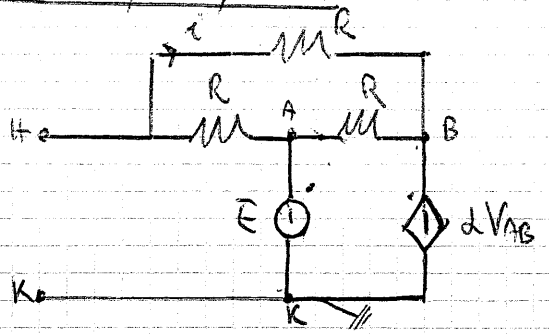
ESAMI 2016

ESAME 18/02/2016

1)



$\bar{E} = 100\,V$ $\quad R = 10\,\Omega$ $\quad \alpha = 3$ $\quad V_H = ?$ $\quad R_{TH} = ?$

$N°_{eq\,MCM} = 2 - 0 = 2$ eq.

$N°_{eq\,MTN} = 3 - 2 - 1 = 0$ eq. $\quad$ Vado in MTN

K nodo di riferimento $\quad V_K = 0$

$V_A - V_K = \bar{E} \rightarrow V_A = \bar{E}$

$V_B - V_K = \alpha V_{AB} \rightarrow V_B = \alpha V_{AB}$

~~$V_{AB} = R \cdot i$~~

$V_{AB} = V_A - V_B$

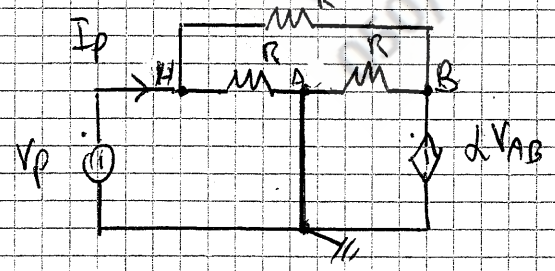
$V_{AB} = \bar{E} - \alpha V_{AB}$

$V_{AB}(1+\alpha) = \bar{E} \rightarrow V_{AB} = \frac{\bar{E}}{1+\alpha} = \frac{100}{4} = 25\,V$

$i = \frac{V_{AB}}{2R} = \frac{25}{20} = 1{,}25\ A$

$V_{HK} = iR + \alpha V_{AB} = 1{,}25 \cdot 10 + 3 \cdot 25 = 87{,}5\,V$

Rendo passivo il bipolo



$N°_{eq\,MCM} = 3 - 0 = 3$ eq

$N°_{eq\,MTN} = 3 - 2 - 1 = 0$ eq.

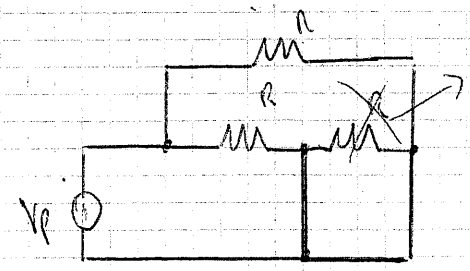
A nodo di riferimento

$V_A = 0$

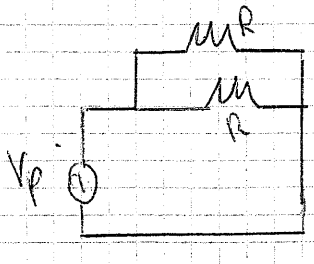
$V_B = \alpha V_{AB}$

$V_H = V_P$

$V_{AB} = V_A - V_B = -\alpha V_{AB}$ $\quad V_{AB} = -\alpha V_{AB} \rightarrow V_{AB} = 0$

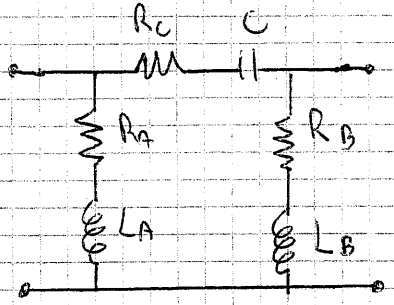


// ad un corto circuito



$R_{TH} = \frac{R}{2} = 5\,\Omega$

2)



