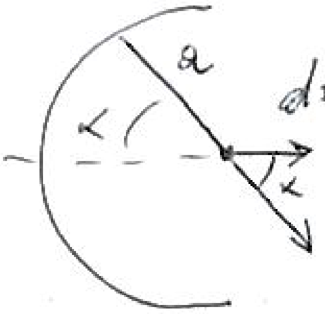
Soluzioni

(1)



$dE_n = dE \cos\alpha$ → unica componente.

$$dE = \frac{d\lambda}{2\pi\varepsilon_0 a}$$

$$d\lambda = \frac{dq}{dl} = \frac{\sigma \cancel{dl}\, a\, d\alpha}{\cancel{dl}} = \frac{Q}{\ell\pi \cancel{a}} \cancel{a}\, d\alpha = \frac{Q}{\ell\pi}\, d\alpha$$

$$E_n = \int_{-\pi/2}^{\pi/2} \frac{Q\, d\alpha}{\ell\pi} \cos\alpha \frac{1}{2\pi\varepsilon_0 a} = \frac{Q}{\pi^2 \varepsilon_0 \ell a}$$

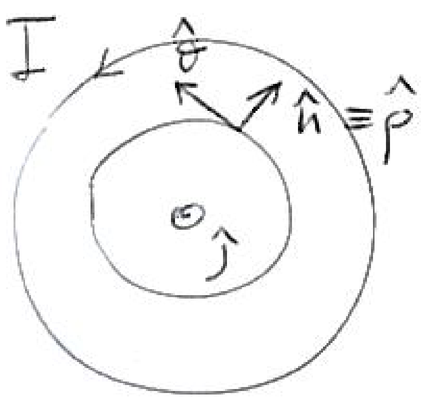
(2)

$$\vec{H}_0 = n I \hat{\jmath} \quad ; \quad H_{t0} = H_t \Rightarrow \vec{H} = n I \hat{\jmath}$$

$$\Rightarrow \vec{B} = \mu \vec{H} = \mu n I \hat{\jmath}$$

$$\vec{J}_{ms} = \vec{M} \times \hat{n} = \left(\frac{\vec{B}}{\mu_0} - \vec{H} \right) \times \hat{n} =$$

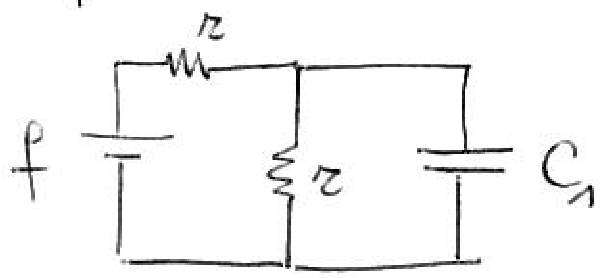
$$= (\mu_r - 1) n I (\hat{\jmath} \times \hat{n}) = (\mu_r - 1) n I \hat{\vartheta}$$



$$\parallel$$

$$4{,}5 \cdot 10^5 \hat{\vartheta} \frac{A}{m}$$

(3) $t \leq 0$



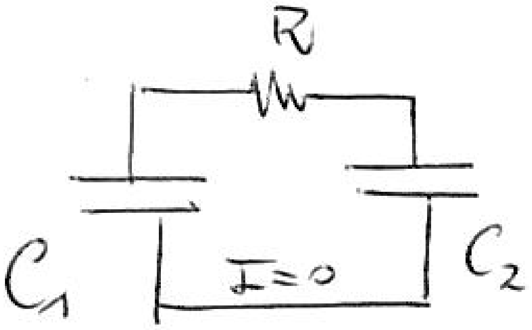
$$I = \frac{f}{2r}$$

$$\Delta V_{C_1} = I r$$

$$Q_1^0 = C_1 \Delta V_{C_1} = C_1 \frac{f}{2}$$

$t = +\infty$

"$U_c = \frac{Q^2}{2C}$"



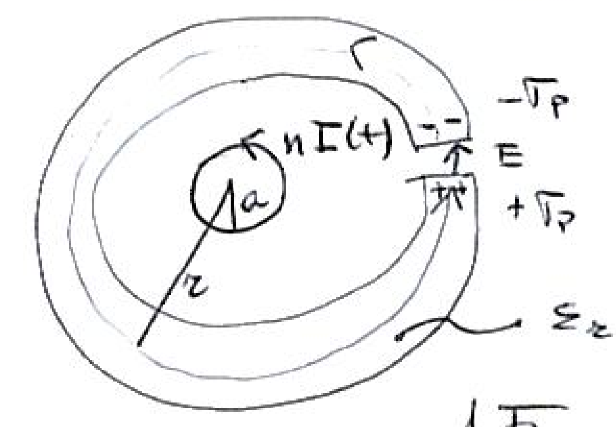
$$\begin{cases} Q_1^\infty + Q_2^\infty = Q_1^0 \\ \frac{Q_1^\infty}{C_1} = \frac{Q_2^\infty}{C_2} \end{cases}$$

$\rightarrow$ conservazione della carica.

$$Q_1^\infty = \frac{Q_1^0 C_1}{C_1 + C_2} \qquad Q_2^\infty = \frac{Q_1^0 C_2}{C_1 + C_2}$$

$$U_J = U_{C_1}^0 - \left(U_{C_1}^\infty + U_{C_2}^\infty\right) = \frac{\left(Q_1^0\right)^2}{2}\left(\frac{1}{C_1} - \frac{1}{C_1 + C_2}\right.$$

(4)



Faraday

$$\oint_{\Gamma_r} \vec{E}\cdot d\vec{l} = E_t \, 2\pi r = -\frac{d\Phi}{dt} = -\pi a^2 \frac{dB}{dt}$$

$$= -\mu_0 n I e^{-t/\tau}\left(-\frac{1}{\tau}\right)\pi a^2$$

$$\Rightarrow \quad E_t = +\frac{\mu_0 n I a^2}{2\tau r} e^{-t/\tau}$$

Nel vuoto delle fenditure

$$E = E_i + \frac{\sigma_P}{\varepsilon_0} = E_i + \frac{P}{\varepsilon_0} = E_i + (\varepsilon_r - 1)E_i =$$

$$= \varepsilon_r E_i = \frac{\varepsilon_r \mu_0 n I a^2}{2\tau r} e^{-t/\tau}$$

Oppure con le condizione di raccordo

$\varepsilon_r E_n$ continue $\Rightarrow$ $E_{vuoto} = \varepsilon_r E_{dielettrico}$

$$\Delta V = E_s d = \frac{\sigma_P}{\varepsilon_0} d$$

5

$$\lambda = \frac{c}{\nu} = \frac{3\cdot 10^8}{10^9} \sim 30\,cm \Rightarrow 1\,cm = \ell$$

$$f_i = -\frac{d\Phi}{dt} = -\frac{dB_z}{dt}\ell^2 =$$

$$= -\frac{dE_y}{dt}\frac{\ell^2}{c} = -\frac{\ell^2}{c}\frac{d}{dt}\left[2E_0 \cos\omega t\right] =$$

$$= \frac{\ell^2}{c} 2E_0\, \omega\, \mathrm{sen}(\omega t)$$

$$f_i^{max} = \frac{10^{-4}}{3\cdot 10^8} \cdot 2\, 10^{-2}\, 2\pi\, 10^9 \simeq 40\,\mu V$$

Esami Orali:

22 Gennaio 2014

ore 9:00

Sala Letture dip. SBAI