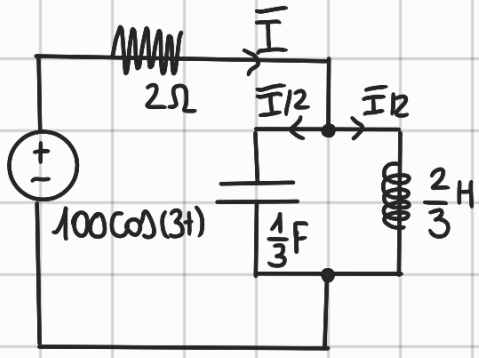
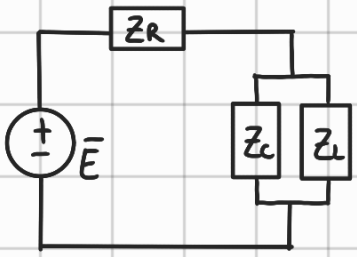
25 MAGGIO 2011 es. 5 OK



Determina potenza attiva, reattiva e potenza istantanee erogata dal generatore

DOMINIO DEI FASORI



$\bar{E} = 100$ V

$Z_R = 2\Omega$

$Z_C = \frac{1}{j\omega C} = \frac{1}{j3\frac{1}{3}} = -j\ \Omega$

$Z_L = j\omega L = j3 \cdot \frac{2}{3} = 2j\ \Omega$

Troviamo la corrente

$Z_C \| Z_L = \frac{-j(2j)}{2j-j} = \frac{2}{j} = -2j$

$+ \Sigma Z_R = 2 - 2j\ \Omega$

$\bar{I} = \frac{\bar{E}}{\bar{Z}} = \frac{100}{2-2j} = \frac{50}{1-j}\frac{1+j}{1+j} = \frac{50+50j}{1+1} = 25+25j$ A

$\bar{P}_g = \frac{1}{2}\bar{E}\cdot\bar{I}^* = \frac{1}{2}100(25-25j) = 1250 - 1250j$ VA

