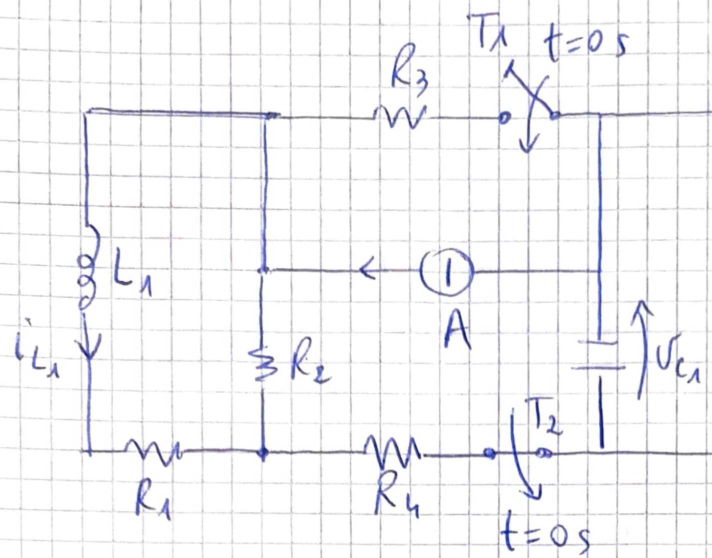
ESERCIZIO SU TRANSITORIO - METODO D'ISPEZIONE



Rete a regime per $t=0^-$ s:

T_1 inizialmente APERTO

T_2 " CHIUSO

DATI:

$R_1 = 2\,\Omega$, $R_2 = 3\,\Omega$, $R_3 = R_4 = 1\,\Omega$

$L_1 = 2\,mH$, $L_2 = 1\,mH$, $C_1 = 2\,mF$

$A = 1\,A$

DETERMINA:

$t = 0^-$: W_{L_1}, W_{L_2}, W_{C_1}

$t = 0^+$: $\frac{di_{L_1}}{dt}$, $\frac{di_{L_2}}{dt}$

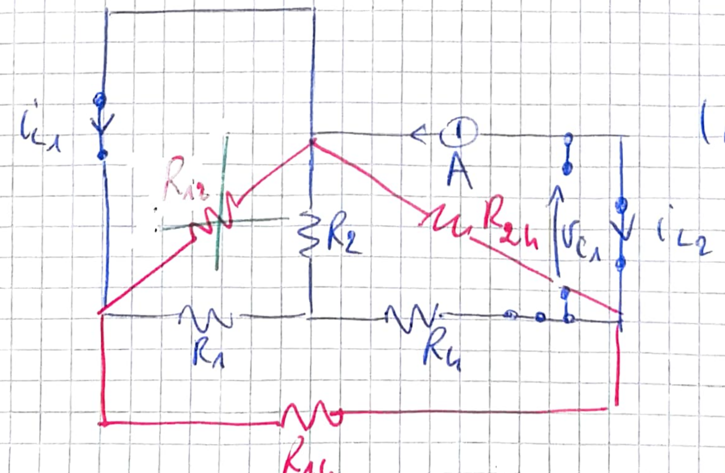
$t \to \infty$: W_{L_1}, W_{L_2}, W_{C_1}

SUGGERIMENTO:

TRASFORMAZIONE STELLA $\rightarrow$ TRIANGOLO

$$\begin{cases} R_{AB} = \dfrac{R_A R_B + R_B R_C + R_A R_C}{R_C} \\ R_{BC} = \dfrac{R_A R_B + R_B R_C + R_A R_C}{R_A} \\ R_{AC} = \dfrac{R_A R_B + R_B R_C + R_A R_C}{R_B} \end{cases}$$

$\boxed{t = 0^-}$ $R_{14} = \frac{11}{3}\,\Omega$, $R_{24} = \frac{11}{2}\,\Omega$, $R_{12} = 11\,\Omega$



