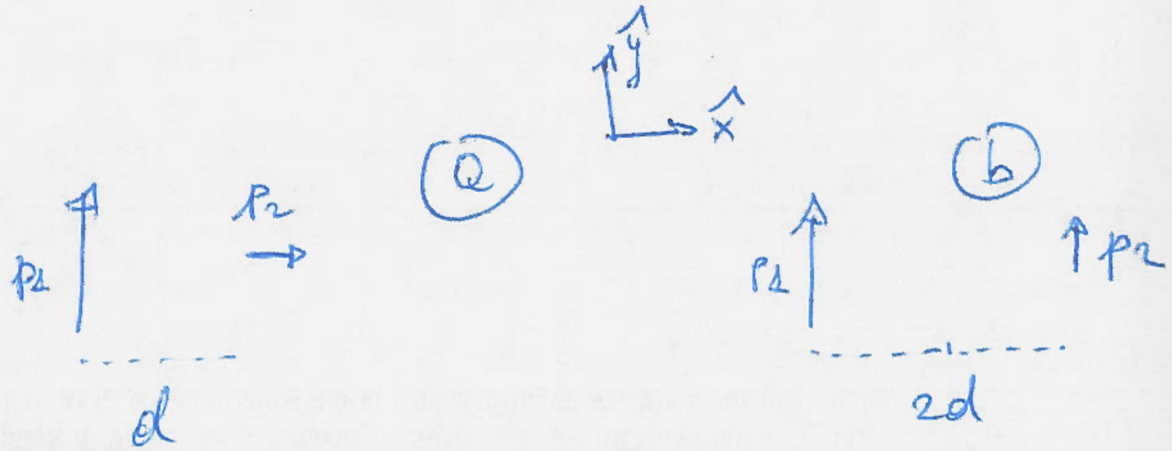
25 - 10 - 2019

1



$$U_{e\,dipolo}^{(d)} = -\vec{p}\cdot\vec{E}(d) = -\vec{p}_2\cdot\vec{E}_1(d)$$

$$\vec{E}_1(d) = \frac{p_1}{4\pi\varepsilon d^3}\,\hat{\theta} = \frac{p_1}{4\pi\varepsilon d^3}(-\hat{y})$$

$$U_e(d) = -\frac{p_2 p_1}{4\pi\varepsilon d^3}\underbrace{\hat{x}\cdot(-\hat{y})}_{\substack{\shortparallel \\ 0}} = 0$$

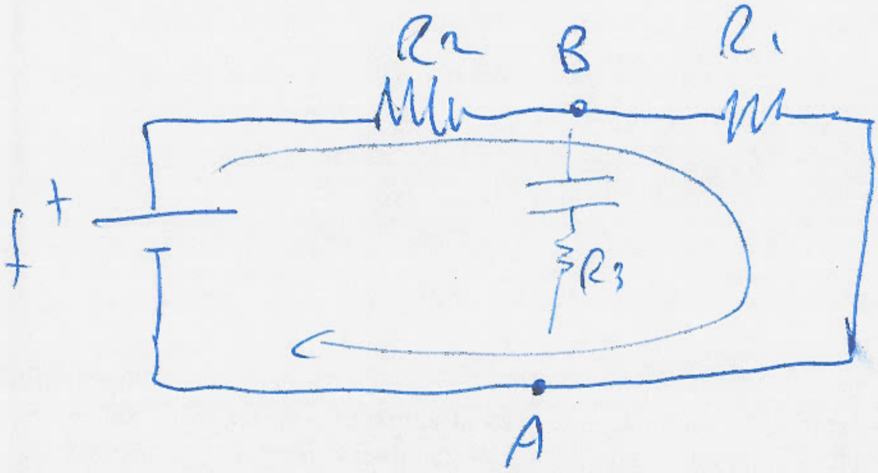
$$U_e(2d) = -\vec{p}\cdot\vec{E}(2d) = -\vec{p}_2\cdot\vec{E}_1(2d)$$

$$\vec{E}_1(2d) = \frac{p_1}{4\pi\varepsilon(2d)^3}\,\hat{\theta} = \frac{p_1}{4\pi\varepsilon(2d)^3}(-\hat{y})$$

$$U_e(2d) = -\frac{p_2 p_1}{4\pi\varepsilon(2d)^3}\underbrace{\hat{y}\cdot(-\hat{y})}_{-1} = \frac{p_2 p_1}{4\pi\varepsilon(2d)^3}$$

$$L_{interno} = -\Delta U_e = -L_{est} \longrightarrow L_{est} = \Delta U_e = p_2 p_1 / 4\pi\varepsilon(2d)^3$$