$P_g = 1250$ W

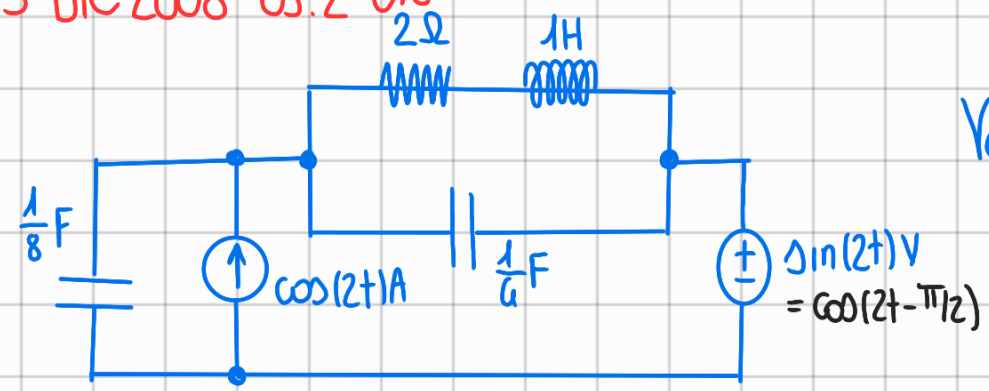
$Q_g = -1250$ VAR

$A = \sqrt{P_g^2 + Q_g^2} = 1767$

$P_{MAX} = P + A = 3017$ W

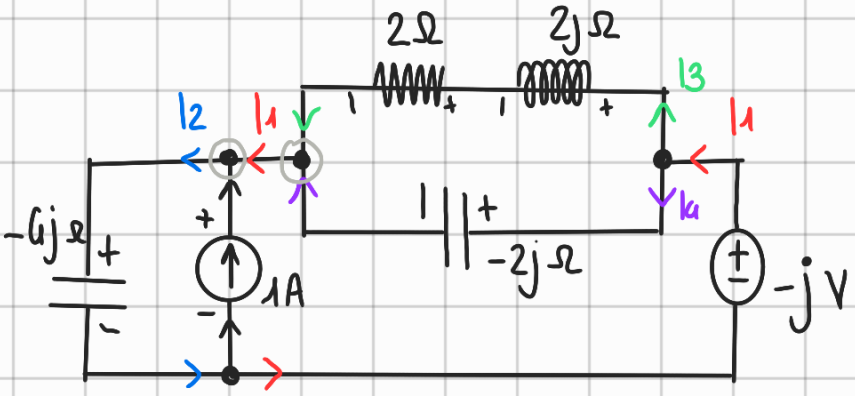
$P_{MIN} = P - A = -517$ W

15 DIC 2008 es. 2 OK

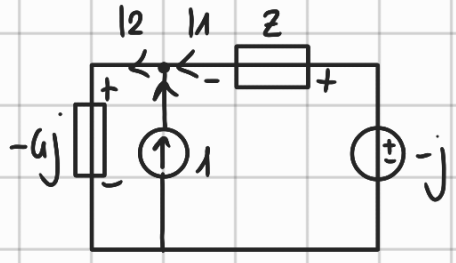


Verifica Bouchezot

DOMINIO DEI FASORI



$$Z = \frac{(2+2j)(-2j)}{2+2j-2j} = 2-2j$$



$$\begin{cases} I_2 = I_1 + 1 \\ -j + 4j I_2 - Z I_1 = 0 \quad -j + 4j(I_1+1) - (2-2j) I_1 = 0 \end{cases}$$

$$-j + 4j I_1 + 4j - 2I_1 + 2jI_1 = 0$$

$$6jI_1 - 2I_1 = -3j \qquad I_1(6j-2) = -3j \quad \bullet\ I_1 = -\frac{9}{20} + \frac{3}{20}j$$

$$|I_1| = 3\sqrt{10}/20 \text{ A} \qquad \bullet\ I_2 = \frac{11}{20} + \frac{3}{20}j$$

$$|I_2| = \sqrt{130}/20 \text{ A}$$

Condensatori $\quad Q_{C1} = \frac{1}{2}(-4j)\left(\frac{\sqrt{130}}{20}\right)^2 = -\frac{13}{20}$ VAR

$$V_L + V_R - V_C = 0$$

$$\begin{cases} 2jI_3 + 2I_3 + 2jI_4 = 0 \\ I_3 + I_4 = I_1 = -\frac{9}{20} + \frac{3}{20}j \end{cases} \qquad I_4 = -\frac{9}{20} + \frac{3}{20}j - I_3$$

$$2j\dot{I}_3 + 2\dot{I}_3 + 2j\left(-\frac{9}{20} + \frac{3}{20}j - \dot{I}_3\right) = 0$$

$$\cancel{2j\dot{I}_3} + 2\dot{I}_3 - \frac{9}{10}j - \frac{3}{10} \cancel{- 2j\dot{I}_3} = 0 \qquad \dot{I}_3 = \frac{3}{20} + \frac{9}{20}j \qquad |\dot{I}_3| = \frac{3\sqrt{10}}{20}$$

$$\dot{I}_4 = -\frac{9}{20} + \frac{3}{20}j - \frac{3}{20} - \frac{9}{20}j = -\frac{3}{5} - \frac{3}{10}j \qquad |\dot{I}_4| = \frac{3\sqrt{5}}{10}$$

