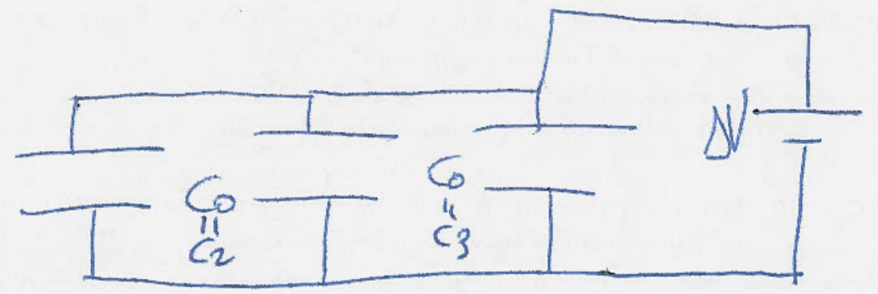
21/01/2020

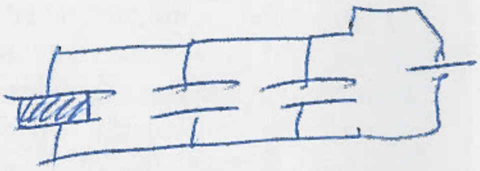
1)

$C_1 = C_0$



$C_1 = C_2 = C_3 = C_0$ INIZ.

POI $C_1' = K C_1 = K C_0$



$$C_{eq_{IN}} = C_1 + C_2 + C_3 = 3C_0$$

$$C_{eq_{FIN}} = C_1' + C_2 + C_3 = kC_0 + C_0 + C_0 = (k+2)C_0$$

$$U_{e_{IN}} = \frac{1}{2} C_{eq_{IN}} \Delta V^2 \qquad U_{eq_{FIN}} = \frac{1}{2} C_{eq_{FIN}} \Delta V^2 = 2U_{eq_{IN}}$$

$$\cancel{\frac{1}{2}} C_{eq_{FIN}} \cancel{\Delta V^2} = 2 \cdot \cancel{\frac{1}{2}} C_{eq_{IN}} \cancel{\Delta V^2}$$

$$C_{eq_{FIN}} = 2 C_{eq_{IN}} \Rightarrow (k+2)\cancel{C_0} = 2 \cdot 3 \cancel{C_0}$$

$$k+2 = 2 \cdot 3 = 6 \qquad \boxed{k = 6 - 2 = 4}$$

$$L_{generatore} = \Delta V \cdot \Delta Q = \Delta V (Q_{FIN} - Q_{IN})$$

$$Q_{IN} = \Delta V \cdot C_{eq_{IN}} \qquad Q_{FIN} = \Delta V \, C_{eq_{FIN}} \qquad \Delta Q = (C_{eq_{FIN}} - C_{eq_{IN}})\Delta V$$

$$\Delta Q = [(k+2)C_0 - 3C_0]\Delta V = (6C_0 - 3C_0)\Delta V = 3C_0\Delta V$$

p. 2

$$\mathcal{L}_{gerador} = \Delta V \left(3 C_0 \Delta V \right) = 3 C_0 \Delta V^2$$

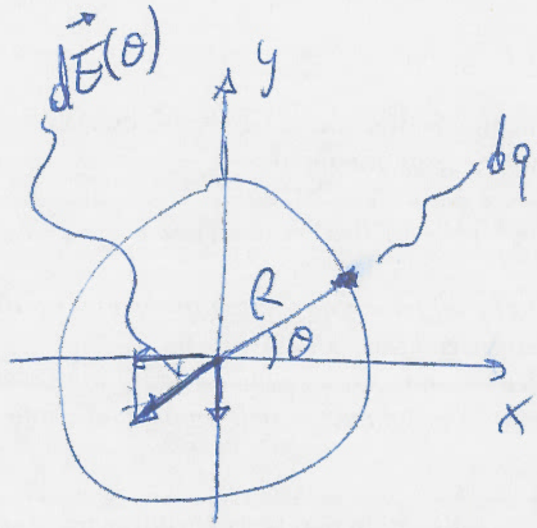
$$\underline{\mathcal{L}_{ger} = (k+2-3) C_0 \Delta V^2 = (k-1) \cancel{C_0} \Delta V^2}$$

$$|Q_f| = |Q_1'| \left(\frac{k-1}{k} \right)$$

$$Q_1' = C_1' \Delta V = k C_0 \Delta V$$

$$|Q_f| = \cancel{k} C_0 \Delta V \left(\frac{k-1}{\cancel{k}} \right) = (k-1) C_0 \Delta V = 3 C_0 \Delta V$$

