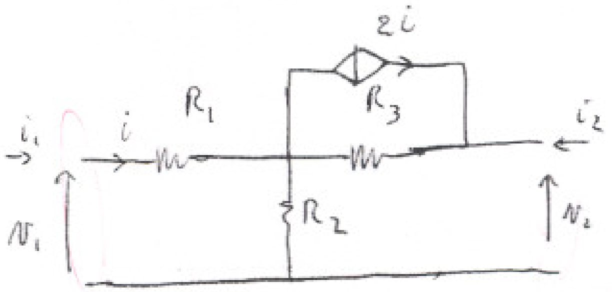
COGNOME (IN STAMPATELLO)	NOME	MATRICOLA	ELT I 14/07/2008	TEMPO 1h10' *3 esercizi a scelta*	

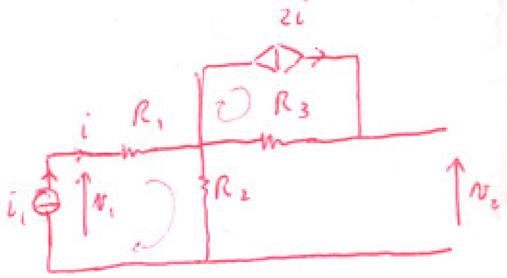
Per ogni esercizio riportare sia il risultato che il procedimento utilizzato (utilizzare solamente questo foglio, che va riconsegnato al termine della prova).

1) Calcolare la rappresentazione del doppio bipolo in termini di matrice di resistenze (dati: R1,R2,R3)



$$\begin{pmatrix} v_1 \\ v_2 \end{pmatrix} = \begin{bmatrix} R_{11} & R_{12} \\ R_{21} & R_{22} \end{bmatrix} \begin{pmatrix} i_1 \\ i_2 \end{pmatrix}$$

$$R_{11} = \left.\frac{v_1}{i_1}\right|_{i_2=0}$$



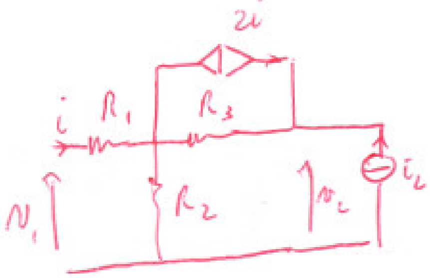
$$R_{21} = \left.\frac{v_2}{i_1}\right|_{i_2=0}$$

pilota $i = i_1$

$v_1 = i_1 R_1 + i_1 R_2 \Rightarrow R_{11} = R_1 + R_2$

$v_2 = i_1 R_2 + 2 i_1 R_3 \Rightarrow R_{21} = R_2 + 2R_3$

$$R_{12} = \left.\frac{v_1}{i_2}\right|_{i_1=0}$$



$$R_{22} = \left.\frac{v_2}{i_2}\right|_{i_1=0}$$

pilota $i = 0$

$\Rightarrow \quad v_1 = R_2 i_2 \Rightarrow R_{12} = R_2$

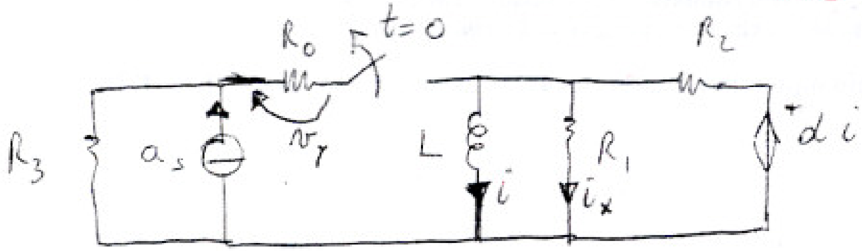
$v_2 = R_3 i_2 + R_2 i_2 \Rightarrow R_{22} = R_2 + R_3$

$$\underline{\underline{R}} = \begin{bmatrix} R_1 + R_2 & R_2 \\ R_2 + 2R_3 & R_2 + R_3 \end{bmatrix}$$