Resistore $P_R = \frac{1}{2} 2 |\dot{I}_3|^2 = \frac{9}{40}$ W

Induttore $Q_L = \frac{1}{2} 2j |\dot{I}_3|^2 = \frac{9}{40}$ (j) VAR

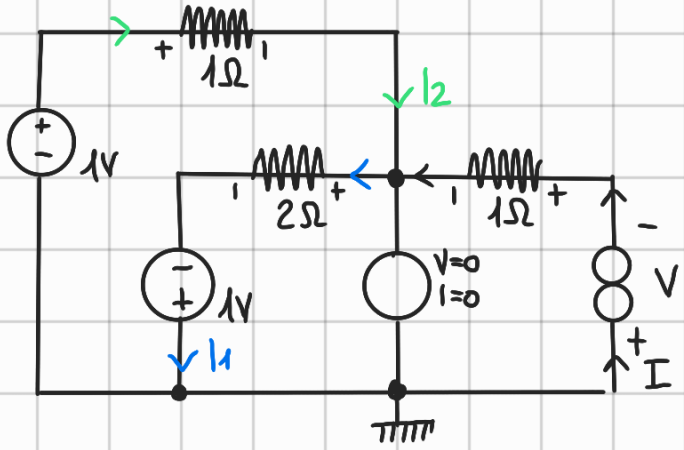
Condensatore $Q_C = \frac{1}{2}(-2j)|\dot{I}_4|^2 = -\frac{9}{20}$ (j) VAR

Generatore corrente $\overline{P_I} = \frac{1}{2}\left(-4j\left(\frac{11}{20} + \frac{3}{20}j\right)(1)\right) =$

$$-j\left(\frac{11}{10} + \frac{3}{10}j\right) = \frac{-11}{10}j + \frac{3}{10}$$

tensione $\overline{P_T} = \frac{1}{2}(-j)\left(-\frac{9}{20} - \frac{3}{20}j\right) = -\frac{3}{40} + \frac{9}{40}j$

