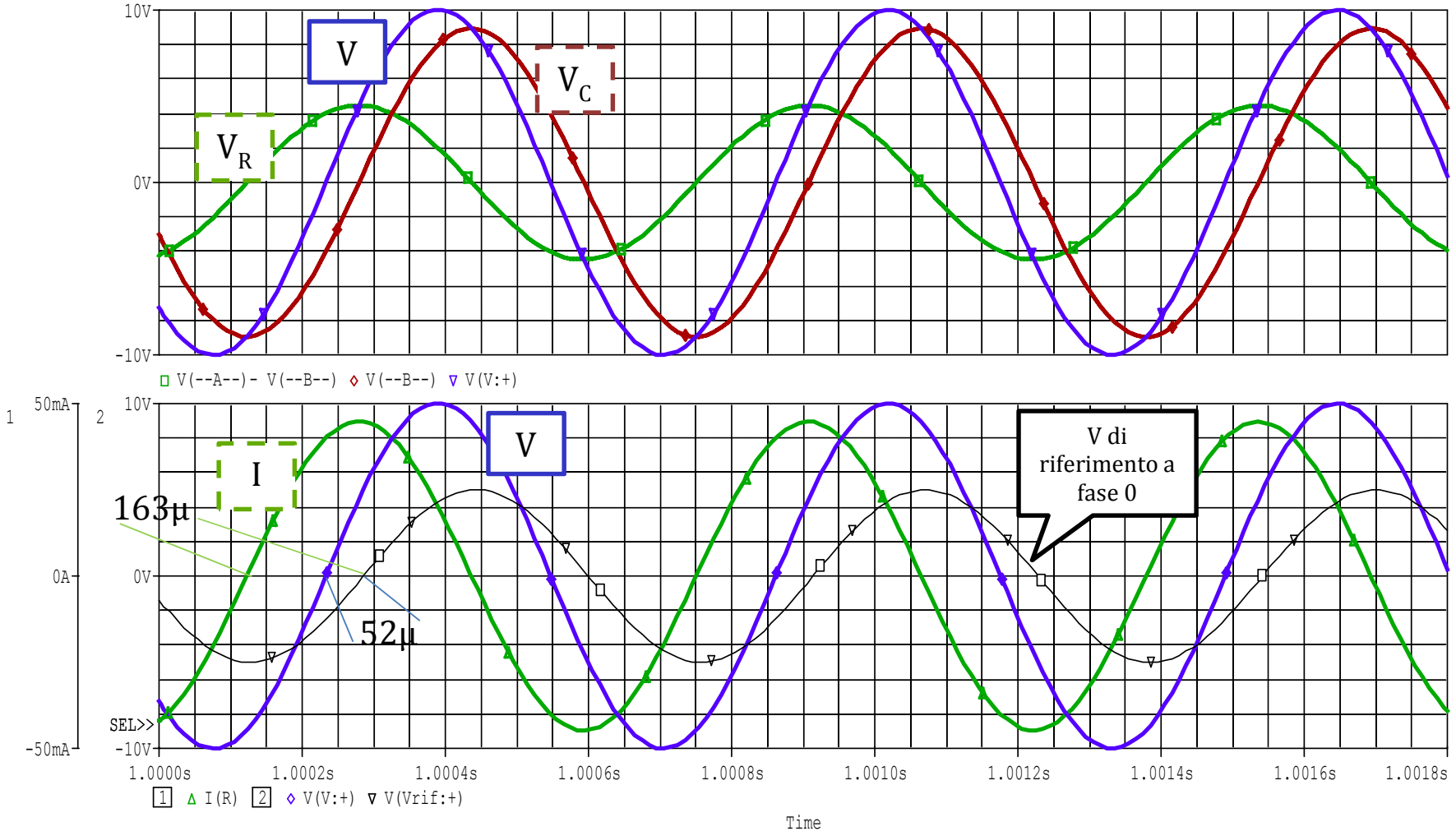
$v_L(t) = V_{LMAX} \cdot sen(\omega t + \alpha_{v_L}) = \mathbf{22,35} \cdot sen(10 \cdot 10^3 t + \mathbf{59m})$

Verifico graficamente che:

$\bar{V} = \bar{V}_R + \bar{V}_C$



Nella $(*)$ è stata utilizzata la regola: $Se\ \bar{X} = \frac{\bar{A}}{\bar{B}}\ \ allora \begin{cases} \lvert\bar{X}\rvert = \frac{\lvert\bar{A}\rvert}{\lvert\bar{B}\rvert} \\ \lfloor\bar{X} = \lfloor\bar{A} - \lfloor\bar{B} \end{cases}$ Nelle $(**)$ è stata utilizzata la regola: $Se\ \bar{X} = \bar{A} \cdot \bar{B}\ \ allora \begin{cases} \lvert\bar{X}\rvert = \lvert\bar{A}\rvert \cdot \lvert\bar{B}\rvert \\ \lfloor\bar{X} = \lfloor\bar{A} + \lfloor\bar{B} \end{cases}$	$\bar{V} = \pm X \pm jY$ Calcolo del MODULO: $\lvert \pm X \pm jY \rvert = \sqrt[2]{X^2 + Y^2}$ Calcolo della FASE: $\begin{cases} \lfloor(+X \pm jY) = arctg\left(\frac{\pm Y}{+X}\right) \\ \lfloor(-X \pm jY) = 180° + arctg\left(\frac{\pm Y}{-X}\right) \end{cases}$



$$\frac{t}{T} = \frac{\alpha}{2\pi} \quad \rightarrow \quad t = \frac{\alpha}{2\pi} \cdot T = \frac{\alpha}{2\pi f} = \frac{\alpha}{\omega} \quad \rightarrow \begin{cases} \alpha = \frac{\pi}{6}\ (30°) \ \rightarrow \ t = \frac{\frac{\pi}{6}}{10k} \cong 52{,}4\mu s \\ \alpha = 2{,}93\ rad \ \rightarrow \ t = \frac{1{,}63}{10k} \cong 163\mu s \end{cases}$$