2) Dato il circuito in figura

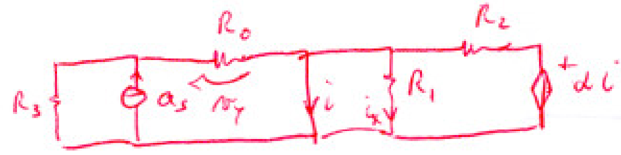
Calcolare e disegnare il grafico di $i_x(t)$ e $v_y(t)$ per $-\infty<t<+\infty$

[L=1/2H, a_s=20A, R1=2Ω, R2=4Ω, R0=R3=10Ω, α=3]



si osserva che i è la variabile di stato $i(0_-) = i(0_+)$

$\underline{t<0}$ a regime

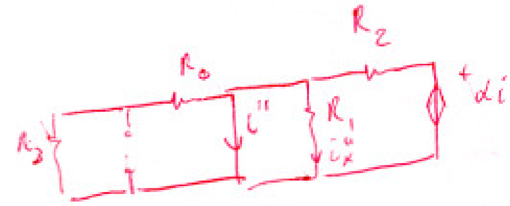


sovrapposizione effetti

1)

$$i' = \frac{a_s R_3}{R_0+R_3} = \frac{20\cdot 10}{20} = 10A$$

2)



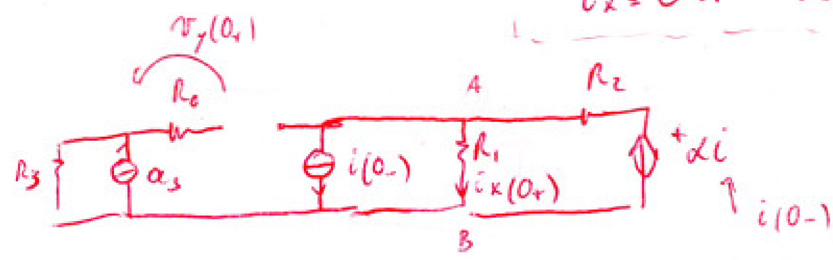
$$i'' = \frac{\alpha i}{R_2} = \frac{3\cdot i}{4}$$

$$\Rightarrow \quad i = i' + i'' = 10 + \frac{3}{4} i \quad \Rightarrow \quad i = 40A \qquad t<0 \Rightarrow i(0_-) = 40A = i(0_+)$$

dal circuito si osserva che $v_y = \left(a_s \frac{R_3}{R_0+R_3} \right) \cdot R_0 = 10 \cdot 10 = 100V \quad t<0$

$i_x = 0A \quad t<0$

$\underline{t=0^+}$

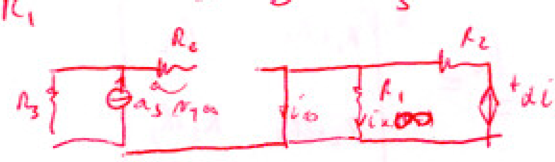


$v_y(0_+) = 0$

Millman $\quad V_{AB} = \dfrac{\frac{\alpha i}{R_2} - i(0_-)}{\frac{1}{R_1} + \frac{1}{R_2}} = \dfrac{\frac{3}{4}\cdot 40 - 40}{\frac{1}{2} + \frac{1}{4}} = \dfrac{-10}{\frac{3}{4}} = -\dfrac{40}{3}\ V$

$$i_x(0_+) = \frac{V_{AB}}{R_1} = -\frac{40}{3}\cdot\frac{1}{2} = -\frac{20}{3}$$