9 NOV 2006 es. 2 Verifica il teorema di Tellegen OK



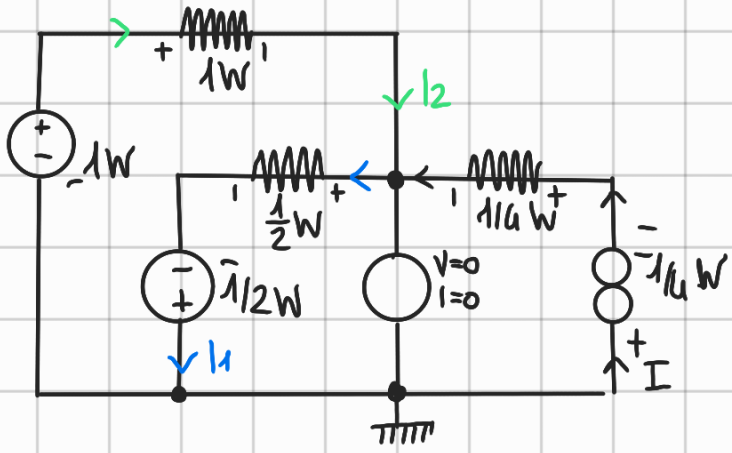
$P = V \cdot I$

KI $\quad I_2 + I = I_1 \qquad I = -1/2\ A$

KV $\quad +1I + V = 0 \qquad V = -1\left(-\frac{1}{2}\right) = 1/2$

$\quad +1 - 2I_1 = 0 \qquad I_1 = 1/2\ A$

$\quad 2I_1 - 1 - 1 + 1I_2 = 0 \qquad I_2 = 1\ A$



$P_{gV} = -1 \cdot I_2 = 1$

$P_{R1} = R I_2 I_2 = 1 \cdot 1 = 1$

$P_{R2} = R I_1 I_1 = 2 \cdot \frac{1}{2^2} = 1/2$

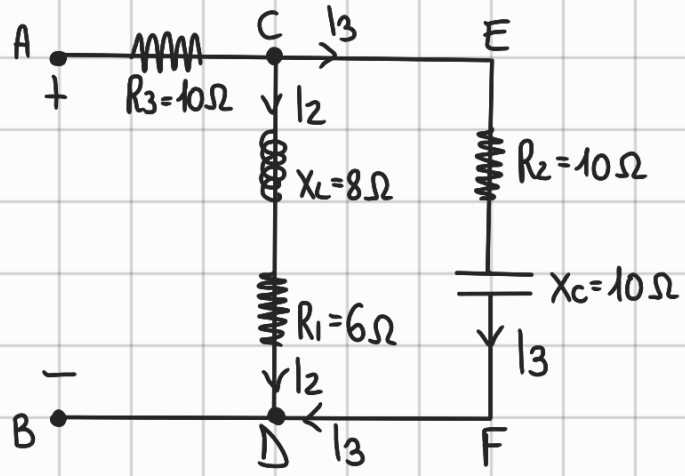
$P_g = 1 I_1 = 1/2$

$P_{R1} = R I I = 1\left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right) = \frac{1}{4}$

$P = V I = +1\left(-\frac{1}{2}\right) = -1/4$

$$-1 + 1 + \frac{1}{2} - \frac{1}{2} + \frac{1}{4} - \frac{1}{4} = 0 \quad \checkmark$$

2 2006 es1 Determina tramite Boucherot P e Q di AB OK



$Q_C = -10^3$ VAR

Trovo I_3 $\quad Q_C = X_C |I_3|^2 \rightarrow |I_3|^2 = \frac{Q_C}{X_C} = \frac{10^{+3}}{10} = 10^2 \quad I_3 = 10$ Aeff

$P_2 = R_2 |I_3|^2 = 10 \cdot 10^2 = 1000$ W

$V_C = X_C I_3 = 10 \cdot 10 = 100$ Veff $\quad V_2 = R_2 I_3 = 10 \cdot 10 = 100$ Veff

$V_{CD} = \underline{(V_C + V_2)} = \underline{200} = 20$ Veff

$A_{EF} = \sqrt{Q_C^2 + P_2^2} = \sqrt{10^{3\cdot 2} + 1000^2} = 1414{,}21$ VA

$A = V I \rightsquigarrow V_{EF} = \frac{A_{EF}}{I_3} = \frac{1414{,}21}{10} = 141{,}42$ Veff

$V_{EF} = V_{CD} = 141{,}32$ Veff

$Q_L = X_L I_2^2 = \frac{V_L^2}{X_L} \qquad P_1 = R_1 I_2^2 = \frac{V_1^2}{R_1}$

$A_{CD} = \sqrt{Q_L^2 + P_1^2} = \frac{V_{CD}}{I_2} \Rightarrow \sqrt{(X_L I_2^2)^2 + (R_1 I_2^2)^2} = \frac{V_{CD}}{I_2}$

$\rightsquigarrow X_L^2 I_2^4 + R_1^2 I_2^4 = \frac{V_{CD}^2}{I_2^2} \rightsquigarrow I_2^2 (X_L^2 I_2^4 + R_1^2 I_2^4) = V_{CD}^2$

$X_L^2 I_2^2 + R_1^2 I_2^2 = V_{CD}^2 \qquad I_2^2 (X_L^2 + R_1^2) = \frac{V_{CD}^2}{X_L^2 + R_1^2}$

$I_2 = \sqrt{\frac{V_{CD}^2}{X_L^2 + R_1^2}} = \sqrt{\frac{(141{,}32)^2}{8^2 + 6^2}} = 14{,}13$ Aeff