2)



$$dq = \lambda(\theta)\underbrace{R\,d\theta}_{dl}$$

$$dq(\theta) = \lambda_0 \operatorname{sen}(\theta) R\, d\theta$$

$$d\vec{E}_x = dE \cos\theta\,(-\hat{x}) \qquad dE_x = -\cos\theta\, dE$$

$$d\vec{E}_y = dE \operatorname{sen}\theta\,(-\hat{y}) \qquad dE_y = -\operatorname{sen}\theta\, dE$$

$$dE = \frac{dq(\theta)}{4\pi\varepsilon R^2} = \frac{\lambda_0 \cancel{R} \operatorname{sen}(\theta)\, d\theta}{4\pi\varepsilon_0 R^{\cancel{2}}}$$

$$\vec{E}_{Tx} = \hat{x}\int_0^{2\pi} dE_x = \hat{x}\int_0^{2\pi} -\frac{\cos\theta\, \lambda_0 \operatorname{sen}\theta}{4\pi\varepsilon R}\, d\theta$$

$$\vec{E}_{Ty} = \hat{y}\int_0^{2\pi} dE_y = \hat{y}\int_0^{2\pi} -\frac{\operatorname{sen}\theta\, \lambda_0 \operatorname{sen}\theta\, d\theta}{4\pi\varepsilon R}$$

$$\vec{E}_{Tx} = \hat{x}\left(-\frac{\lambda_0}{4\pi\varepsilon R}\right)\int_0^{2\pi} \cos\theta \operatorname{sen}\theta\, d\theta = \hat{x}\left(\frac{-\lambda_0}{4\pi\varepsilon R}\right)\int \operatorname{sen}\theta\, d\operatorname{sen}\theta =$$

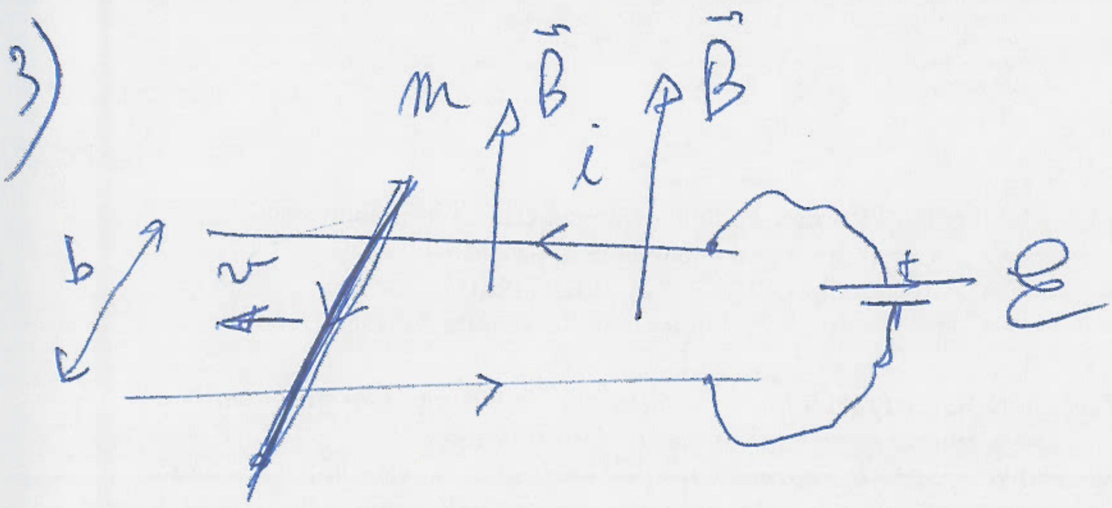
$$= \hat{x}\left(\frac{-\lambda_0}{4\pi\varepsilon R}\right)\frac{\operatorname{sen}^2\theta}{2}\Big|_0^{2\pi} = \emptyset$$

$$\vec{E}_{T,y} = \hat{y}\left(-\frac{\lambda_0}{4\pi\varepsilon_0 R}\right)\int_0^{2\pi} \sin^2\theta \, d\theta =$$

$$= \hat{y}\left(-\frac{\lambda_0}{4\cancel{\pi}\varepsilon_0 R}\right)\cancel{\pi} = -\hat{y}\,\frac{\lambda_0}{4\varepsilon_0 R}$$

$$\vec{E} = \vec{E}_{T,y} = -\hat{y}\,\frac{\lambda_0}{4\varepsilon_0 R}$$

3)