$\underline{t \to \infty}$ a regime

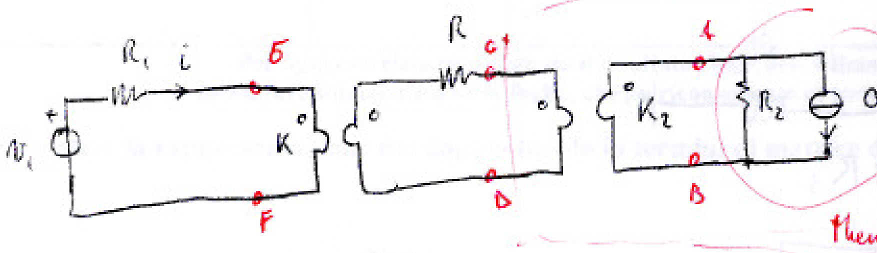


$i_\infty = 0A$

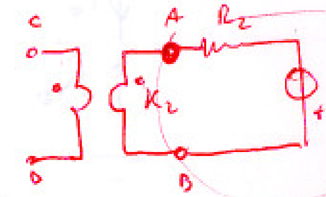
$i_{x\infty} = 0A$

$v_{y\infty} = 0V$

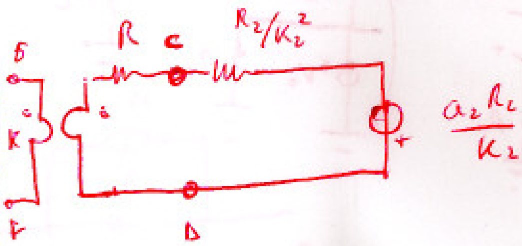
3) Calcolare la corrente *i* [V1=4V, R1=36Ω, R2=8Ω, R=2Ω, a2=1A, k=4, k_2=2]



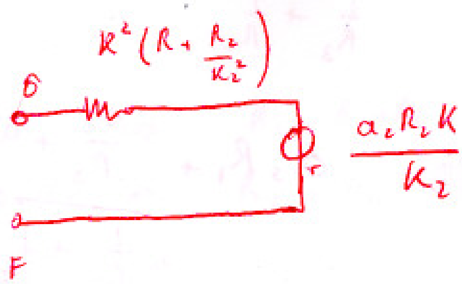
Thevenin



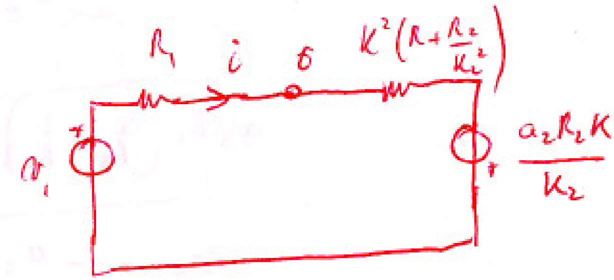
Thevenin



Thevenin



$\Rightarrow$



$$i = \frac{v_1 + a_2 \frac{R_2 k}{k_2}}{R_1 + k^2\left(R + \frac{R_2}{k_2^2}\right)} = \frac{4 + \frac{1 \cdot 8 \cdot 4}{2}}{36 + 16\left(2 + \frac{8}{4}\right)}$$

$$i = \frac{20}{100} = \frac{1}{5} = 0.2A$$

τ

uso generatore di prova per $R_{eq} = \frac{v_p}{a_p}$

pilota $i = a_p$

$$v_p = \frac{a_p - \frac{\alpha i}{R_2}}{\frac{1}{R_1} + \frac{1}{R_2}} =$$ Millman

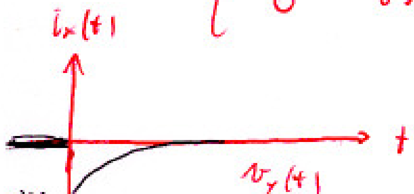
$$v_p = \frac{a_p - \frac{\alpha a_p}{R_2}}{\frac{1}{R_1} + \frac{1}{R_2}} =$$