$Q_L = X_L I_2^2 = 8 (14{,}13)^2 = 1597{,}7$ VAR

$P_1 = R_1 I_2^2 = 6 \cdot (14,13)^2 \simeq 1197,94$ W

$Q_{AB} \Rightarrow Q_L - Q_C = 1597,7 - 1000 \approx 600$ VAR

$P_{CD} = P_1 + P_2 = 1197 + 1000 = 2197$ W

$A = \sqrt{Q_{AB}^2 + P_{CD}^2} = \sqrt{2197^2 + 600^2} = 2277$ VA

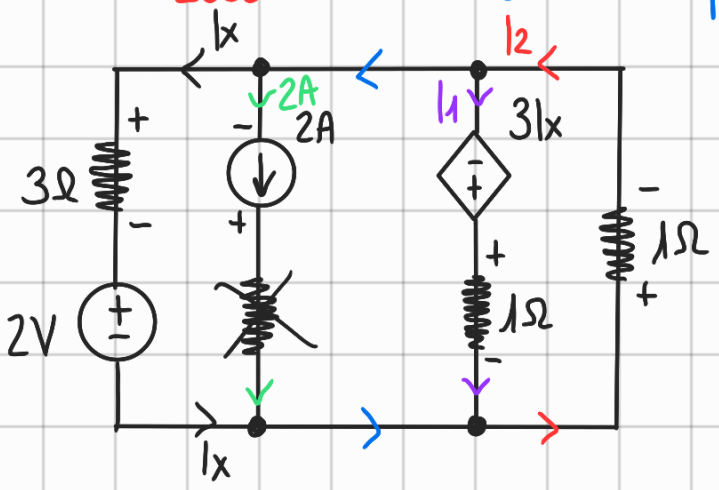
$A = VI \qquad I = \frac{A}{V} = \frac{2277}{161,32} = 16,11$ Aeff

$P_{R3} = 10 \cdot 16,11^2 = 2595,32$ W

$P_{Tot} = 2197 + 2595,32 = 4792,32$ W

OK

16 DIC 2006 ED2 Determina la potenza erogata dal generatore contr.



KCI: $+I_x + 2 + I_1 = I_2$

KVL: $+V_c + 2V - 3I_x = 0$

$-3I_x + 1I_1 + V_c = 0$

$-1I_2 - 1I_1 + 3I_x = 0$

$I_x = I_2 - I_1 - 2$

$V_c = -2 - 3(I_2 - I_1 - 2) = -2 - 3I_2 + 3I_1 + 6$

$= 3I_1 - 3I_2 + 6$

$$\begin{cases} \bullet\ -3(I_2 - I_1 - 2) + I_1 + 3I_1 - 3I_2 + 6 = 0 \\ \bullet\ -I_2 - I_1 + 3(I_2 - I_1 - 2) = 0 \end{cases}$$

$$\begin{cases} -3I_2 + 3I_1 + 6 + I_1 + 3I_1 - 3I_2 + 6 = 0 \\ -I_2 - I_1 + 3I_2 - 3I_1 - 6 = 0 \end{cases} \qquad -6I_1 + 2I_2 - 6 = 0 \qquad 2I_2 = 6 + 6I_1$$

$\bullet\ I_2 = 3 + 2I_1$

$7I_1 - 6I_2 + 10 = 0$ $\qquad 7I_1 - 18 - 12I_1 + 10 = 0$

$-5I_1 = 8$ $\qquad I_1 = -8/5$ A

$I_2 = -1/5$ A

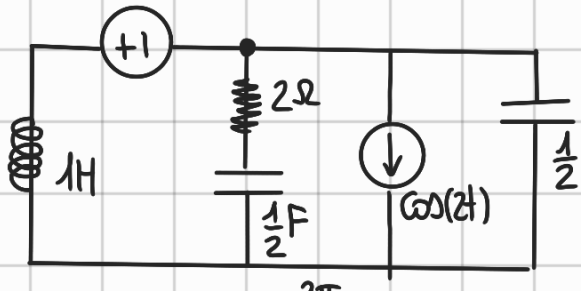
$$I_x = -\frac{1}{5} + \frac{8}{5} - 2 = -3/5 \text{ A}$$