$i_{L_1}(0^-) = I_{L_1 0} = A \dfrac{R_{24}}{R_{14} + R_{24}} = 0{,}6\,A$

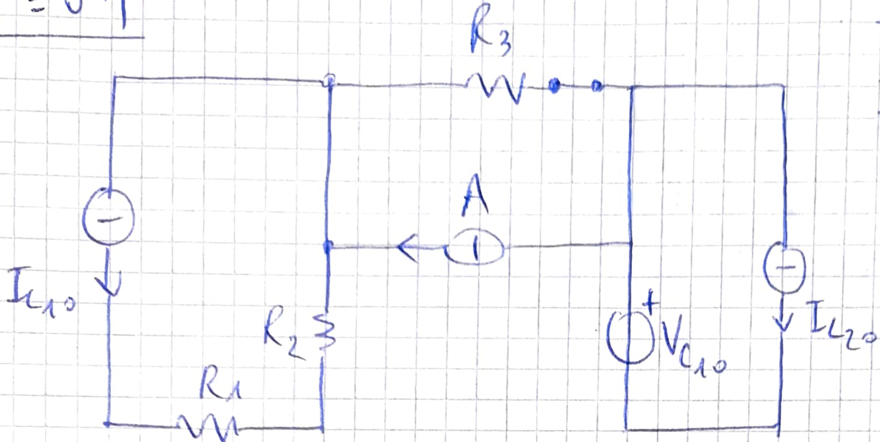
(PARTITORE DI CORRENTE)

$i_{L_2}(0^-) = -A = -1\,A = I_{L_2 0}$

$v_{C_1}(0^-) = V_{C_1 0} = 0\,V$

$$\Rightarrow \begin{cases} W_{L_{10^-}} = \frac{1}{2} L_1 I_{L_{10}}^2 = 0{,}360 \text{ mJ} \\ W_{L_{20^-}} = \frac{1}{2} L_2 I_{L_{20}}^2 = 0{,}500 \text{ mJ} \\ W_{C_{10^-}} = \frac{1}{2} C_1 V_{C_{10}}^2 = 0 \text{ J} \end{cases}$$

$\boxed{t = 0^+}$



$I_{L_{10}} = 0{,}6 \text{ A}$

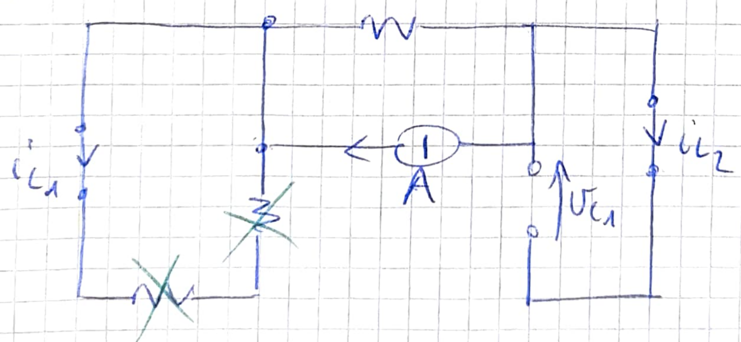
$I_{L_{20}} = -1 \text{ A}$

$V_{C_{10}} = 0 \text{ V}$

$$\left.\frac{di_{L_1}}{dt}\right|_{0^+} = -\frac{I_{L_{10}}(R_1 + R_2)}{L_1} = -1500 \text{ A/s}$$

$$\left.\frac{di_{L_2}}{dt}\right|_{0^+} = \frac{V_{C_{10}}}{L_2} = 0 \text{ A/s}$$

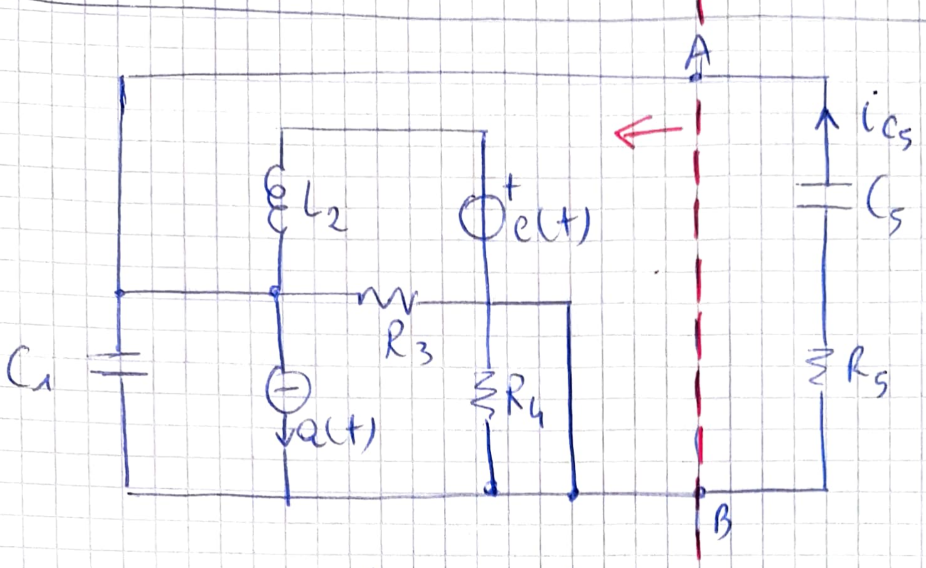
$\boxed{t \to \infty}$



$i_{L_2}(\infty) = i_{L_1}(\infty) = 0 \text{ A} \qquad v_{C_1}(\infty) = 0 \text{ V}$

