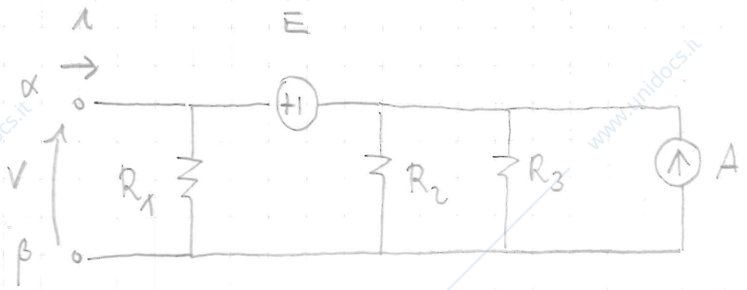
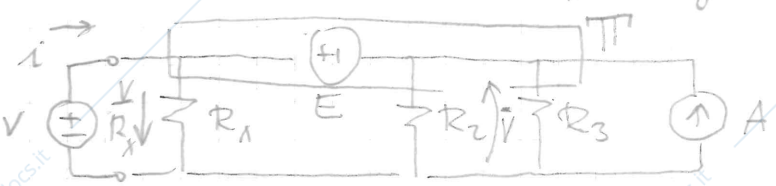
1)



- determinare $f(i,V)=0$

- Assumo che erota bose tensione $\rightarrow$ $i=g(V)$ e $i-g(V)=f(i,V)$



$\bar{V}+E-V=0 \qquad \bar{V}=V-E$

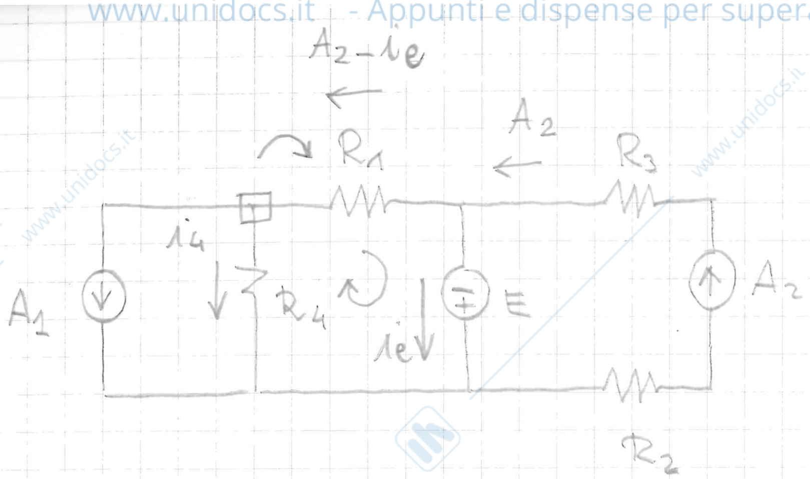
kcl Π: $-i+\frac{V}{R_1}+\left(\frac{1}{R_2}+\frac{1}{R_3}\right)\bar{V}-A=0$

$-i+\frac{1}{R_1}V+\left(\frac{1}{R_2}+\frac{1}{R_3}\right)(V-E)-A=0$

$-i+\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right)V-\left(\frac{1}{R_2}+\frac{1}{R_3}\right)E-A=0$

$i=\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right)V-\frac{(R_2+R_3)E+R_2R_3A}{R_2R_3}$

2)