$V_x = 3I_x = -9/5$ V

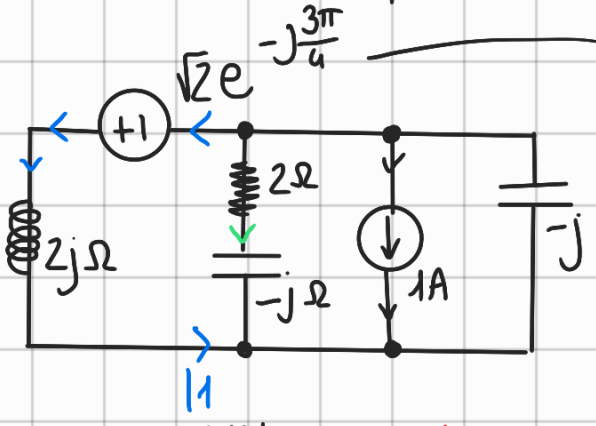
$$P = VI = -\frac{9}{5}\cdot\left(-\frac{3}{5}\right) = \frac{27}{25} \text{ W}$$

16 DIC 2006 es 2 trova Qe P del carico RC OK

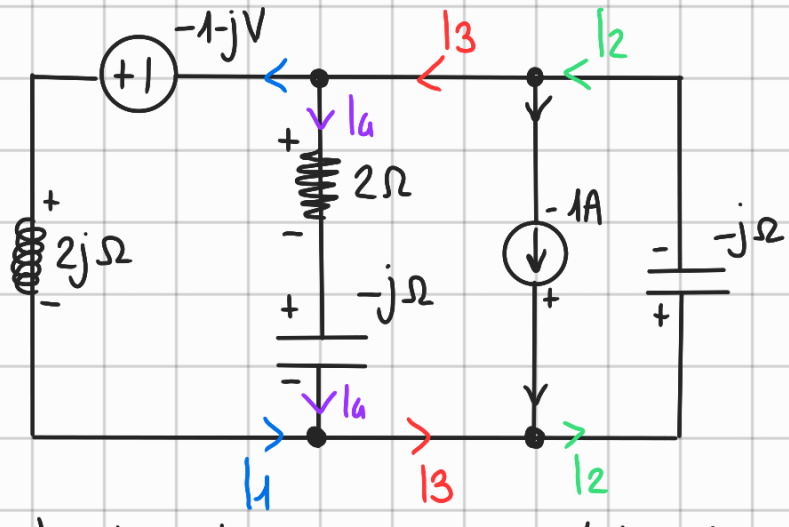
$\sqrt{2}\sin(2t-\pi/4) = \sqrt{2}\cos(2t-\frac{3\pi}{4})$



FASORI → $\omega = 2$



$\sqrt{2}\left(-\frac{(1+j)}{\sqrt{2}}\right) = -1-j$ V



KI $I_1 - I_a - 1 + I_2 = 0$

- $I_1 + I_2 = 1 + I_a$

KV
$$\begin{cases} 2I_a - jI_a - 2jI_1 - 1 - j = 0 \\ +jI_2 + jI_a - 2I_a = 0 \\ I_1 + I_2 = 1 + I_a \end{cases} \quad \begin{cases} (2-j)I_a - 2jI_1 - 1 - j = 0 \\ jI_2 + (j-2)I_a = 0 \\ I_a = I_1 + I_2 - 1 \end{cases}$$