$\Rightarrow W_{L_1\infty} = W_{L_2\infty} = W_{C_1\infty} = 0 \text{ J}$

ESERCIZIO SU REGIME SINUSOIDALE



DATI:

$C_1 = 3\,mF$
$L_2 = 1\,mH$
$R_3 = 3\,\Omega$
$R_4 = 2\,\Omega$
$C_5 = 2\,mF$
$R_5 = 1\,\Omega$
$\omega = 3\,rad/s$

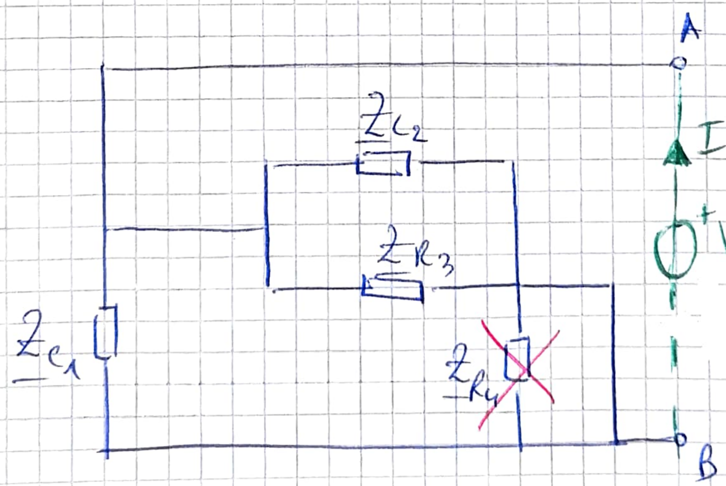
$a(t) = 3\sin(3t - 30°)\ A$
$e(t) = 2\sin(3t - 105°)\ V$

DETERMINA CIRCUITO EQUIVALENTE DI THEVENIN TRA I TERMINALI A & B (PARTE SINISTRA)

$\underline{A} = \frac{3}{\sqrt{2}} \angle -120°\ A$, $\underline{E} = \sqrt{2} \angle -195°\ V$

$\underline{Z}_{C_1} = -111j\,\Omega$, $\underline{Z}_{L_2} = 0{,}003j\,\Omega$, $\underline{Z}_{R_3} = 3\,\Omega$, $\underline{Z}_{R_4} = 2\,\Omega$
$\underline{Z}_{R_5} = 1\,\Omega$, $\underline{Z}_{C_5} = -167j\,\Omega$

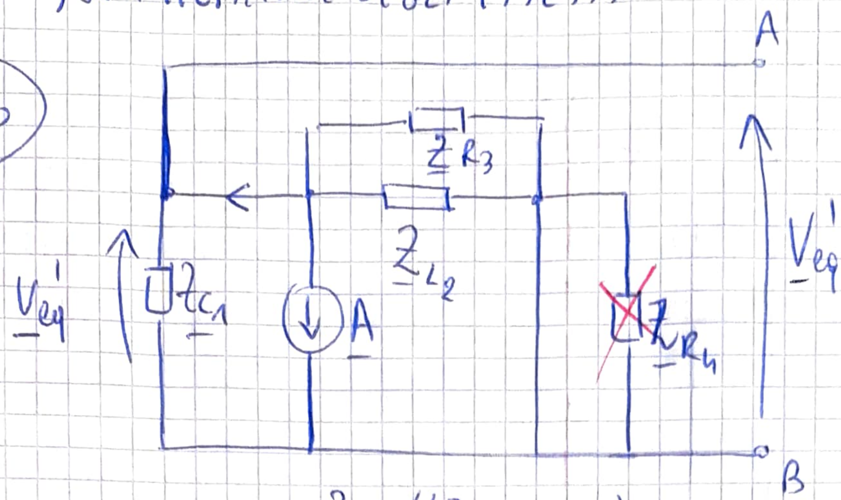
$\boxed{\underline{Z}_{eq}}$



$$\underline{Z}_{eq} = \underline{Z}_{C_1} \parallel \underline{Z}_{L_2} \parallel \underline{Z}_{R_3} = \left(\frac{1}{\underline{Z}_{C_1}} + \frac{1}{\underline{Z}_{L_2}} + \frac{1}{\underline{Z}_{R_3}}\right)^{-1}$$
$$= 0{,}003 + j3\ m\Omega$$

