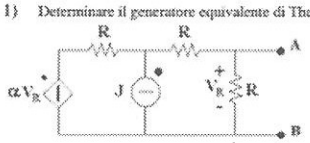
1. COMPITINI

compitino 02/05/2014

1) Determinare il generatore equivalente di Thevenin del bipolo in figura.

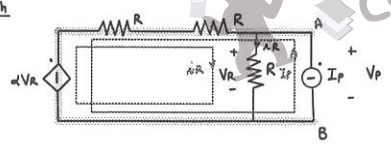


$J = 4A$
$R = 2\Omega$
$\alpha = 0.5$

$E_{TH} = 3.2V$

$R_{TH} = 1.6\Omega$

Rth



$R_{th} = \frac{V_P}{I_P}$

$V_P = V_R = R\, i_R$

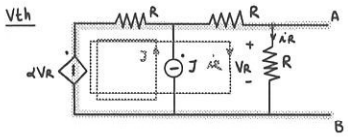
in) $\alpha V_R = i_n 2R - I_P 2R$

$\alpha R i_n = i_n 3R - I_P 2R$

$i_n(\alpha - 3) = -2I_P \longrightarrow i_n = -\frac{2I_P}{\alpha - 3}$

$V_P = \frac{-2RI_P}{\alpha - 3} \longrightarrow R_{th} = \frac{-2R}{\alpha - 3} = 1{,}6$

Vth



$V_{th} = V_{AB} = V_R = R\, i_R$

i_R) $\alpha R i_R = i_R 3R - JR$

$i_R = \frac{J}{3 - \alpha}$

$V_{th} = \frac{JR}{3 - \alpha} = 3.2V$

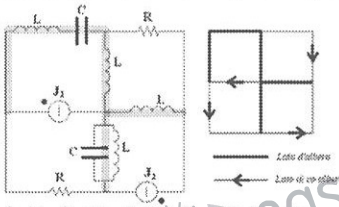

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2) Scrivere un sistema di equazioni con il metodo delle correnti di maglia nel dominio fasoriale, utilizzando l'albero e i versi di riferimento indicati in figura. Esprimere i coefficienti ed i termini noti delle equazioni numericamente, nella forma cartesiana: $a + jb$. **Nota: compilare solo i campi ritenuti necessari.**



Numero di equazioni lin. ind.= 2

Eq1:

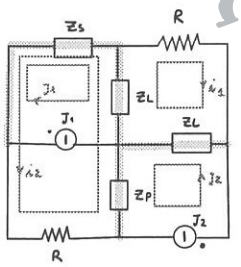
Eq2:

Eq3:

Eq4:

....

$J_1 = 2A \quad J_2 = 3jA \quad R = 15\Omega \quad X_L = 20\Omega \quad X_C = 10\Omega$



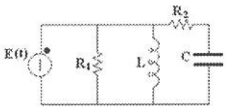
$$Z_S = Z_L + Z_C = JWL + \frac{1}{JWC}$$

$$Z_P = \frac{Z_C \cdot Z_L}{Z_C + Z_L}$$

$i_1)\quad 0 = \dot{i}_1 (R + 2Z_L) + J_2 Z_L - J_1 Z_L + \dot{i}_2 Z_L \longrightarrow 60 + 40J = \dot{i}_1 (15 + 40J) + \dot{i}_2 (20J)$

$i_2)\quad 0 = \dot{i}_2 (Z_S + Z_L + Z_P + R) - J_2 Z_P - J_1 (Z_S + Z_L) + \dot{i}_1 Z_L \longrightarrow -20 + 100J = \dot{i}_1 (20J) + \dot{i}_2 (15 + 56{,}67J)$

3) Con riferimento al circuito di figura, determinare i valori della potenza attiva o reattiva assorbita dai componenti indicati nella tabella.



$E(t) = 200\sqrt{2}\cos(10t)\,V$
$R_1 = 5\,\Omega$
$R_2 = 10\,\Omega$
$L = 0.5\,H$
$C = 0.01\,F$

$P_{R_1} = 8000\,W$

$P_{R_2} = 2000\,W$

$Q_C = -2000\,VAR$

$Q_L = 8000\,VAR$

$E = 200 \quad (\text{eff.}) \qquad W = 10$

$$P_{R1} = \frac{E^2}{R_1} = 8000\ W$$

$$Q_L = \frac{E^2}{X_L} = \frac{E^2}{JWL} = -8000\,J \longrightarrow |Q_L| = 8000\ VAR$$

$$V_{R2} = E\,\frac{R_2}{R_2 + \frac{1}{JWC}} = 100 + 100\,J \longrightarrow |V_{R2}| = 141{,}42$$