Con i versi scelti la v è verso sinistra

$$t=0 \qquad v_0 = 0 \qquad i_0 = \frac{\mathcal{E}}{R}$$

$$t=+\infty \qquad v_{+\infty} = v_\infty = \text{costante} \rightarrow a_{cc} = 0 \Rightarrow \boxed{\vec{F} = 0}$$

$$\vec{F} = i_\infty \vec{b} \times \vec{B} \Rightarrow i_\infty b B = 0 \rightarrow \boxed{i_{+\infty} = 0}$$

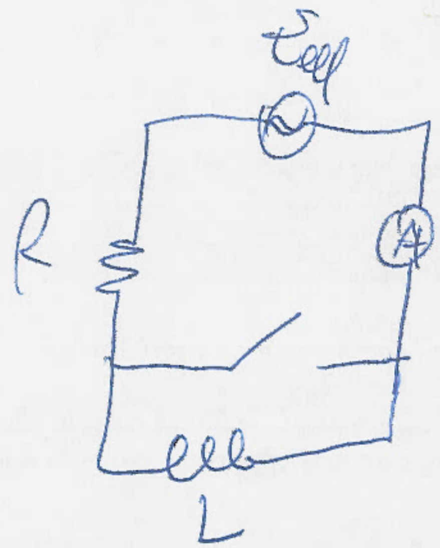
$$i_{+\infty} = 0 = i_{\mathcal{E}} + i_{IND} = \frac{\mathcal{E}}{R} + \frac{\mathcal{E}_{IND}}{R} = 0$$

$$\mathcal{E}_{IND} = -\mathcal{E} \Rightarrow -\frac{d}{dt}\phi(\vec{B}) = -\mathcal{E}$$

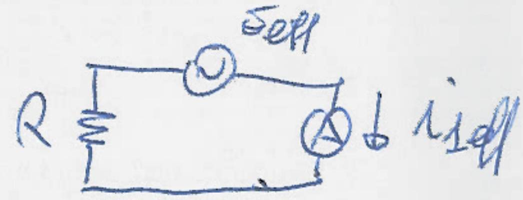
$$\frac{d}{dt}(\vec{B}) = \frac{d}{dt} B \cdot b\, x(t) = B \cdot b \frac{dx(t)}{dt} = B b v_\infty$$

$$B b v_\infty = \mathcal{E} \qquad \boxed{v_\infty = \frac{\mathcal{E}}{Bb}} \qquad \boxed{E_k = \frac{1}{2} m v_\infty^2}$$

4)

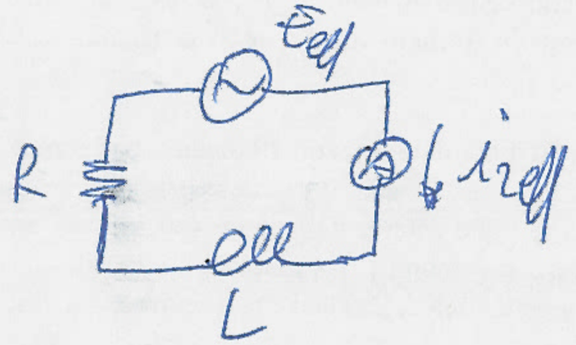


1) int. chiuso



$$R = \frac{\mathcal{E}_{eff}}{i_{1eff}}$$

2) int APERTO



$$\omega = 2\pi\nu$$

$$Z_L = j\omega L$$

$$Z_R = R$$

$$Z = \sqrt{Z_R^2 + Z_L^2}$$

$$\mathcal{E}_{eff} = Z\, i_{2eff}$$

$$Z = \sqrt{R^2 + \omega^2 L^2}$$

$$Z = \frac{\mathcal{E}_{eff}}{i_{2eff}} = \sqrt{R^2 + \omega^2 L^2} \Rightarrow \frac{\mathcal{E}_{eff}^2}{i_{2eff}^2} = R^2 + \omega^2 L^2$$

$$L^2 = \frac{\mathcal{E}_{eff}^2}{\omega^2 i_{2eff}^2} - \frac{R^2}{\omega^2} \qquad L = \frac{1}{\omega}\sqrt{\frac{\mathcal{E}_{eff}^2}{i_{2eff}^2} - R^2}$$

$$P_{m_2} = \mathcal{E}_{eff}\, i_{2eff} \cos\phi = \mathcal{E}_{eff} \cdot i_{2eff} \cdot \frac{R}{Z}$$