$R_A = 10\,\Omega \quad R_B = 20\,\Omega$

$R_C = 5\,\Omega$

$L_A = 10\,mH \quad L_B = 20\,mH$

$C = 0{,}2\,mF$

$\omega = 1000\,rad/s$

$\bar{Y}_{11} = ?$

$\bar{Y}_{12} = ?$

$\bar{Y}_{21} = ?$

$\bar{Y}_{22} = ?$

$X_C = 5\,\Omega$

$X_{LA} = 10\,\Omega$

$X_{LB} = 20\,\Omega$

$\bar{Z}_C = R_C - jX_C = 5 - 5j$

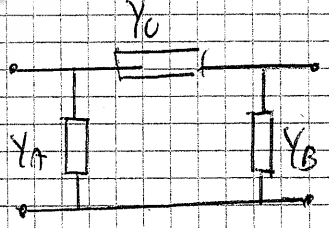
$\bar{Z}_A = 10 + 10j$

$\bar{Z}_B = 20 + 20j$

$\bar{Y}_C = \frac{1}{\bar{Z}_C} = \frac{1}{5-5j} = \frac{5+5j}{50} = 0{,}1 + 0{,}1j\ \Omega^{-1}$

$\bar{Y}_A = \frac{1}{\bar{Z}_A} = \frac{1}{10+10j} = \frac{10-10j}{200} = 0{,}05 - 0{,}05j\ \Omega^{-1}$

$\bar{Y}_B = \frac{1}{\bar{Z}_B} = \frac{1}{20+20j} = \frac{20-20j}{400} = 0{,}025 - 0{,}025j\ \Omega^{-1}$

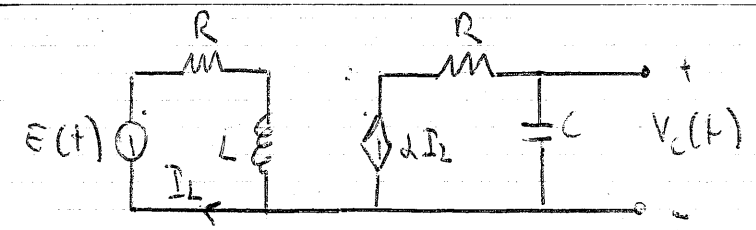


$\bar{Y}_{11} = \bar{Y}_A + \bar{Y}_C = 0{,}05 - 0{,}05j + 0{,}1 + 0{,}1j = 0{,}15 + 0{,}05j\ \Omega^{-1}$

$\bar{Y}_{22} = \bar{Y}_B + \bar{Y}_C = 0{,}025 - 0{,}025j + 0{,}1 + 0{,}1j = 0{,}125 - 0{,}075j\ \Omega^{-1}$

$\bar{Y}_{21} = \bar{Y}_{12} = -\bar{Y}_C = -0{,}1 - 0{,}1j\ \Omega^{-1}$

3)



