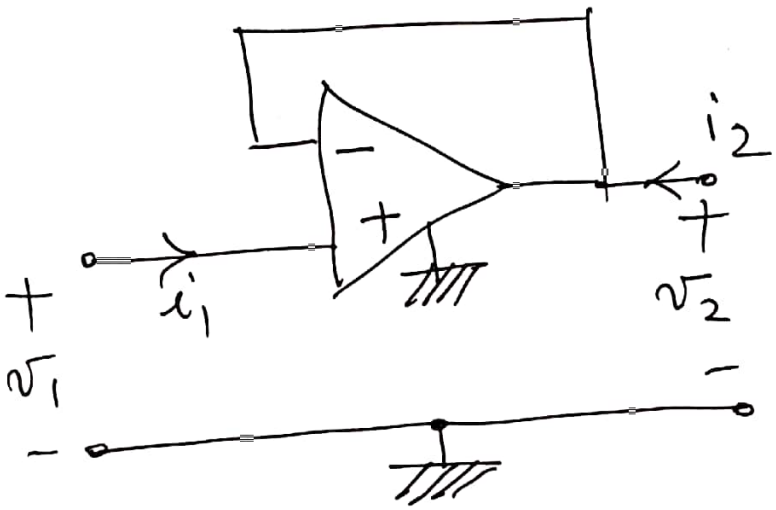
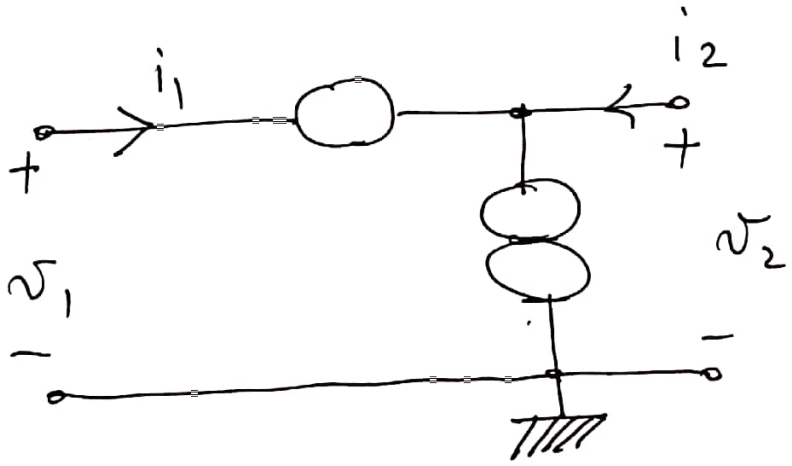
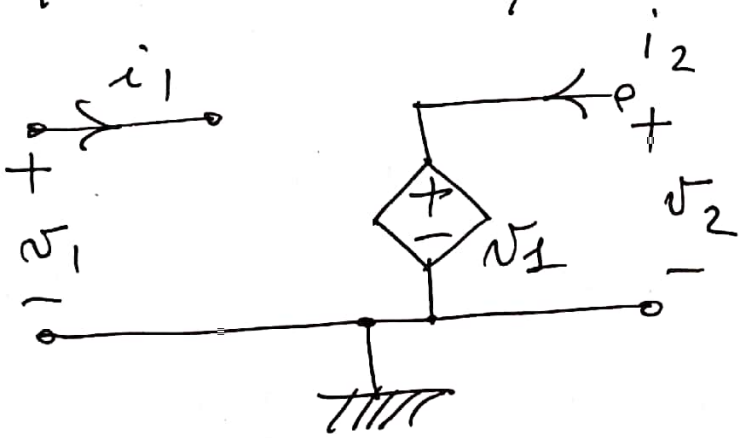
Esempio Circuito separatore (buffer)





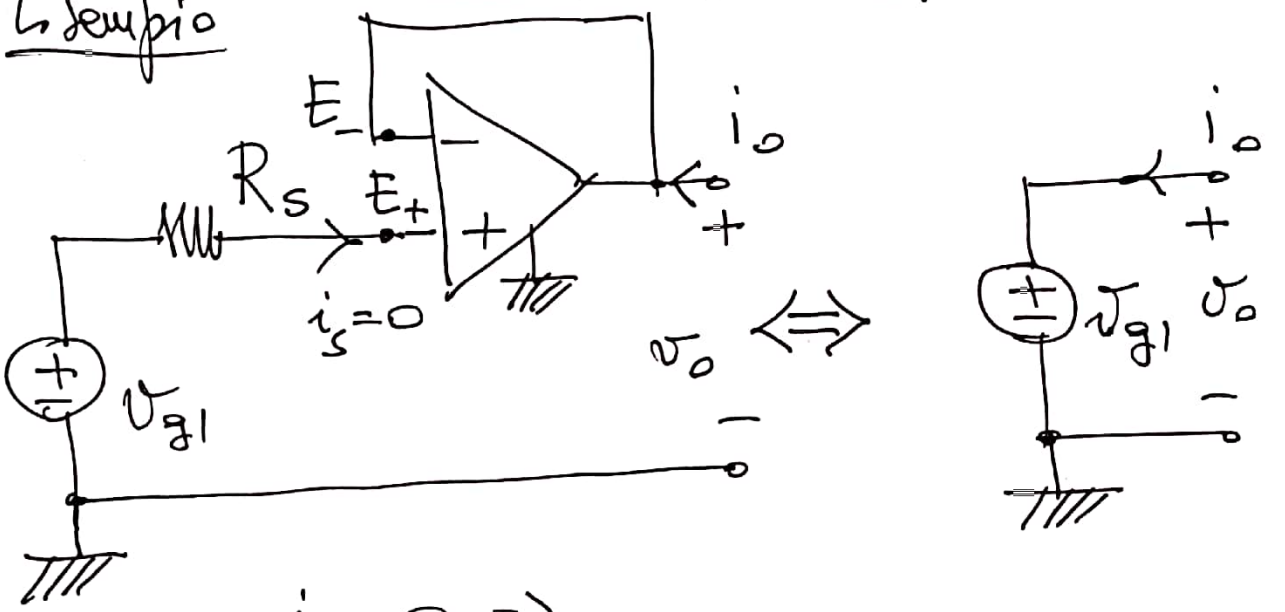
$$\begin{cases} v_2 = v_1 \\ i_1 = 0 \end{cases}$$

