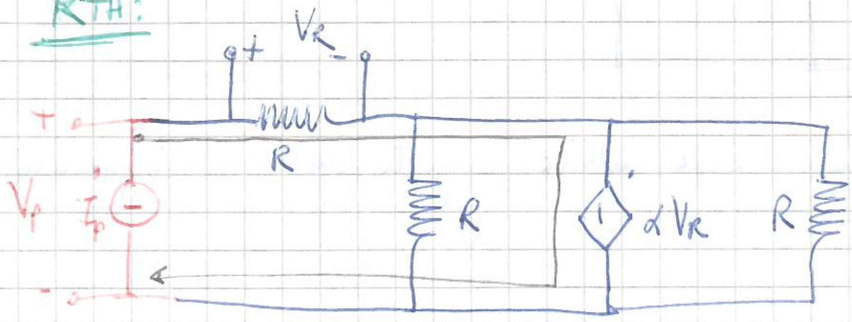
Risoluzione compito di Elettrotecnica - Ingegneria Informatica 18 7 2018

## ESERCIZIO 1

**$R_{TH}$:**

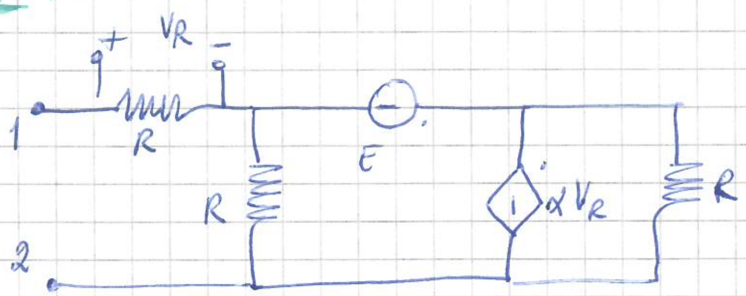



$V_R = R I_p$

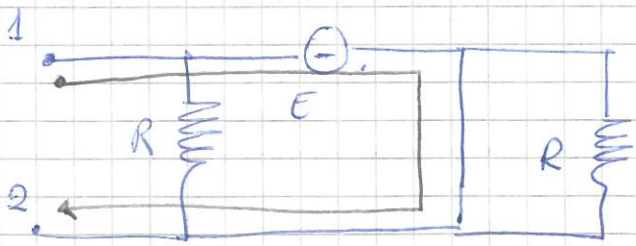
$V_p = V_R + \alpha V_R = 1,5\, V_R = 1,5\, R I_p$

$$R_{TH} = \frac{V_p}{I_p} = 1,5 R = 15\,\Omega$$

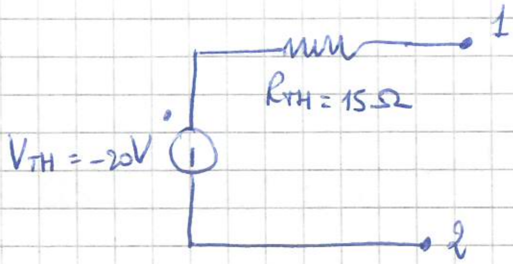
**$V_{TH}$:**



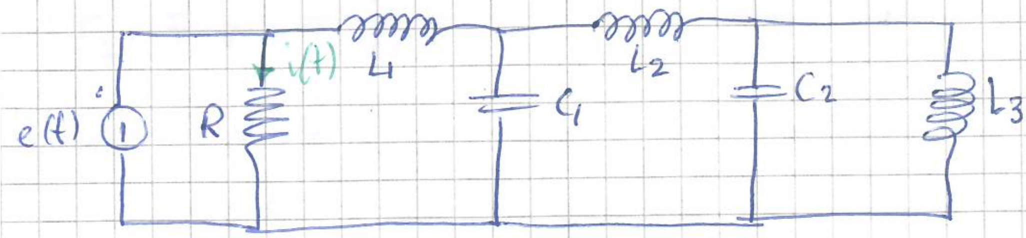

Ora sulla resistenza R a sinistra non scorre corrente (tensione a vuoto), quindi $V_R = \phi$




$V_{TH} = -E = -20V$



# ESERCIZIO 2




Per il teorema di Boucherot la potenza attiva erogata da $e(t)$ è uguale alla potenza dissipata su R