2

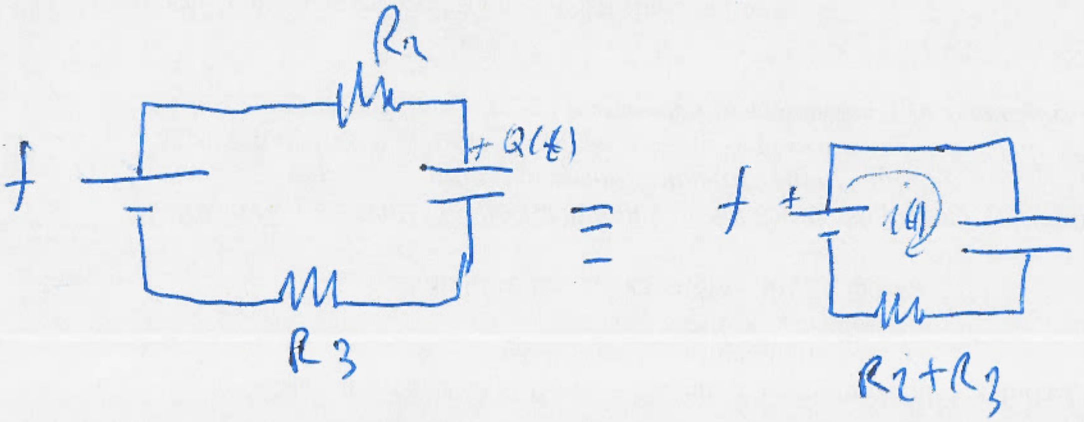


INIZIO, NON SCORRE CORRENTE SU R_3 PERCHÉ È A REGIME

$$i_0 = \frac{f}{R_1+R_2} \qquad V_{BA} = R_1 i_0 = \frac{R_1 f}{R_1+R_2}$$

$$V_{BA} = V_{C_{iniz.}} + \underbrace{V_{R_3}}_{0 = R_3 \cdot i_3 = 0} = V_{C_{iniz}}$$

$$V_{C_{iniz}} = V_{BA} = \frac{R_1 f}{R_1+R_2} \qquad \underbrace{Q_{iniz}}_{Q_0} = C \cdot V_{C_{iniz}} = \frac{C R_1 f}{R_1+R_2}$$



$$f - V_C(t) = (R_2+R_3)\, i(t) \qquad i(t) = \frac{dQ(t)}{dt}$$

$$\text{e' } V_C(t) = \frac{Q(t)}{C}$$

$\longrightarrow$

$$f - \frac{Q(t)}{C} = (R_2+R_3)\frac{dQ(t)}{dt}$$

$$Cf - Q(t) = C(R_2+R_3)\frac{dQ(t)}{dt}$$

$$Q(t) - Cf = -C(R_2+R_3)\frac{dQ(t)}{dt}$$

$$-\int_0^t \frac{dt}{C(R_2+R_3)} = \int_{Q_0}^{Q(t)} \frac{dQ(t)}{Q(t)-Cf}$$

$$-\frac{1}{C(R_2+R_3)}t = \ln\frac{Q(t)-Cf}{Q_0-Cf}$$

$$\tau = C(R_2+R_3)$$

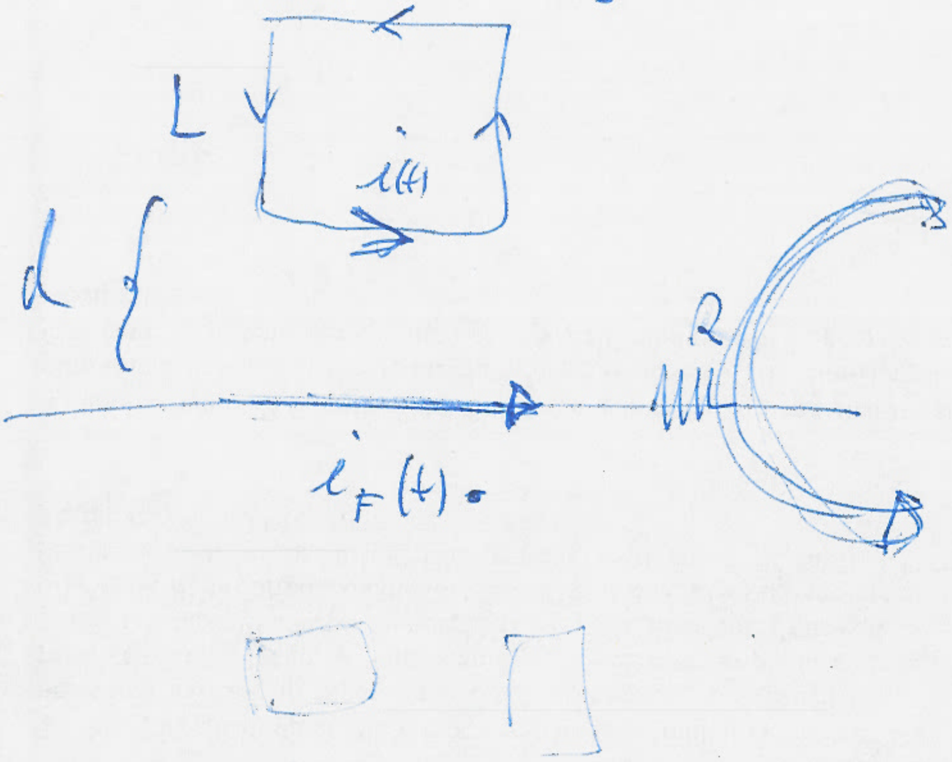
$$e^{-\frac{t}{\tau}} = \frac{Q(t)-Cf}{Q_0-Cf}$$