relazioni costitutive



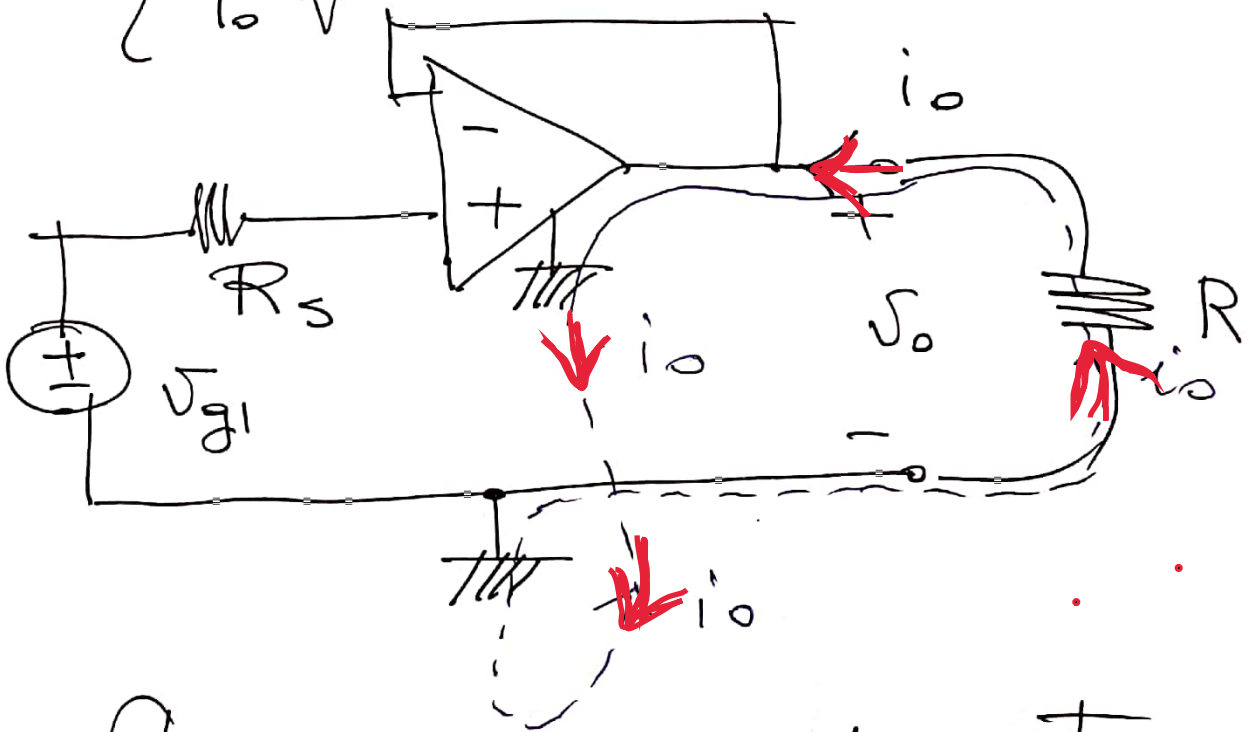
Impiego c.to ripetitore

Esempio



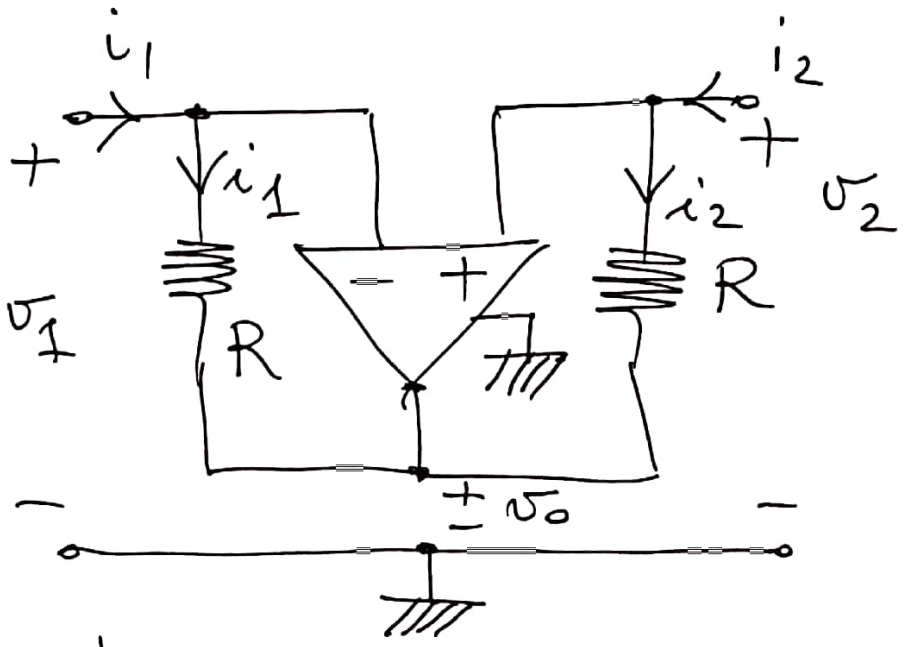
$i_s = 0 \Rightarrow$

$$\begin{cases} v_o = E_- = E_+ = v_{g1} \\ i_o \ \forall \end{cases}$$



Notare la circolazione di corrente nel circuito.