$E_0 = 10V$ $\quad$ $V_c(t)$ per $-\infty < t < 0$

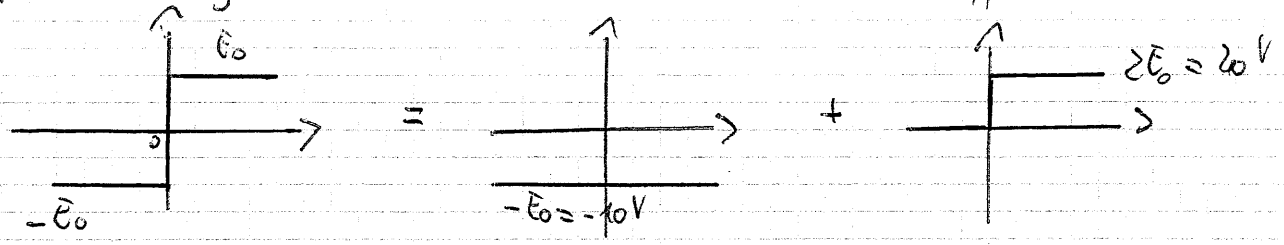
$R = 20\,\Omega$

$L = 2H$

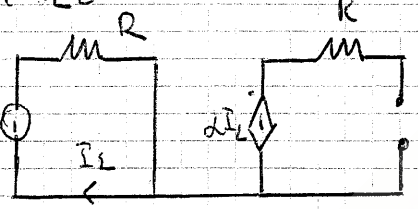
$C = 0{,}5\,F$

$\alpha = 10\,V/A$

per $T_{<0}$ regime stazionario



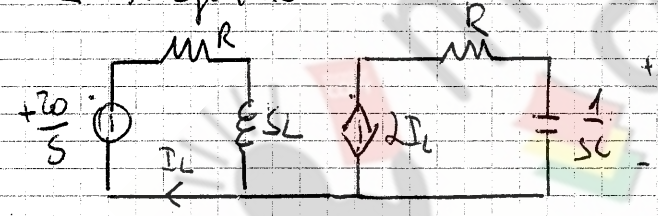
- per $T_{<0}$



$$I_L = -\frac{E_0}{R} = -\frac{10}{20} = -0{,}5A$$

$$V_c(0^-) = 2I_L = 10(-0{,}5) = -5V$$

- L-Trasformo



$$I_L = \frac{\frac{20}{s}}{R+sL} = \frac{\frac{20}{s}}{20+2s} = \frac{20}{s}\cdot\frac{1}{20+2s} = \frac{10}{s}\cdot\frac{1}{s+10}$$

~~$\frac{100}{s}\cdot\frac{1}{s+10} = \frac{A}{s} + \frac{B}{s+10}$~~

$$V_c(s) = 2I_L \cdot \frac{\frac{1}{sC}}{\frac{1}{sC}+R} = \frac{100}{s}\cdot\frac{1}{s+10}\cdot\frac{\frac{1}{sC}}{\frac{1+sCR}{sC}} = \frac{100}{s}\cdot\frac{1}{s+10}\cdot\frac{1}{RC\left(s+\frac{1}{RC}\right)}$$

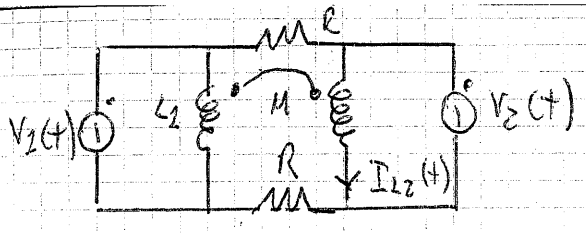
$$V_c(s) = \frac{100}{s}\cdot\frac{1}{s+10}\cdot\frac{1}{10(s+0{,}1)} = \frac{A}{s} + \frac{B}{s+10} + \frac{C}{s+0{,}1}$$

$$A = \frac{10}{10\cdot 0{,}1} = 10$$

$$B = \frac{10}{-10(-10+0{,}1)} = 0{,}101 \qquad C = \frac{10}{-0{,}1(-0{,}1+10)} = -10{,}101$$

$$V_c(t) = -5 + \left(10 + 0{,}101e^{-10t} - 10{,}101e^{-0{,}1t}\right)u(t)\ V$$

4)



$I_{L2} = 2\sqrt{2}\cos(1000t)$ A

$v_1(t) = 100\sqrt{2}\cos(1000t + \frac{\pi}{2})$ V

$L_1 = 150$ mH

$L_2 = 20$ mH

$M = 50$ mH

$R = 10\ \Omega$

$v_2(t) = ?$

$\bar{W}_{L1L2} = ?$

$\bar{S}_{v_1} = ?$

$\bar{S}_{v_2} = ?$

Circuito a regime sinusoidale

$X_{L1} = 150 \qquad X_{L2} = 20 \qquad X_M = 50$

$I_{L2} = I_2 = 2 \qquad V_1 = 100j$

$$\begin{cases} V_1 = j X_{L1} I_1 + j X_M I_2 \\ V_2 = j X_{L2} I_2 + j X_M I_1 \end{cases} \qquad \begin{cases} 100 = j150 I_1 + j50 \cdot 2 \\ V_2 = j20 \cdot 2 + j50 I_1 \end{cases}$$

$$\begin{cases} I_1 = \frac{j100 - 100j}{150j} = \frac{0,66 - 0,66j}{j} = -j0,66 - 0,66 \\ V_2 = 40j + j50(-j0,66 - 0,66) = 40j - j33 - 33j = 33 + 7j \end{cases}$$