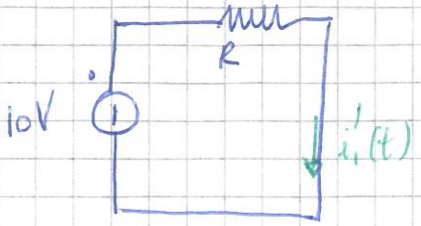
$$i(t) = \frac{e(t)}{R} = \sqrt{2}\cos(1000t)$$

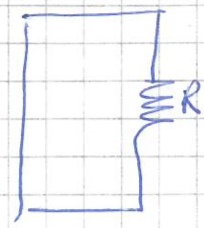
$P = R \cdot i^2 = \underline{10\ W}$ = potenza attiva erogata da $e(t)$

ESERCIZIO 3

Utilizziamo la sovrapposizione degli effetti per evitare di introdurre le condizioni iniziali.

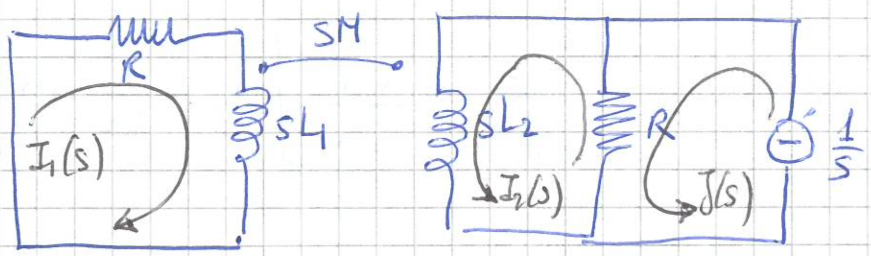
① Solo V




$$i_1'(t) = 0{,}5A$$

② Solo J




$$\begin{cases} (R+sL_1)I_1(s) + sM\,I_2(s) = 0 \\ (R+sL_2)I_2(s) + sM\,I_1(s) - RJ(s) = 0 \end{cases} \Rightarrow I_2(s) = -\frac{R+sL_1}{sM} I_1(s)$$

$$-\frac{(R+sL_1)(R+sL_2)I_1(s)}{sM} + sM\,I_1(s) = RJ(s) \Rightarrow$$

$$\Rightarrow I_1(s) = \frac{R}{\cancel{s}} \cdot \frac{\cancel{s}M}{s^2M^2 - s^2L_1L_2 - (RL_1+RL_2)s - R^2} =$$

$$= -\frac{RM}{s^2(L_1L_2 - M^2) + (RL_1+RL_2)s + R^2} = -\frac{0.24}{5.6\cdot 10^{-5}s^2 + 0.6s + 400}$$

$$i_1''(t) = \left(0.4615\cdot e^{-10000t} - 0.4615\cdot e^{-714t}\right)u(t)$$

$$i_1(t) = 0.5 + \left(0.4615\cdot e^{-10000t} - 0.4615\, e^{-714t}\right)u(t)$$

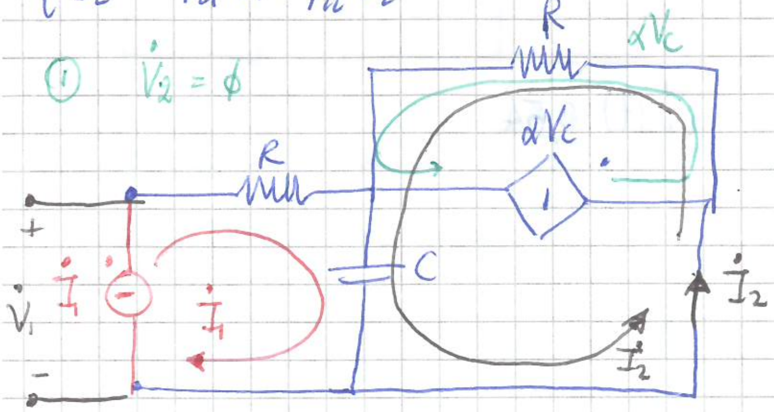
$$\lim_{t\to 0^-} i_1(t) = \lim_{t\to 0^+} i_1(t) = 0{,}5A$$

$$\lim_{t\to +\infty} i_1(t) = 0{,}5A \quad \text{ok!}$$

# ESERCIZIO 4

$$\begin{cases} \dot I_1 = \overline{Y}_{11}\dot V_1 + \overline{Y}_{12}\dot V_2 \\ \dot I_2 = \overline{Y}_{21}\dot V_1 + \overline{Y}_{22}\dot V_2 \end{cases}$$