Inverritore di corrente (I-NIC)

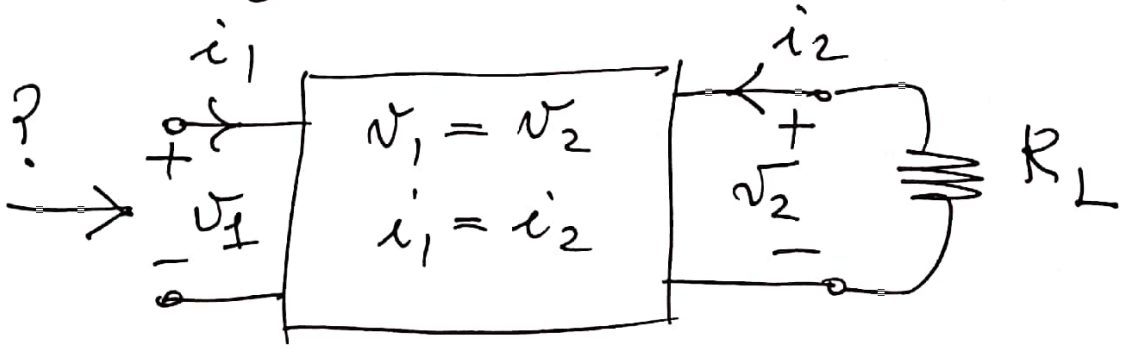


Si ha: $v_1 = v_2$

$$i_1 = \frac{v_1 - v_o}{R} \; ; \quad i_2 = \frac{v_2 - v_o}{R}$$

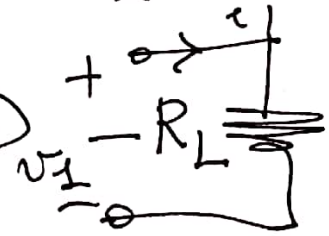
$$\Rightarrow \quad i_1 = i_2$$

$$\Rightarrow \begin{cases} v_1 = v_2 \\ i_1 = i_2 \end{cases} \quad \text{I-NIC}.$$

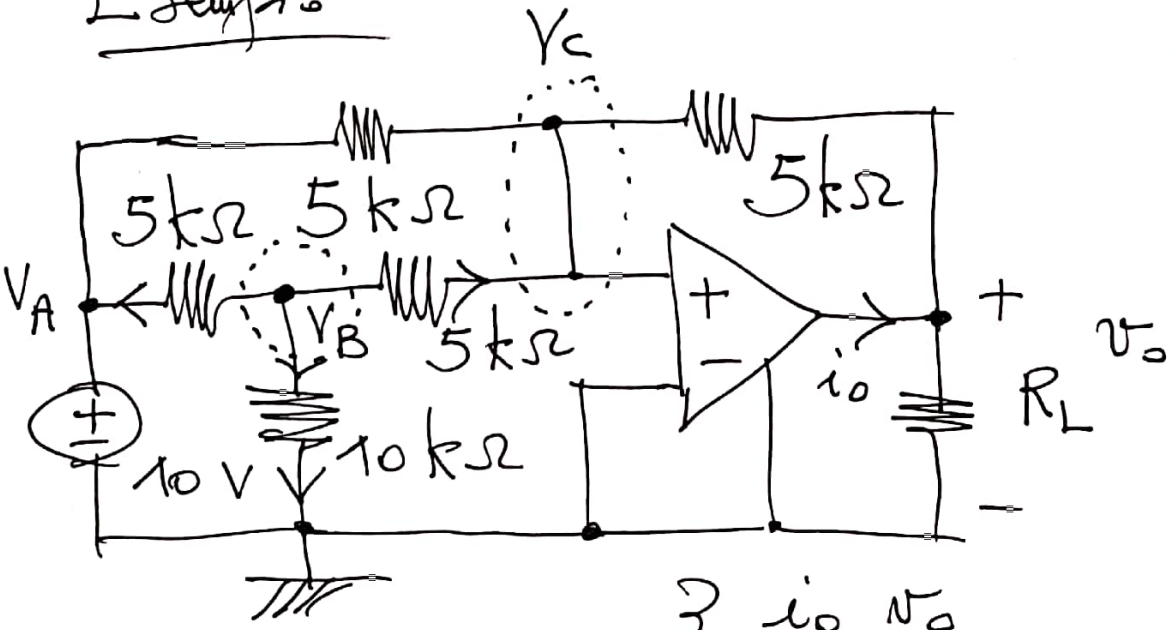


$$\frac{v_1}{i_1} = \frac{v_2}{i_2}, \quad \text{ma} \quad v_2 = -R_L i_2.$$

$$\Rightarrow \quad \frac{v_1}{i_1} = -R_L \quad \ldots \Leftrightarrow$$



Esempio



? i_o, v_o.

4 nodi A, B, C, D;
4 incognite V_A, V_B, V_C, V_D
Ma: $V_A = 10\ V$, $V_C = 0$.
$\Rightarrow$ 2 sole incognite V_B e V_o

KCL nodi B e C.