$$P_e^E = i_e E$$

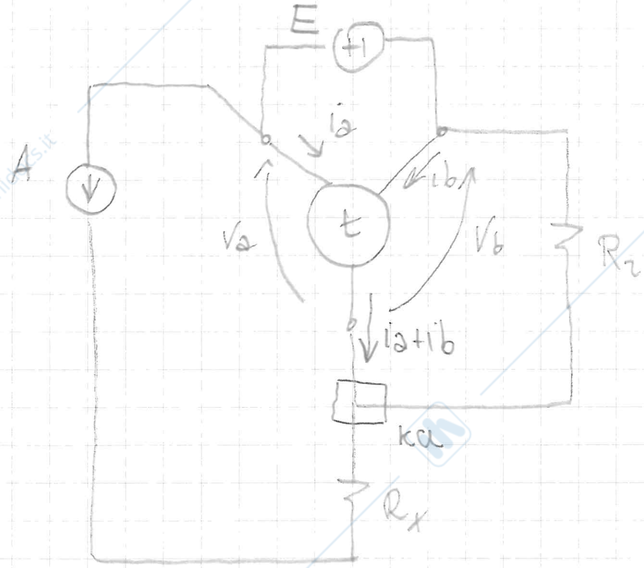
$$i_4 = A_2 - i_e - A_1$$

$$E + R_4(A_2 - i_e - A_1) + R_1(A_2 - i_e) = 0$$

$$i_e(R_1 + R_4) = E + R_4(A_2 - A_1) + R_1 A_2$$

$$i_e = \frac{E - R_4 A_1 + (R_4 + R_1) A_2}{(R_1 + R_4)}$$

3)



$$\begin{cases} i_a = g V_a \\ V_b = \tau i_a \end{cases} \qquad \tau \neq 0 \quad g \neq 0 \quad \tau g \neq 1$$

base per "t"

$(V_a, V_b) \longrightarrow i_a = g V_a$, $i_a = V_b/\tau$ No!

$(i_a, i_b) \longrightarrow V_a = i_a/g$, $V_b = \tau i_a$ ok

$(V_a, i_b) \longrightarrow i_a = g V_a$ $V_b = \tau g V_a$ ok

$(i_a, V_b) \longrightarrow i_a = \frac{V_b}{\tau}$ No!

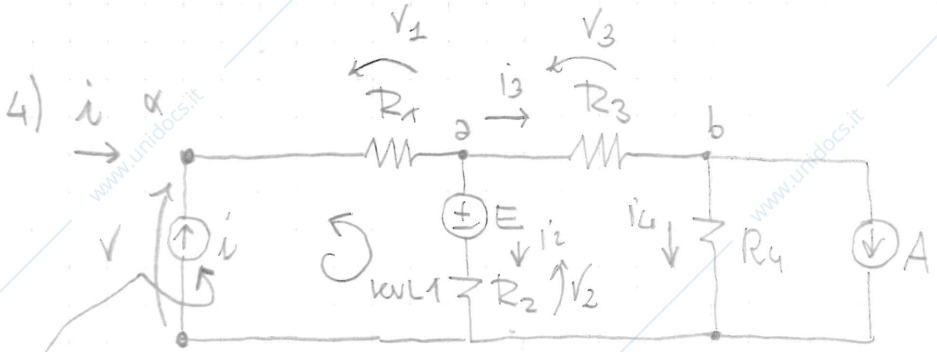
$p_a^t = V_a i_a + V_b i_b = g V_a^2 + r i_a i_b = g V_a^2 + r g V_a i_b$ cerco V_a e i_b

$V_a - V_b = E \longrightarrow \frac{i_a}{g} - r i_a = E \qquad i_a = \frac{Eg}{1-rg} \rightarrow V_a = \frac{E}{1-rg}$

$i_a + i_b + A + \frac{V_b}{R_2} = 0$ kcl

$i_b = -A - i_a - \frac{1}{R_2}\overbrace{r i_a}^{V_b} = -A - \left(1 + \frac{r}{R_2}\right)\frac{Eg}{1-rg}$

4)



$0 = f(i, V)$?

assumo bassa corrente

$V_1 = R_1 i \qquad V_2 + E + R_1 i - V = 0$ KVL1

$i_2 = \left(\frac{V - R_1 i - E}{R_2}\right)$

$V_3 = R_3 \overbrace{\left(i - \frac{V - R_1 i - E}{R_2}\right)}^{i_3}$

$i_4 = \left(i - \frac{V - R_1 i - E}{R_2}\right) - A$

KVL "αabcβ"

$V - R_1 i - R_3\left(i - \frac{V - R_1 i - E}{R_2}\right) - R_4\left(i - \frac{V - R_1 i - E}{R_2} - A\right) = 0$

$V\left(1 + \frac{R_3}{R_2} + \frac{R_4}{R_2}\right) = \left(R_1 + R_3 + \frac{R_3 R_1}{R_2} + R_4 + \frac{R_4 R_1}{R_2}\right) i + \frac{R_3}{R_2} E + \frac{R_4}{R_2} E - R_4 A$