$$(Q_0-Cf)e^{-t/\tau} = Q(t)-Cf$$

$$Q(t) = Cf + (Q_0-Cf)e^{-t/\tau}$$

(3)

$$i_S(t) = i(t) = i_0 + \alpha t^2$$



$$B = \frac{\mu_0 i_F}{2\pi R}$$

$$M_{12} = M_{21} = M \qquad \mathcal{E}_i = -M \frac{di}{dt}$$

$$M = \frac{\phi_{F,S}}{i_F} = \frac{\phi_{S,F}}{i_S}$$

CONSIDERO UNA CORRENTE i_F SUL FILO E NON SULLA SPIRA

$$\phi_{F,S} = L\int_d^{d+L} \frac{\mu_0 i_F}{2\pi r}\,dr = \frac{\mu_0 i_F L}{2\pi} \ln\left(\frac{d+L}{d}\right)$$

$$M = \frac{\phi_{F,S}}{i_F} = \frac{\mu_0 L}{2\pi} \ln\left(\frac{d+L}{d}\right)$$

$\longrightarrow$

$\boxed{P\_5}$

$$M = \frac{\phi_{S,F}}{i_S} \rightarrow \phi_{S,F} = M i_S = i_S(t)\frac{\mu_0 L}{2\pi}\ln\left(\frac{d+L}{d}\right)$$

$$\mathcal{E}_{\text{nel filo}} = \mathcal{E}_{S,F} = -M\frac{di_S}{dt} =$$

$$= -\frac{\mu_0 L}{2\pi}\ln\left(\frac{d+L}{d}\right)\cdot\frac{d}{dt}\left(i_0+\alpha t^2\right) =$$

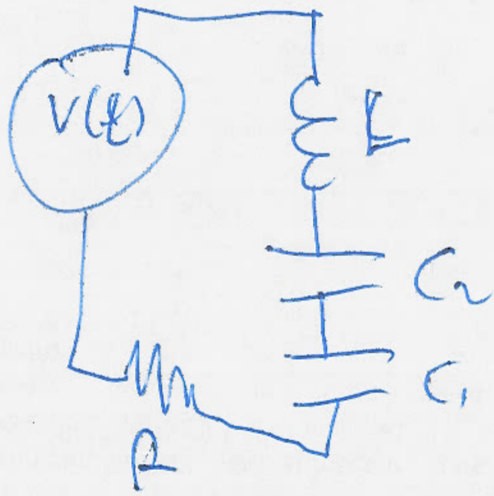
$$= -\frac{\mu_0 L}{2\pi}\ln\left(\frac{d+L}{d}\right)2\alpha t = \mathcal{E}_{FILO}(t)$$

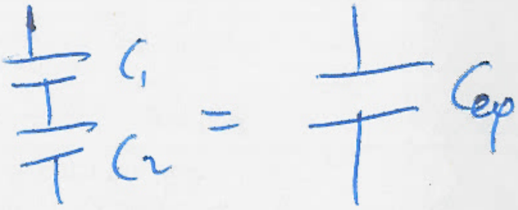
$$i_{FILO}(t) = \frac{\mathcal{E}_{FILO}(t)}{R} = -\frac{\mu_0 L}{2\pi R}\ln\left(\frac{d+L}{d}\right)2\alpha t$$

$$i_{FILO}(t_0) = -\frac{\mu_0 L}{2\pi R}2\alpha t_0\ln\left(\frac{d+L}{d}\right)$$

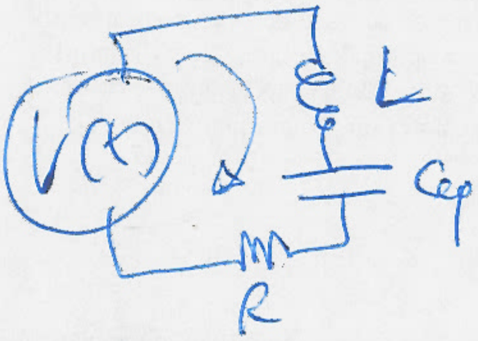
verso opposto: quindi $\xleftarrow{i_F}$

C1





$$C_{eq} = \frac{1}{\frac{1}{C_1}+\frac{1}{C_2}}$$



$$\omega = 2\pi f$$

$$i_{eff} = \frac{V_{eff}}{Z} \qquad Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C_{eq}}\right)^2}$$

$$\mathcal{E}_{eff\,L} = Z_L\, i_{eff} = \omega L\, i_{eff}$$

$$\mathcal{E}_{max\,L} = \sqrt{2}\cdot \mathcal{E}_{eff\,L} = \sqrt{2}\,\omega L\, i_{eff} = \frac{\omega L \sqrt{2}\, V_{eff}}{Z}$$

$$P_m = \frac{1}{2} i_{eff}\, \mathcal{E}_{eff} \cos\phi = \frac{1}{2}\mathcal{E}_{eff}\cdot\frac{\mathcal{E}_{eff}}{Z}\cdot\frac{R}{Z}$$