x $I_1 = -\frac{3}{61} + \frac{28}{61}i$

y $I_2 = 55/61 - 5/61\,j$

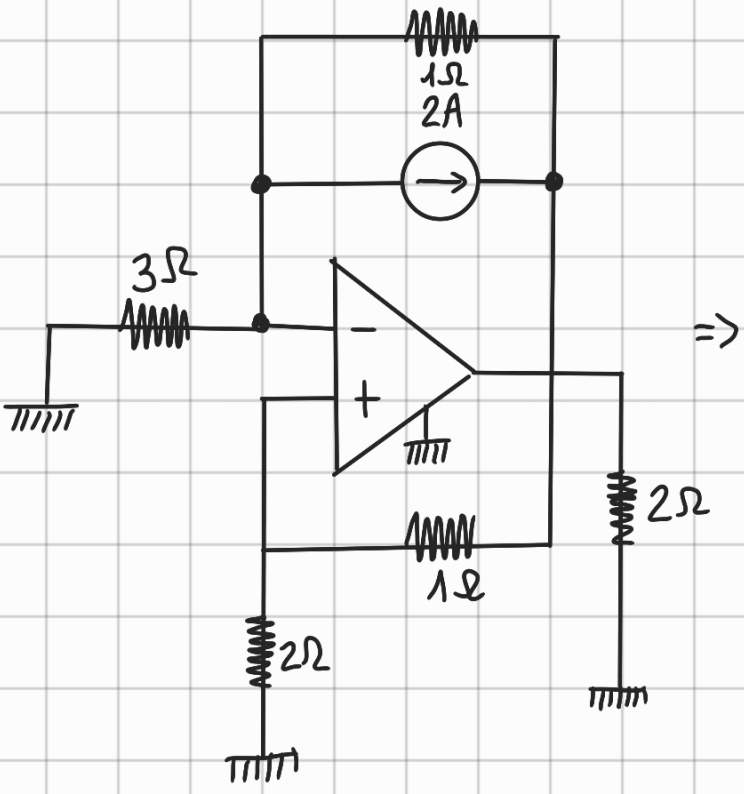
z $I_a = -\frac{9}{61} + \frac{23}{61}j$ ⇝

$|I_a| = 0{,}40$

$P_R = \frac{1}{2} 2 |I_a|^2 = 0{,}16$ W ✓

$Q_C = \frac{1}{2}(-1)|I_a|^2 = -0{,}08$ ✓

3 2006 es2 Determina $P_{di\ ao}$ e $P_{del\ generatore\ di\ corrente}$



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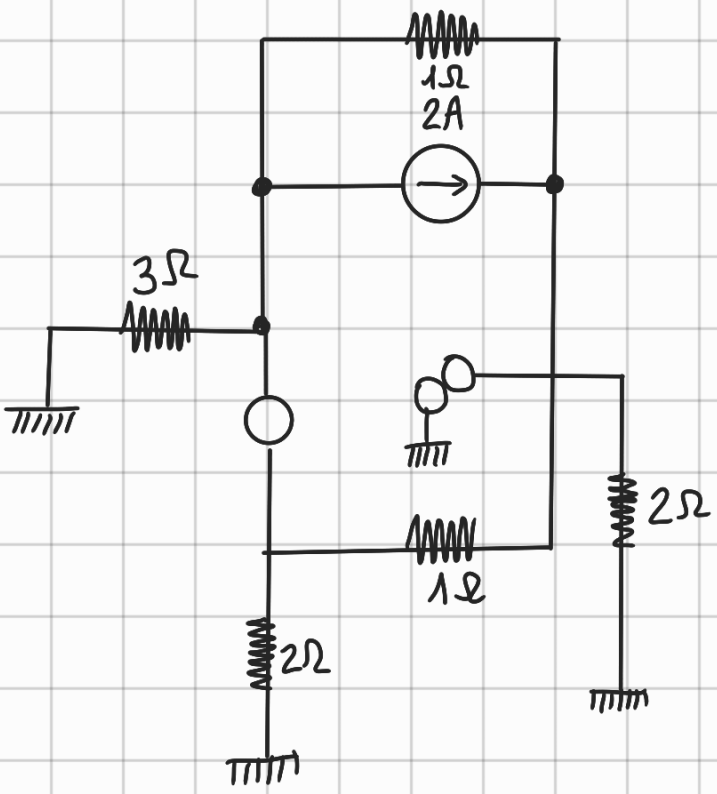