(B) $$\frac{v_B - 10}{5\times10^3} + \frac{v_B}{5\times10^3} + \frac{v_B}{10\times10^3} = 0$$

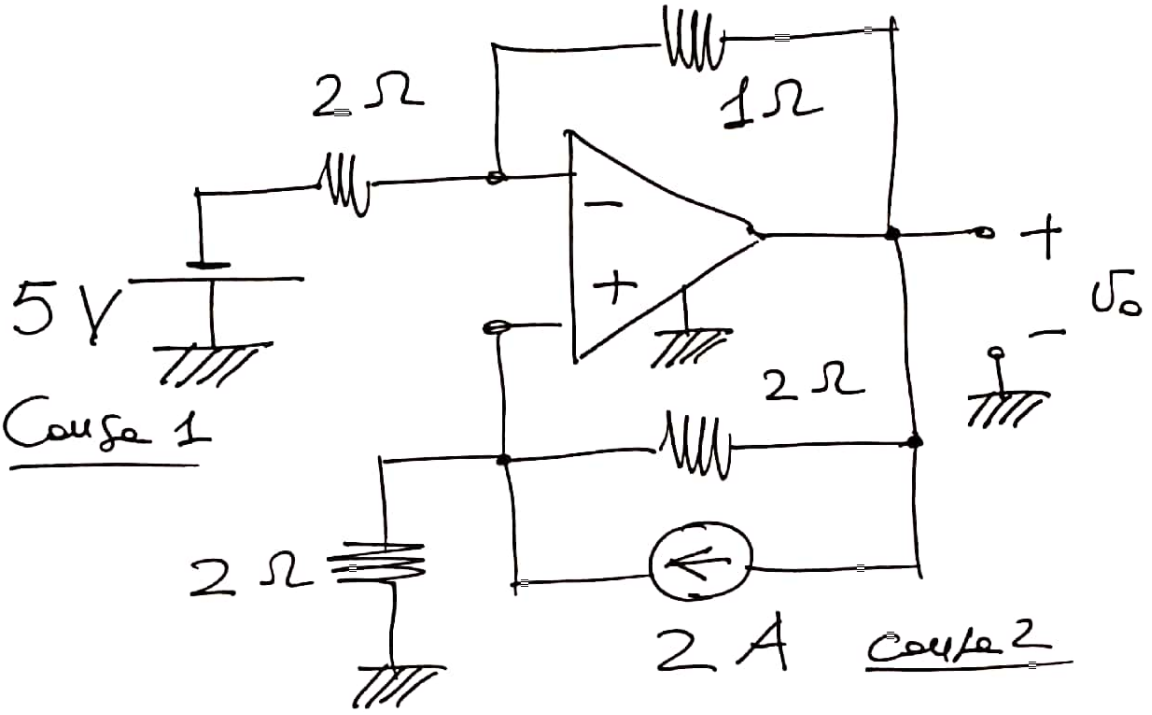
$$2v_B - 20 + 2v_B + v_B = 0 \Rightarrow$$

$$\boxed{v_B = 4\ V}$$

(C) $$\frac{10 - 0}{5\times10^3} + \frac{v_o - 0}{5\times10^3} + \frac{v_B - 0}{5\times10^3} + 0 = 0$$

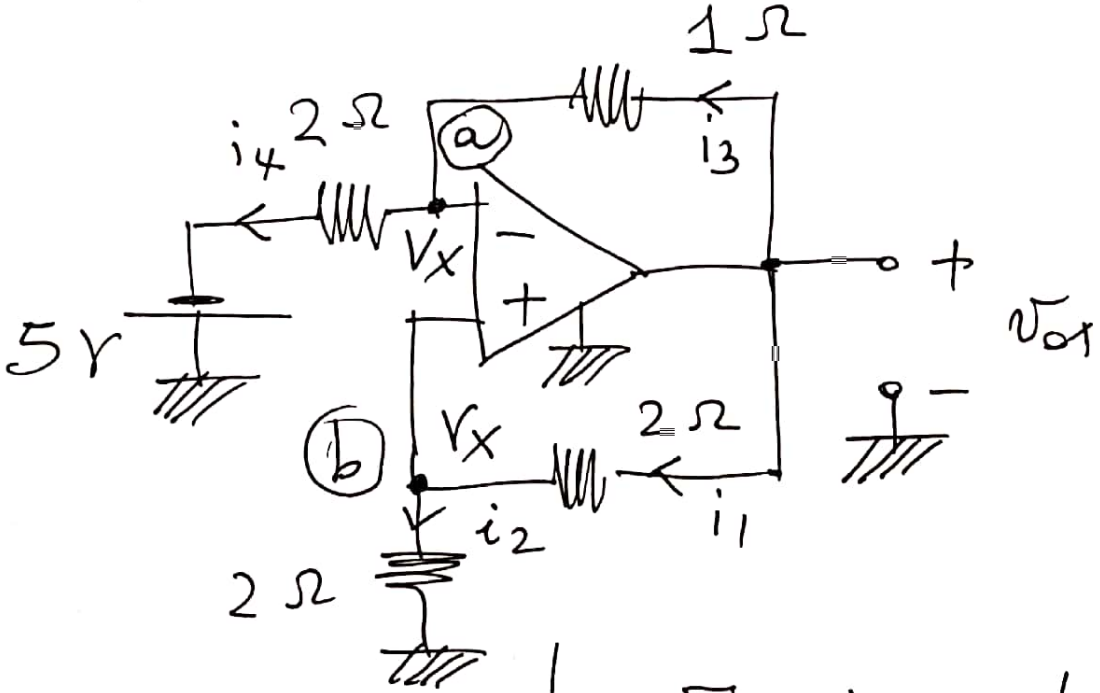
$$10 + v_o + 4 = 0 \qquad \boxed{v_o = -14\ V}.$$

Esempio Determinare v_o usando il p.s.e.