$|V_2| = \sqrt{33^2 + 7^2} = 33,73$ $\qquad \arctg \frac{7}{33} = 0,21$

$V_2(t) =$

$I_1 = \frac{100j - 100j}{150j} = 0$

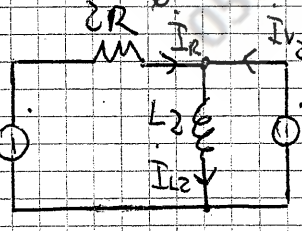
$V_2 = j\,20 \cdot 2 = j40$

$v_2(t) = 40 \cdot \sqrt{2}\cos(1000t + \frac{\pi}{2}) = 56,56\cos(100t + \frac{\pi}{2})$

$\bar{W}_{L1L2} = \frac{1}{2} I_{L2}^2 L_2 = \frac{1}{2} \cdot 4 \cdot 20m = 40$ mJ

Essendo $I_1 = 0$

↳



$I_R = \frac{V_1 - V_2}{2R} = \frac{-j40 + j100}{20} = j3$

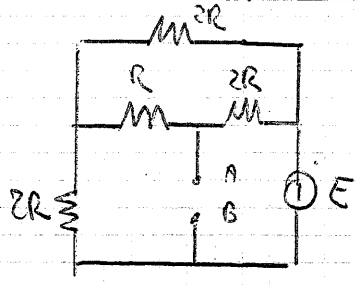
$\bar{S}_{v1} = V_1 |\dot{I}_R^*| = 100j\,|-3j| = 300$ VA

$\bar{S}_{v2} = V_2 |\dot{I}_{v2}^*| = j40(2 + j3) = 80j - 120$ VA

$-I_{v2} - I_R + I_{L2} = 0 \qquad I_{v2} = I_{L2} - I_R = 2 - j3$

ESAME 01/02/2016

1)



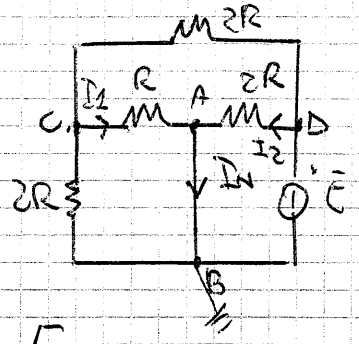
$E = 100\ V$

$R = 90\ \Omega$

$I_N = ?$

$R_N = ?$

Cortocircuito ai morsetti A e B



$A \equiv B$

N° eq. MCM = 3 − 0 = 3 eq.

N° eq. MTN = 3 − 1 − 1 = 1 eq.

$V_B = V_A = 0$

$V_D = E$

$$0 = V_C\left(\frac{1}{2R} + \frac{1}{R} + \frac{1}{2R}\right) - \frac{V_D}{2R}$$

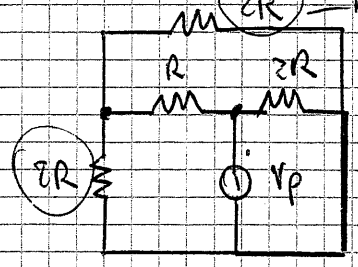
$$V_C\left(\frac{2}{R}\right) - \frac{E}{2R} = 0 \rightarrow 2V_C = \frac{E}{2} \rightarrow V_C = \frac{E}{4} = 25\ V$$

$$I_1 = \frac{V_C - V_A}{R} = \frac{25}{90} = 0{,}277\ A$$

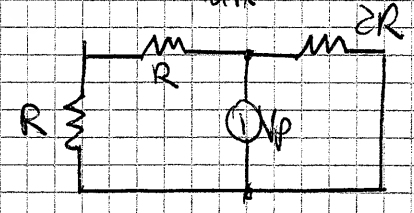
$$I_2 = \frac{V_D - V_A}{2R} = \frac{100}{180} = 0{,}555\ A$$

$$I_N = I_1 + I_2 = 0{,}833\ A$$

Rendo passivo il bipolo



$$R_p = \frac{4R^2}{4R} = R$$



$R_S = 2R$

$$R_{TH} = R_p = \frac{2R \cdot 2R}{4R} = R = 90\ \Omega$$