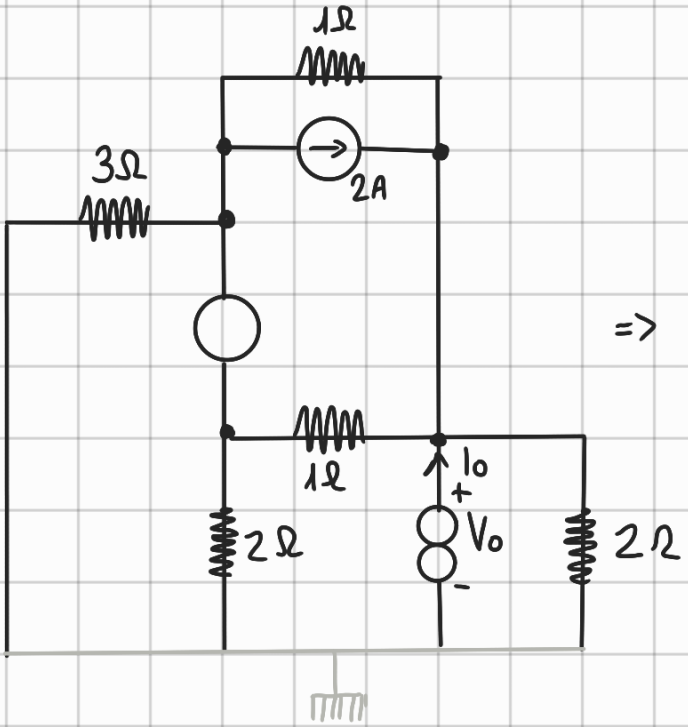

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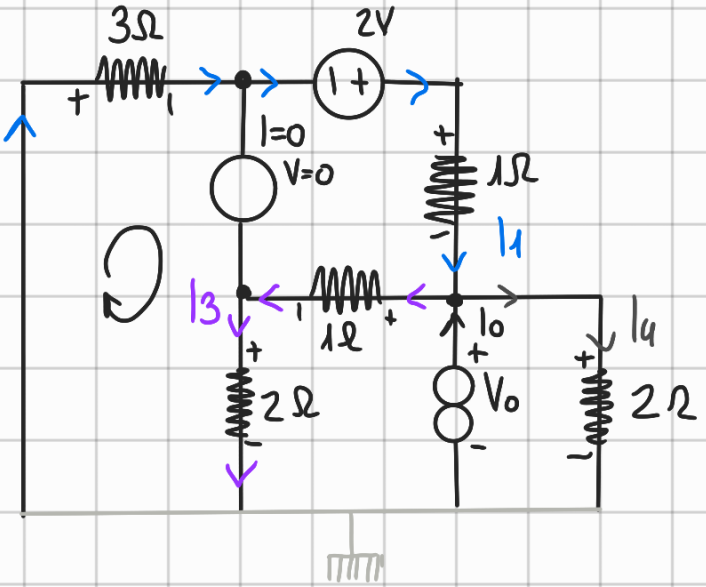

$$\begin{cases} 2I_3 + 3I_1 = 0 \\ I_o + I_1 = I_3 + I_4 \\ 2I_4 - 2I_3 - 1I_3 = 0 \\ -2 + 1I_4 + 1I_3 = 0 \\ 2I_4 - 3 \cdot 6 = 0 \end{cases}$$

$2I_4 - V_o = 0 \quad \bullet \quad V_o = 2I_4$

$I_1 = \frac{-2I_3}{3} = -4\ A$

$-6 - 2I_3 + 3I_3 = 0$

$-2 - \frac{2}{3} I_3 + I_3 = 0 \qquad I_3 = 6\ A$

$2I_4 = 18 \qquad I_4 = 9\ A \qquad I_o = I_3 + I_4 - 1 = 6 + 9 + 4 = 19\ A$

$I_o = 19\ A \qquad P = I_o V_o = 19 \cdot 18 = 342\ W \qquad V_o = 18\ V$