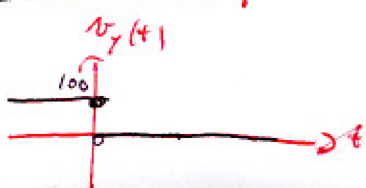
$$R_{eq} = \frac{v_p}{a_p} = \frac{R_2 - \alpha}{\frac{R_2}{R_1} + 1} = \frac{4-3}{\frac{4}{2}+1} = \frac{1}{3}\,\Omega$$

$$\tau = L/R_{eq} = \frac{1}{2}\,3 = \frac{3}{2} \text{ sec.}$$

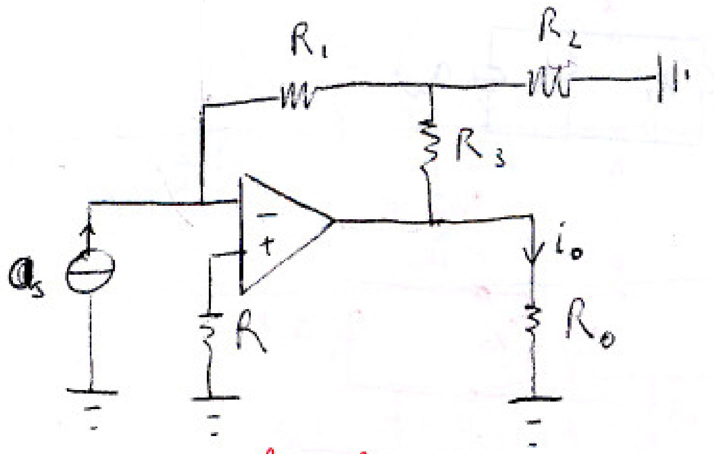
$$i_x(t) = \begin{cases} 0 & t < 0 \\ -\frac{20}{3} e^{-\frac{2}{3}t} & t > 0 \end{cases}$$

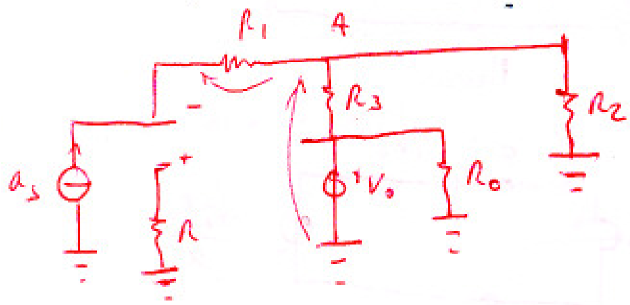
$$v_y(t) = \begin{cases} 100 & t < 0 \\ 0 & t > 0 \end{cases}$$





4) Calcolare io [R1=R0=R=16kΩ, R2=4kΩ, R3=8kΩ, a_s=10A]





$v_+ = 0 = v_-$

$v_- = 0$

$v_- = a_s R_1 + v_A$

Millman $\quad v_A = \dfrac{\dfrac{v_o}{R_3} + a_s}{\dfrac{1}{R_3} + \dfrac{1}{R_2}} =$

$$v_- = a_s R_1 + \dfrac{\dfrac{v_o}{R_3} + a_s}{\dfrac{1}{R_3} + \dfrac{1}{R_2}} = 0$$

$$a_s R_1 \left(\frac{1}{R_3} + \frac{1}{R_2} \right) + \frac{v_o}{R_3} + a_s = 0$$

$$v_o = - a_s R_3 \left(1 + \frac{R_1}{R_3} + \frac{R_1}{R_2} \right) = -10 \cdot 8K \left(1 + \frac{\overset{2}{\cancel{16K}}}{\cancel{8K}} + \frac{\overset{4}{\cancel{16K}}}{\cancel{4K}} \right) =$$

$$v_o = -80K \,(7) = -560\,KV$$

$$i_o = \frac{v_o}{R_o} = \frac{-560K}{16K} = -35A$$