Causa 1 — Causa 2

$$v_o = v_{o1} + v_{o2}$$



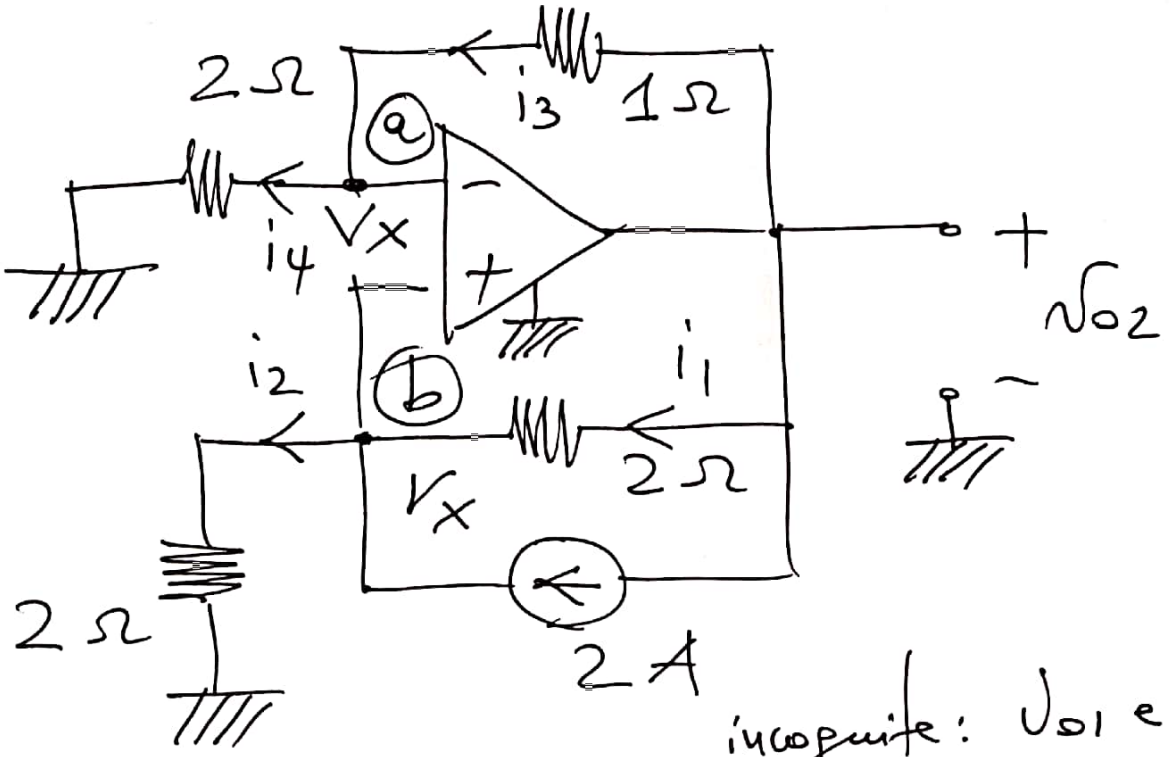
1 sola incognita V_x in effetti e V_{o1}

kI nodo, (b): $i'_1 = i'_2$, cioè

$$\frac{v_{o1} - V_x}{2} = \frac{V_x - 0}{2} \Rightarrow V_x = \frac{v_{o1}}{2}$$

kI nodo, (a): $i'_3 = i'_4$

$$v_{o1} - \frac{v_{o1}}{2} = \left[\frac{v_{o1}}{2} + 5\right]\frac{1}{2} \Rightarrow \boxed{v_{o1} = 10\ V}$$



incognite: V_{o1} e V_x

KI nodo (b): $i_1 + 2 = i_2$

$$2 + \frac{V_{o2} - V_x}{2} = \frac{V_x - 0}{2}$$

KI nodo (a): $i_3 = i_4$

$$\frac{V_{o2} - V_x}{1} = \frac{V_x - 0}{2}$$

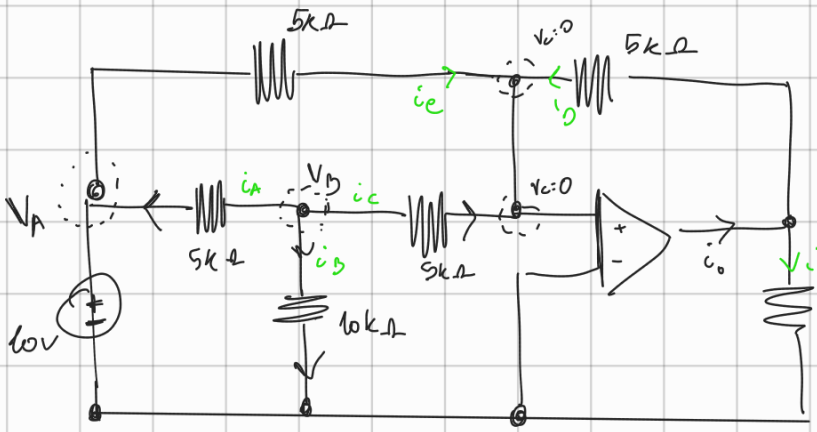
risolvendo ottengo: $V_{o2} = 12\ V.$

Allora

$$V_o = V_{o1} + V_{o2} = 10 + 12 = 22\ V.$$

17/04

(4) Esempio



$R_L = 5k\Omega$

incognite V_o e V_B

$V_A = 10V$

- $i_a = i_B + i_C$ $\quad \frac{V_a - V_B}{5k\Omega} = \frac{V_B}{10k\Omega} + \frac{V_o}{5k\Omega}$ $\quad \Rightarrow V_A = V_B + \frac{3}{2} V_B$

