Soluzioni

(1) $dq = \lambda dl$ nel punto O genera:

$$dV_1 = \frac{\lambda dl}{4\pi\varepsilon_0 (l+d)} \rightarrow V_1 = \int_0^L dV_1$$

$$V_1 = \frac{\lambda}{4\pi\varepsilon_0} \ln\left(\frac{d+L}{d}\right)$$

$$V(O) = (3-1)\, V_1 = \frac{\lambda}{2\pi\varepsilon_0} \ln\left(\frac{d+L}{d}\right)$$

(2) $\vec{B}$ è uscente dal foglio e dato solo dai tratti circolari

$$B = \int_{\text{arco1}} \frac{\mu_0}{4\pi} \frac{I}{r^2} dl_1 + \int_{\text{arco2}} \frac{\mu_0}{4\pi} \frac{I}{9r^2} dl_2 =$$

$$= \frac{\mu_0 I}{4\pi} \left(\int_0^{3\frac{\pi}{2}} \frac{r\, d\theta}{r^2} + \int_0^{\pi/2} \frac{3r\, d\theta}{9r^2} \right) =$$

$$= \frac{\mu_0 I}{4\pi r} \left(3\frac{\pi}{2} + \frac{1}{3}\frac{\pi}{2} \right) = \frac{5}{12} \frac{\mu_0 I}{r} =$$

$$= \frac{5 \cdot 4\pi 10^{-7} \cdot 10}{12 \cdot 10^{-1}} \simeq 5 \cdot 10^{-5}\ \text{T}$$

(3)

$$\Delta V_c(t=0) = \frac{f}{R_1+R_2}\cdot R_2$$

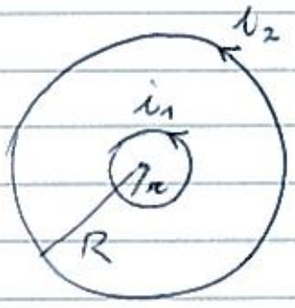
$$Q_0 = C\Delta V_c$$

$$Q(t) = Q_0 e^{-\frac{t}{\tau}} \qquad \tau = RC = (R_2+R_3)C$$

$$I_{R3}(t) = -\frac{dQ(t)}{dt} = \frac{1}{\tau} Q_0 e^{-\frac{t}{\tau}}$$

$$W_{R3} = \int_0^\infty R_3 I_{R_3}^2 dt = \frac{1}{2}\frac{Q_0^2}{C}\frac{R_3}{R_2+R_3}$$

(4)



$$i_1 = I_0 \sin \omega t \;, \quad \omega = 2\pi/T$$

$$f_{2\,\text{indotte}} = -M_1\frac{di_1}{dt} = -M I_0 \frac{2\pi}{T}\cos\omega t$$

$$\Phi_1 = M i_2 \qquad f_0$$

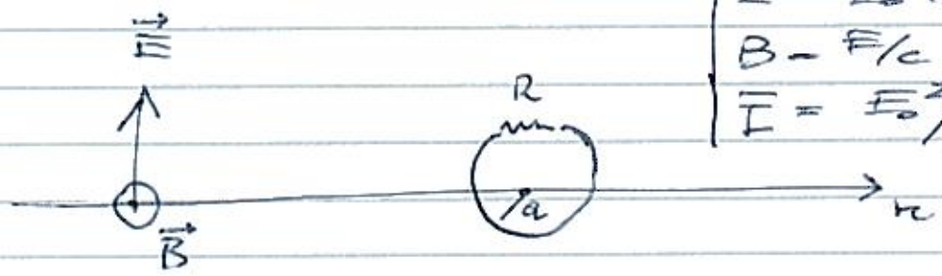
$$\pi r^2 B_2(0) = M i_2$$

$$\pi r^2\left(\frac{\mu_0 i_2}{2R}\right) = M i_2 \Rightarrow M = \frac{\pi}{2}\mu_0\frac{r^2}{R}$$

$$f_0 = \frac{\pi}{2}\mu_0\frac{r^2}{R} I_0 \frac{2\pi}{T} = 20\,\mu V$$

(5)

onde: $\begin{cases} E = E_0 \sin(\omega t) \\ B = E/c \\ \bar{I} = E_0^2/2Z \end{cases}$



$$|f_i| = \frac{d\Phi(B)}{dt} = \pi a^2 \frac{1}{c} \frac{dE}{dt} = \frac{\pi a^2}{c} E_0 \omega \cos(\omega t)$$

$$W_J = \frac{f_i^2}{R} = \left(\frac{\pi^2 a^4 \omega^2 2 Z \bar{I}}{R c^2} \right) \cos^2(\omega t)$$

$$\overline{W_J} = \frac{1}{2} \left(\frac{\pi^2 a^2 \omega^2 2 Z \bar{I}}{R c^2} \right)$$