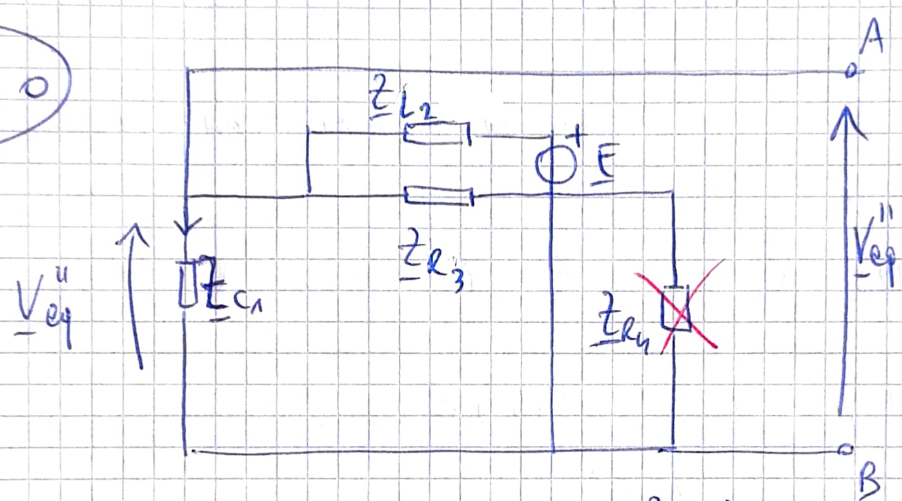
$\boxed{\underline{V}_{eq}}$ SOVRAPPOSIZIONE DEGLI EFFETTI

→ $\underline{A} \neq 0$



$$\underline{V}'_{eq} = \underline{Z}_{C_1}\left(-\underline{A}\,\frac{\underline{Z}_{L_2}//\underline{Z}_{R_3}}{\underline{Z}_{L_2}//\underline{Z}_{R_3}+\underline{Z}_{C_1}}\right) = 6,36 \angle 150^\circ \ \text{mV}$$

→ $\underline{E} \neq 0$



$$\underline{Z}_x = \underline{Z}_{C_1}//\underline{Z}_{R_3} + \underline{Z}_{L_2} = \frac{\underline{Z}_{C_1}\underline{Z}_{R_3}}{\underline{Z}_{C_1}+\underline{Z}_{R_3}} + \underline{Z}_{L_2}$$

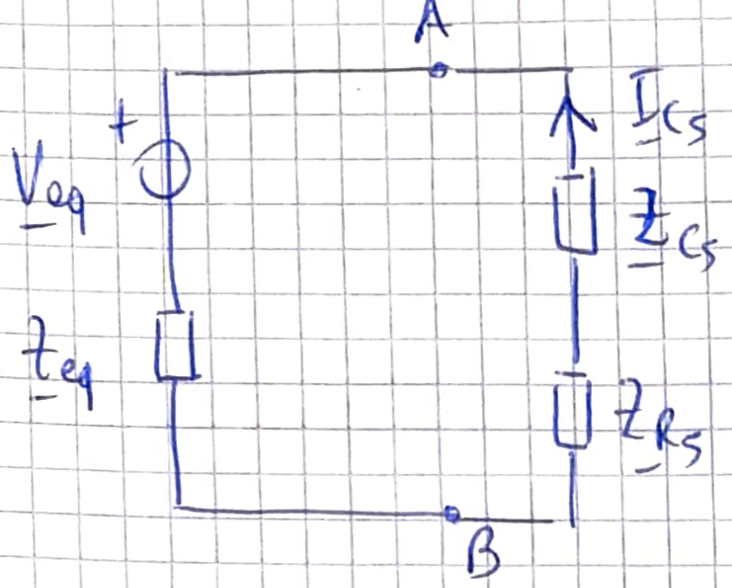
$$= 2,9988 \angle -1,4909^\circ \ \Omega$$

$$\underline{I}_E = \frac{\underline{E}}{\underline{Z}_x} = 0,47159 \angle 166,49^\circ \ \text{A}$$

PARTITORE DI CORRENTE:

$$\underline{V}''_{eq} = \underline{Z}_{C_1}\left(\underline{I}_E\,\frac{\underline{Z}_{R_3}}{\underline{Z}_{R_3}+\underline{Z}_{C_1}}\right) = 1,41 \angle 165^\circ \ \text{V}$$

$$\Rightarrow \underline{V}_{eq} = \underline{V}'_{eq} + \underline{V}''_{eq} = 1,42 \angle 165^\circ \ \text{V}$$



$$\underline{I}_{C_5} = -\frac{\underline{V}_{eq}}{\underline{Z}_{eq} + \underline{Z}_{C_5} + \underline{Z}_{R_5}} = 8{,}50\angle 74{,}7^\circ \text{ mA}$$