$V_B = \frac{2}{5} V_A = 4\ V$

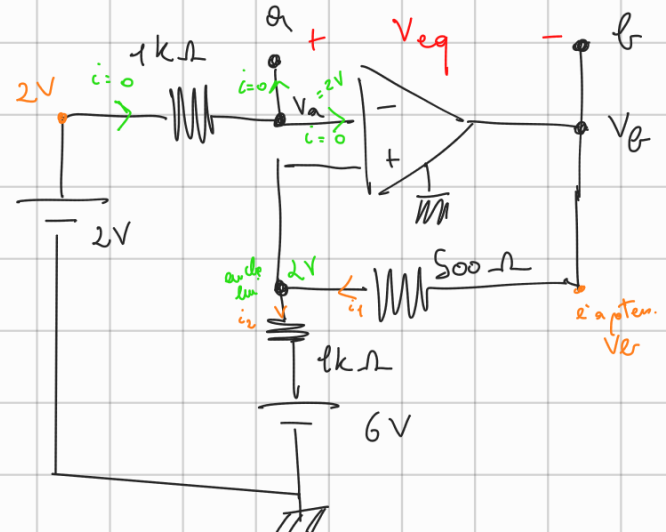
- $i_C + i_{B1} + i_e = 0$ $\quad \frac{V_B}{5k\Omega} + \frac{V_a}{\quad}$ $\quad \left(\frac{10-0}{5k} + \frac{V_o - 0}{5\cdot 10^3} + \frac{V_B - 0}{5\times 10^3} \right.$

$10 - 0$

$10 + V_o + 4 = 0$ $\quad V_o = -14\ V$

$i_o = i_a + i_R = \frac{V_o}{5k\Omega} + \frac{V_o}{\quad} = -\frac{28}{5}\ A$

Esempio ? Eq. di Thevenin bipolo a b



$V_{eq} = V_a - V_B$

$V_a = 2V$ su R_1 1kΩ non c'è drop

$i_1 = i_2$

$\frac{V_B'' - 2}{500} = \frac{2 - 6}{1000}$ $\quad \Rightarrow 2V_B - 4 = -4$

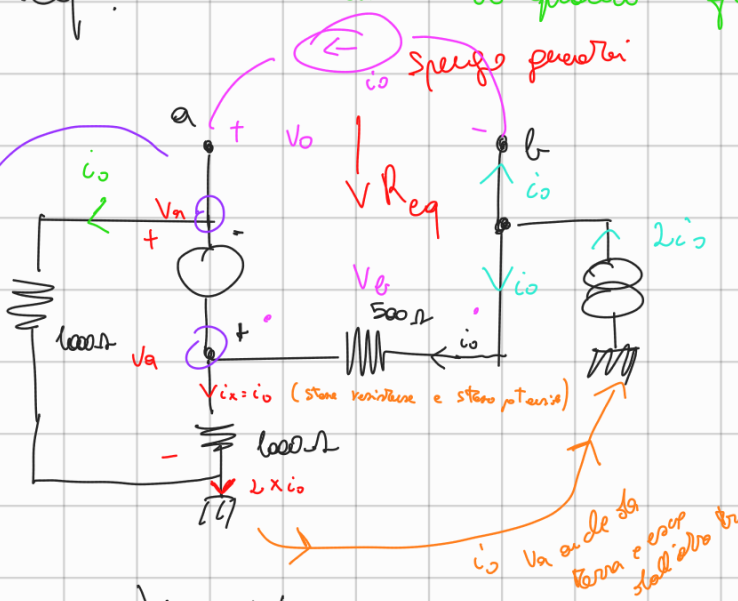
$V_B = 0$

pot. di uscita è 0

$V_{eq} = 2 - 0 = 2\,V$

R_{eq} ? Resistenza di quando spengo le batterie, uso nullatore per generatore

Def. operativo



$$R_{eq} = \frac{V_o}{i_o}$$

$V_o = V_a - V_b$ o scrivo 2 KVL Kirchoff o vedo come vedo la corrente

↘ scrivere Kirchoff

i_o non può essere nel nullatore

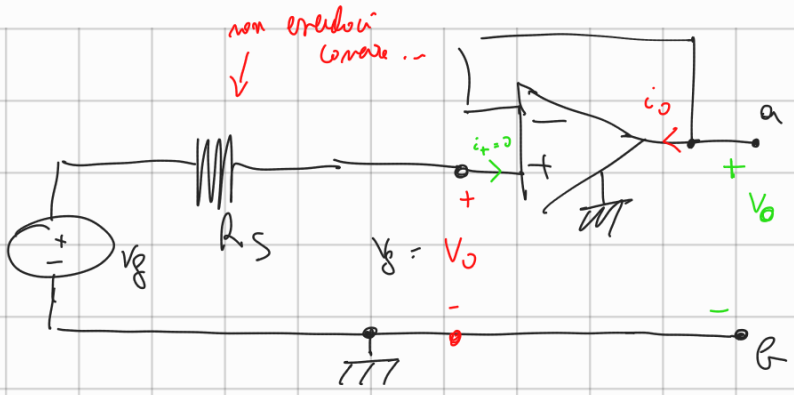
$V_a = 1000\, i_o$

$i_x = \frac{1000\, i_o}{1000} = i_o$

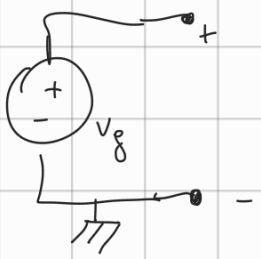
$V_b = 500\, i_o + 1000\, i_o = 1500\, i_o$

$V_o = V_a - V_b = 1000\, i_o - 1500 i_o \Rightarrow \quad V_o = -500\, i_o$

non crediamo conosca ...



