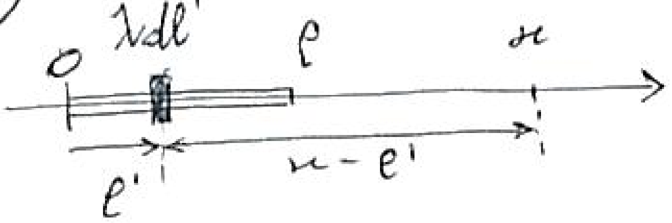
Soluzioni

(1)



per $x > \ell$:

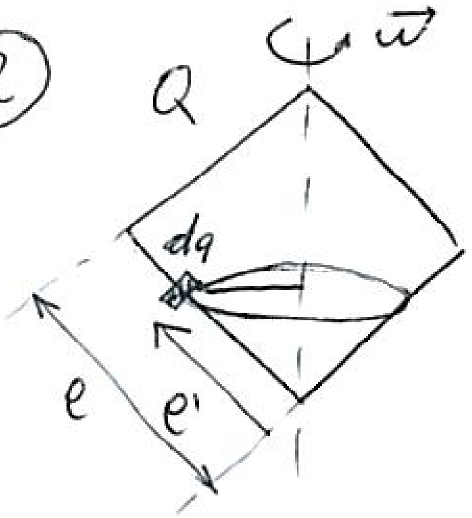
$$dV = \frac{1}{4\pi\varepsilon_0}\frac{dq}{r} = \frac{1}{4\pi\varepsilon_0}\frac{\lambda d\ell'}{x-\ell'}$$

$$V(x) = \frac{\lambda}{4\pi\varepsilon_0}\int_0^{\ell}\frac{d\ell'}{x-\ell'} = -\frac{\lambda}{4\pi\varepsilon_0}\ln\left(\frac{x-\ell}{x}\right) = \frac{\lambda}{4\pi\varepsilon_0}\ln\left(\frac{x}{x-\ell}\right)$$

per $x < 0$:

$$dV = \frac{1}{4\pi\varepsilon_0}\frac{\lambda d\ell'}{-x+\ell'} \Rightarrow V(x) = \frac{\lambda}{4\pi\varepsilon_0}\ln\left(\frac{x-\ell}{x}\right)$$

(2)



Un lato:

$$dm_1 = dI\,S = \frac{dq}{T}S =$$

$$= \frac{\lambda d\ell'\omega}{2\pi}\cdot\pi\left(\ell'\sin 45^\circ\right)^2 =$$

$$= \frac{\omega\lambda}{4}\ell'^2 d\ell'$$

$$m_1 = \frac{\omega}{4}\frac{Q}{4\ell}\int_0^{\ell}\ell'^2 d\ell' = \frac{1}{48}\omega Q\ell^2$$

$$\vec{m} = \frac{1}{12}\vec{\omega}Q\ell^2$$

(3) $R_{eq} = \dfrac{R_2 R_3}{R_2 + R_3} = 8\,\Omega$

$R_T = r + R + R_1 + R_{eq} = \dfrac{f}{i} = 24\,\Omega$

$R_1 = 4\,\Omega$

$V_1 = R_1 i = 2V \; ; \quad C_1 = 2\dfrac{U_1}{V_1^2} = 2 \cdot 10^{-6} F$

$V_2 = R_{eq} i = 4V \; ; \quad C_2 = 2\dfrac{U_2}{V_2^2} = 0{,}25 \cdot 10^{-6} F$

(4) $\oint \vec{H} \cdot d\vec{l} = \int_S \dfrac{\partial \vec{D}}{\partial t} \cdot \hat{n}\, dS$

$\begin{cases} \text{simmetria cilindrica} \\ \vec{D} \text{ uniforme} \end{cases}$

$2\pi r H = \dfrac{\partial D}{\partial t} \pi r^2$

$J_{sp} = \dfrac{\partial D}{\partial t} = \dfrac{i}{\pi R^2} = \dfrac{I \sin \omega t}{\pi R^2}$

$\Rightarrow \quad H = \dfrac{r I}{2\pi R^2} \sin \omega t$

(5) $\lambda = c/\nu = 1\,m$; $\frac{\omega}{K} = c$

$$E = E_y = E_0 \cos(Kx - \omega t)$$

$$B = B_z = B_0 \cos(Kx - \omega t) = \frac{E_0}{c}\cos(Kx - \omega t)$$

$$f_i = -\frac{\partial \Phi(B)}{\partial t}$$

$$\Phi(B) = \int_0^L \frac{E_0}{c}\cos(Kx - \omega t)\, L\, dx =$$

$$= \frac{E_0 L}{cK}\left[\operatorname{sen}(KL - \omega t) + \operatorname{sen}\omega t\right]$$

$$f_i = -\frac{d\Phi}{dt} = \frac{E_0 L \omega}{cK}\left[\cos(KL - \omega t) - \cos\omega t\right]$$

$$\boxed{i(t) = \frac{f_i}{R} = \frac{E_0 L}{R}\left[\cos(\overset{\pi/2}{KL} - \omega t) - \cos\omega t\right]} =$$

$$i(t) = 0{,}83 \cdot 10^{-3}\,(\operatorname{sen}\omega t - \cos\omega t)\ A.$$