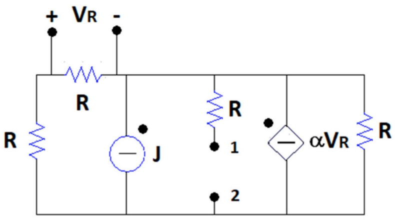
PROVA 31/01/2018

giovedì 3 dicembre 2020 15:38

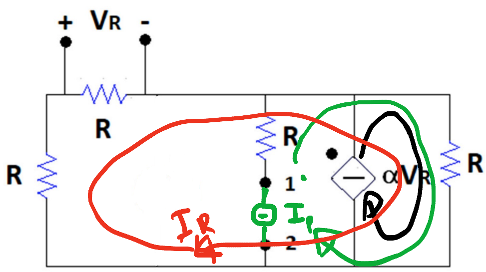
ES 1

1) Determinare il **circuito equivalente di Thevenin** fra i punti **1** e **2** del circuito in figura.



J = 2 A;
R = 10 Ω;
α = 0.2 A/V.

R_{TN}



$$\begin{cases} V_R = R\, I_R \\ \alpha V_R R + I_p R + 3 I_R R = 0 \end{cases}$$

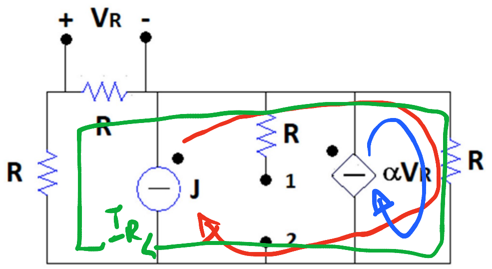
$$\alpha I_R R^2 + R I_p + 3 I_R R = 0$$

$$I_R = \frac{-R I_p}{\alpha R^2 + 3R} \qquad I_R = \frac{-I_p}{\alpha R + 3} = -\frac{1}{5} I_p$$

$$V_p = R I_p - 2R\left(-\frac{1}{5} I_p\right) = I_p R\left(1 + \frac{2}{5}\right) = \frac{7}{5} R I_p$$

$$R_{TH} = \frac{V_p}{I_p} = \frac{7}{5} R$$

V_{TN}



$$\begin{cases} V_R = R I_R \\ 3R I_R + R\alpha V_R + R J = 0 \end{cases}$$

$$3R I_R + \alpha R^2 I_R + R J = 0$$

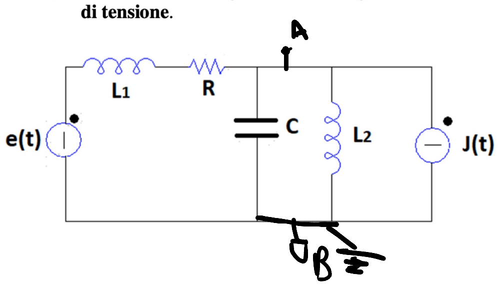
$$I_R (3R + \alpha R^2) = -RJ$$

$$I_R = \frac{-J}{3+\alpha R} = -\frac{1}{5} J = -\frac{2}{5} A$$

$$V_{TH} = R I_R + R\alpha V_R + R J = R\left(-\frac{2}{5}\right) + \alpha R^2\left(-\frac{2}{5}\right) + 2R = 8 V$$

ES 2

2) Determinare l'**energia media immagazzinata nell'induttore** L_2 e **la potenza apparente erogata dal generatore di tensione**.



e(t) = $30\sqrt{2}\sin(1000t)$ V;
J(t) = $\sqrt{2}\sin(1000t)$ A;
R = 10 Ω;
C = 100 μF;
L_1 = 10 mH;
L_2 = 20 mH.

$\dot{V}_A = ?$

$\dot{E} = 30 V$

$\dot{J} = 1 A$

$$J + \frac{E}{jωL_1 + R} = \left(\frac{1}{jωL_1 + R} + jωC + \frac{1}{jωL_2}\right)\dot{V}_A$$

$$\dot{V}_A = \frac{J + \frac{E}{jωL_1 + R}}{\frac{1}{jωL_1 + R} + jωC + \frac{1}{jωL_2}} = 50 - 30j$$

$I_? = \frac{V_A}{\ldots} = 1.5 - 2.5 j$

$$I_{L_2} = \frac{V_A}{j\omega L_2} = -1{,}5 - 2{,}5\,j$$

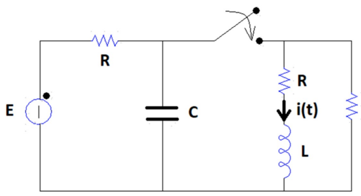
$$W_{L_2} = \frac{1}{2} L I^2 = 0{,}085\ j$$

$$I_E = \frac{E - V_A}{R + j\omega L_1} = 0{,}5 + 0{,}25\,j$$

$$P_E = E \cdot I_E = 76{,}18\ W$$

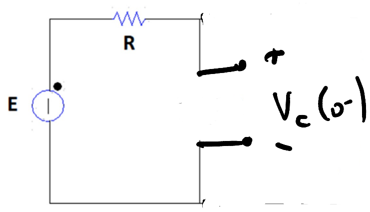
ES 3

3) Determinare l'andamento temporale della corrente **i(t)** per -∞ **< t <** +∞, considerando che l'interruttore si **chiude** per t=0. Il circuito è ipotizzato a regime per tempi negativi.



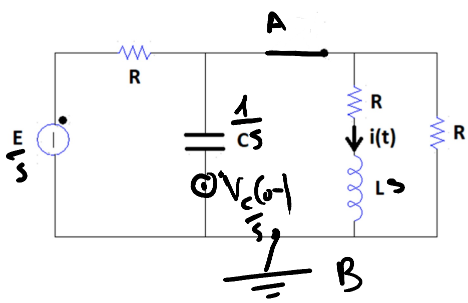
R = 20 Ω;
L = 10 mH;
C = 10 μF;
E = 30 V (costante).

$t < 0 \qquad i(t) = 0$



$$V_c(0^-) = E = 30\,V$$

$t \geq 0$



$$\frac{E}{sR} + C\,V_c(0^-) = V_A\left(\frac{3}{R} + \frac{1}{Ls} + Cs\right)$$

$$\frac{E}{sR} + C\,V_c(0^-) = V_A\left(\frac{3}{R} + \frac{1}{Ls} + Cs\right)$$

$$V_A = \frac{E/sR + C\,V_c(0^-)}{3/R + 1/Ls + Cs} = \frac{E + sRC\,V_c(0^-)}{3s + R/L + RCs^2}$$

$$i(t) = \frac{V_A}{R+sL} = E + RsC\,V(0^-)$$