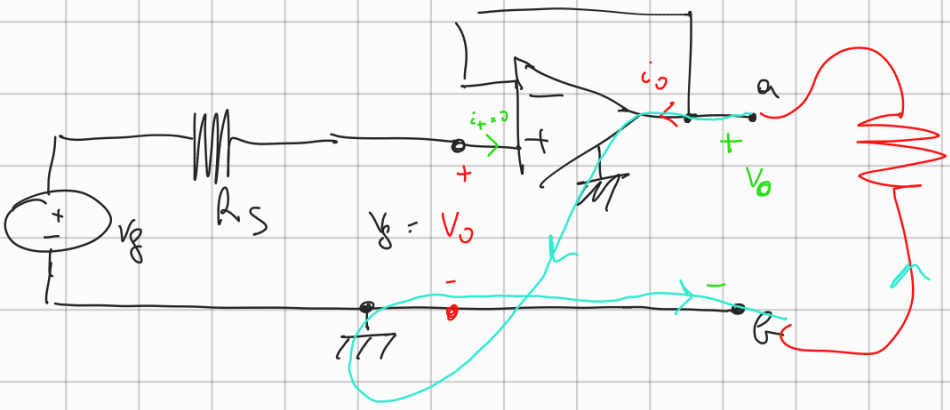
$\Leftrightarrow$



$$\begin{cases} V_o = V_g \\ (\forall i_o) \end{cases}$$

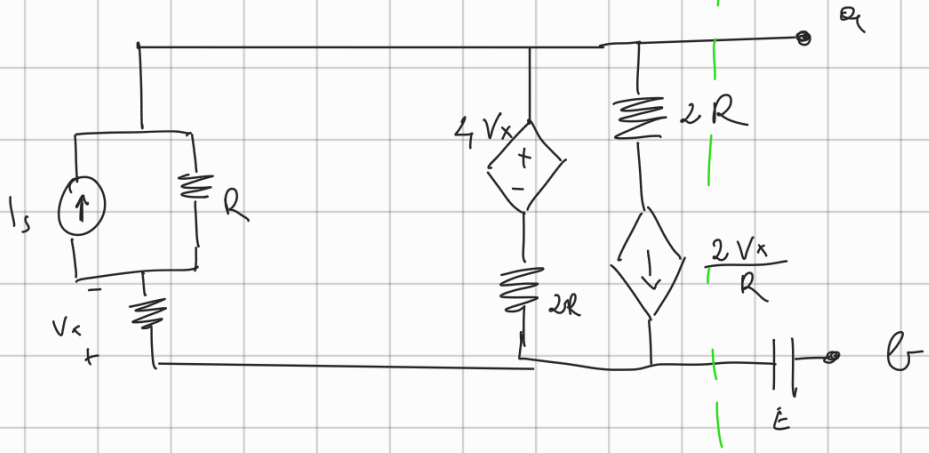
Modello ideale se vuole si realizza un generatore ideale

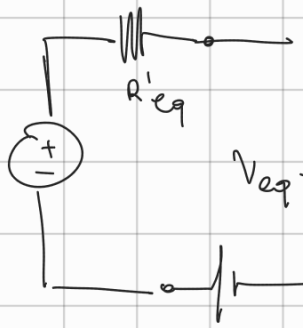
Negli operazionali ci sono alcuni 2 a terra (la corrente fa giri strani