(1) $\dot V_2 = \phi$




$$\begin{cases} \left(R + \frac{1}{j\omega C}\right)\dot I_2 + R\alpha\dot V_c + \frac{1}{j\omega C}\dot I_1 = \phi \\ \dot V_c = \left(\dot I_1 + \dot I_2\right)\frac{1}{j\omega C} \end{cases} \Rightarrow \left[R + \frac{1}{j\omega C} + \frac{R\alpha}{j\omega C}\right]\dot I_2 = \left(-\frac{1}{j\omega C} - \frac{\alpha R}{j\omega C}\right)\dot I_1$$

$$\Downarrow$$

$$(10 - 30j)\dot I_2 = 30j\,\dot I_1 \Rightarrow$$

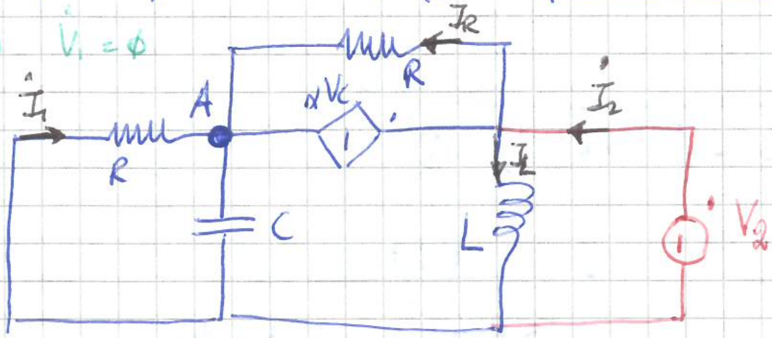
$$\Rightarrow \dot I_2 = (-0.9 + 0.3j)\dot I_1 = \beta\dot I_1$$

$$\dot V_1 = R\dot I_1 + \frac{1}{j\omega C}\left(\dot I_1 + \dot I_2\right) = \left(R + \frac{1}{j\omega C} + \frac{\beta}{j\omega C}\right)\dot I_1 \Rightarrow \overline{Y}_{11} = \left(R + \frac{1+\beta}{j\omega C}\right)^{-1} =$$

$$= \boxed{+0.0868 + 0.0038j}\ S$$

$$\dot I_2 = \beta\dot I_1 = \beta\overline{Y}_{11}\dot V_1 \Rightarrow \overline{Y}_{21} = \beta\cdot\overline{Y}_{11} = \boxed{-0.0792 + 0.0226j}$$

(2) $\dot V_1 = \phi$




$$A: -\alpha\dot V_c = \dot V_A\left(\frac{1}{R} + j\omega C + \frac{1}{R}\right) - \dot V_2\frac{1}{R}$$

Poiché $\dot V_A = \dot V_c \Rightarrow \dot V_A\left(\frac{2}{R} + j\omega C + \alpha\right) = \dot V_2\left(\frac{1}{R}\right) \Rightarrow \dot V_A = (0.1321 - 0.0377j)\dot V_2 = \gamma\dot V_2$

$$\dot I_1 = -\frac{\dot V_A}{R} = -\frac{\gamma\dot V_2}{R} \Rightarrow \dot Y_{12} = -\frac{\gamma}{R} = \boxed{-0.0132 + 0.0038j}$$

$$\dot I_2 = \dot I_L + \dot I_R - \alpha\dot V_c = \frac{\dot V_2}{j\omega L} + \frac{\dot V_2 - \dot V_A}{R} - \alpha\dot V_A = \underbrace{\left(\frac{1}{j\omega L} + \frac{1}{R} - \frac{\gamma}{R} - \alpha\gamma\right)}_{\overline{Y}_{22}}\dot V_2$$

$$\boxed{\overline{Y}_{22} = 0.0208 - 0.0774j}$$