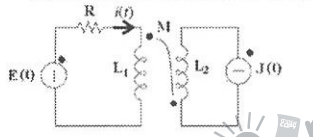
↑ partitore di tensione

$$P_{R2} = \frac{|V_{R2}|^2}{R_2} = 2000$$

$$E = V_{R2} + V_C \longrightarrow V_C = E - V_{R2} = 100 - 100J \longrightarrow |V_C| = 141{,}42$$

$$Q_C = -\frac{V^2}{X_C} = -V^2 \omega C = -2000 \text{ VAR}$$

4) Per il circuito di figura, considerato a regime sinusoidale, determinare l'espressione temporale della corrente $i(t)$ e l'energia elettromagnetica media $\overline{W}$ immagazzinata negli induttori accoppiati.



$E(t) = 10\cos(100t)\text{V}$
$J(t) = 2\cos(100t)\text{A}$
$R = 5\Omega \quad L_1 = 0.1\text{H} \quad L_2 = 0.2\text{H} \quad M = 0.1\text{H}$

$i(t) = 2\cos(100t)\text{A}$
$\overline{W} = 0.1\text{J}$

- $\dot{E} = 10 \quad \omega = 100$

  $\dot{J} = 2$

$$\dot{E} = R\dot{I} \longrightarrow \dot{I} = \frac{\dot{E}}{R} = 2 \longrightarrow i(t) = 2\cos(100)$$

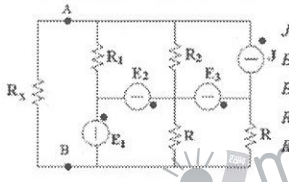
- $\overline{W} = \frac{1}{2} L_1 I_{EFF}^2 + \frac{1}{2} L_2 J_{EFF}^2 - M I_{EFF} J_{EFF} \cos(\varphi_1 - \varphi_2) = \frac{1}{2} L_1 I_{EFF}^2 + \frac{1}{2} L_2 J_{EFF}^2 - M I_{EFF} J_{EFF} = 0.1\,J$

  $I_{EFF} = \frac{2}{\sqrt{2}}$

  $J_{EFF} = \frac{2}{\sqrt{2}}$

COMPITINO 24/04/2015

1) Determinare il circuito equivalente di Thevenin del bipolo a valle dei morsetti AB (esclusa Rx) in figura. Determinare quindi la potenza dissipata sulla resistenza Rx.



$J = 4A$
$E_1 = 10V ; E_2 = 20V$
$E_3 = 30V$
$R = R_x = 2\Omega$
$R_1 = 3\Omega ; R_2 = 4\Omega$

$E_{TH} =$	25.43 V
$R_{TH} =$	1.714 Ω
$P_{R_x} =$	93.74W

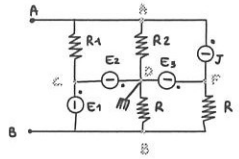
otterrò



$P_x = R_x i_x^2$

dove $i_x = \frac{E_{th}}{R_x + R_{th}}$

Eth



$V_{AB} = U_A - U_C + U_C - U_B = U_A - U_B = U_A + E_1 + E_2$

MCH: 4 - 1 = 3

MPN: 5 - 1 - 3 = 1 eq

nodo D a riferimento:

$U_D = 0$

$U_F = E_3$

$U_C = -E_2$

$U_B = -E_1 - E_2$

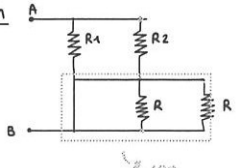
unica incognita U_A

$J = U_A\left(\frac{1}{R_1} + \frac{1}{R_2}\right) - \frac{U_F}{R_2} - \frac{U_C}{R_1}$ ($-E_2$)

$U_A = \frac{J - \frac{E_2}{R_1}}{\frac{1}{R_1} + \frac{1}{R_2}}$

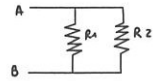
$V_{AB} = \frac{J - \frac{E_2}{R_1}}{\frac{1}{R_1} + \frac{1}{R_2}} + E_1 + E_2 = -4.57 + 10 + 20 = 25.43$

Rth



con corto

<=?



$R_{th} = \frac{R_1 R_2}{R_1 + R_2} = 1{,}714\ \Omega$

Quindi $P_x = R_x \cdot \left(\frac{E_{th}}{R_{th} + R_x}\right)^2 = 2 \cdot 6.847^2 = 93{,}76$