Voglio

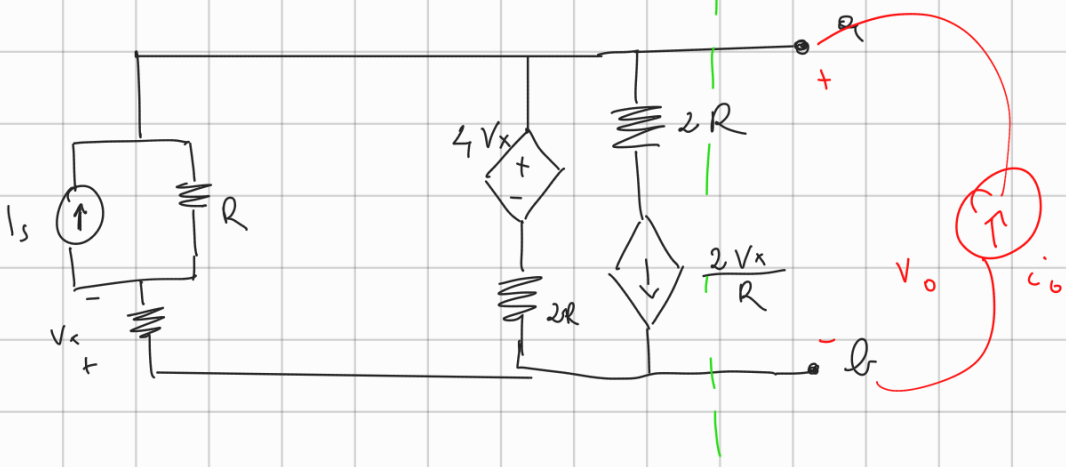
Faccio equivalente

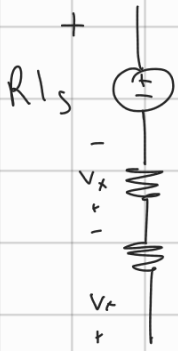




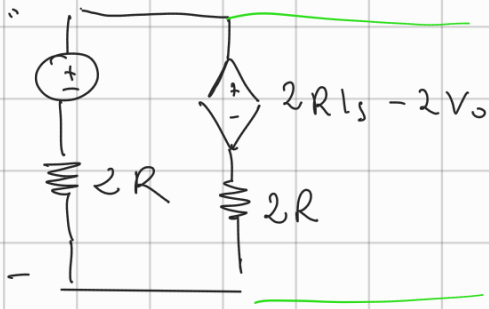
$V_{eq} = V'_{eq} + E$

E' in serie la batteria, la R equivalente è la stessa e la V_{eq} sarà somma



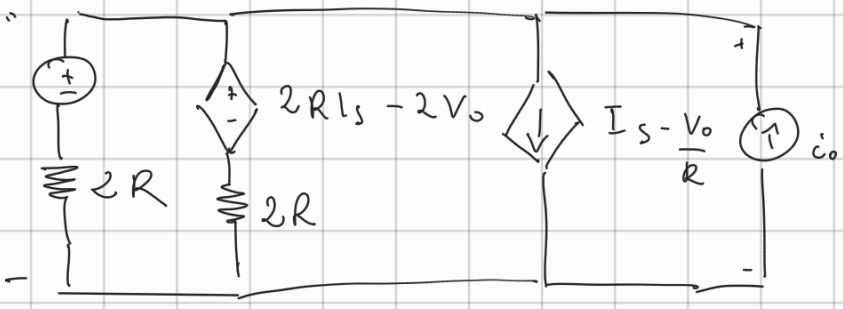


$\Rightarrow$



$V_o = RI_s - 2V_x$

$\Rightarrow V_x = \frac{RI_s - V_o}{2}$

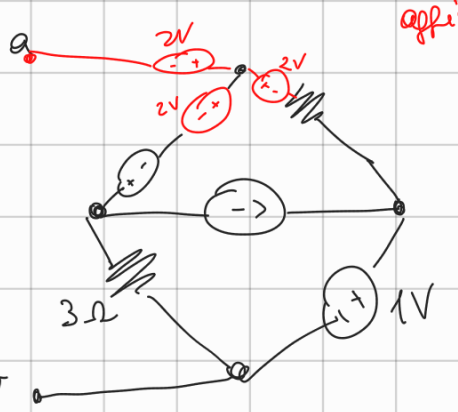


Una resistenza è risolvente

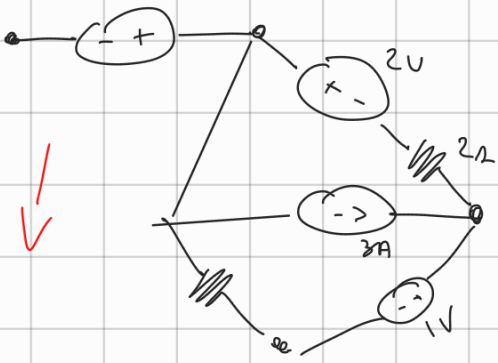
$$V_o = \frac{\frac{RI_s}{2R} + \frac{2RI_s - 2V_o}{2R} - I_s + \frac{V_o}{R} + i_o}{\frac{1}{2\Omega} + \frac{1}{2R}}$$

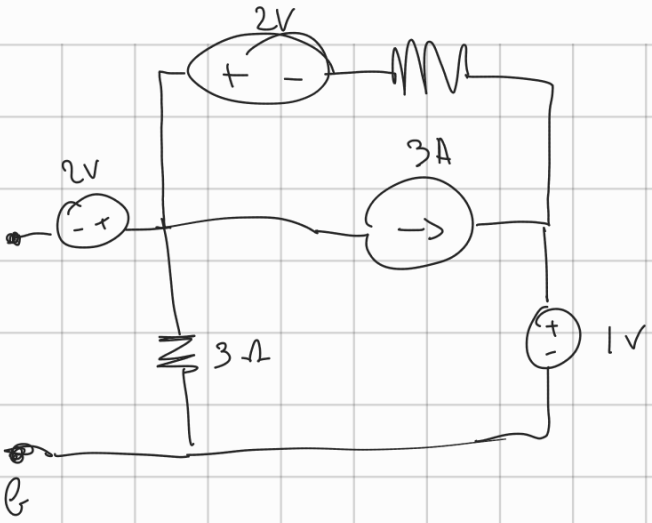
Norton Bipolo a-b usando trasformazioni circuitali

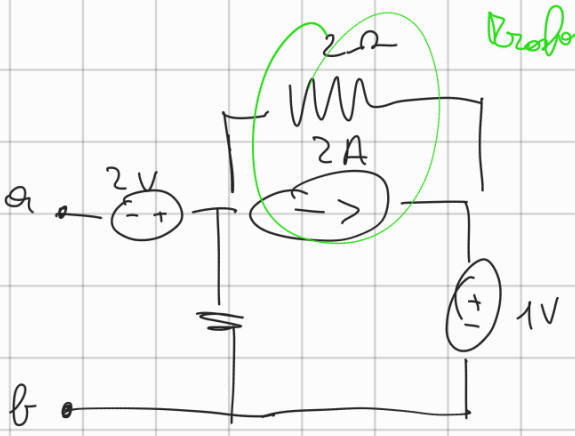
applicando un generatore

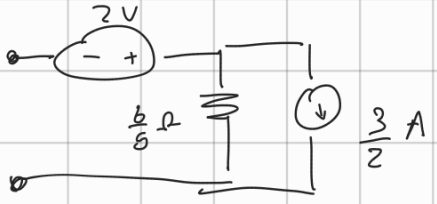


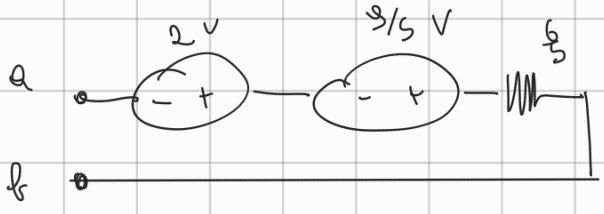
elimino il cortocircuito











Risolvere con trasformazioni generatore di corrente.