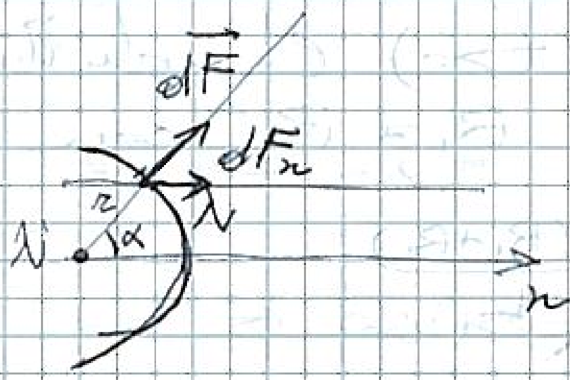
Soluzioni

(1)

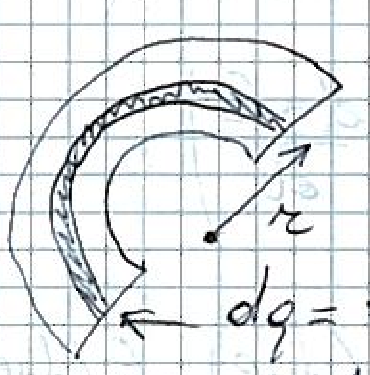


$$dF_x = dq\,E\cos\alpha = \lambda\,dl \cdot \frac{\lambda'}{2\pi\varepsilon_0 r}\cos\alpha = \lambda\,r\,d\alpha \cdot \frac{\lambda'}{2\pi\varepsilon_0 r}\cos\alpha$$

$$dF_x = \frac{\lambda\lambda'}{2\pi\varepsilon_0}\cos\alpha\,d\alpha$$

$$F_x = \frac{\lambda\lambda'}{2\pi\varepsilon_0}\int_{-\pi/2}^{\pi/2}\cos\alpha\,d\alpha = \frac{\lambda\lambda'}{\pi\varepsilon_0}$$

(2)



$$dq = \sigma\pi r\,dr$$

$$di = \frac{dq}{T} = \frac{dq}{\frac{2\pi}{\omega}} \quad ; \quad dB = \frac{\mu_0\,di}{2r}$$

$$B = \int_a^{3a}\frac{\mu_0}{2\cancel{r}}\,\frac{\sigma\cancel{\pi}\cancel{r}\,dr\,\omega}{2\cancel{\pi}} = \frac{\mu_0\sigma\omega}{4}(3a-a)$$

$$\vec{B} = \frac{\mu_0\,\omega\,\sigma\,a}{2} \quad \square$$

(3) $i_0 = \frac{f}{R_1}$

Dopo l'apertura ($t>0$) l'induttanza si scarica su $R_1 + R_2$ con legge:

$$i(t) = i_0 \, e^{-\frac{t(R_1+R_2)}{L}}$$

La potenza dissipata su R_2 è data da:

$$W_{R_2}(t) = R_2 \, i_0^2 \, e^{-\frac{2t(R_1+R_2)}{L}}$$ $\square$

(4) $Q = \frac{\Phi_{in} - \Phi_{fin}}{R}$

$$\Phi_{fin} = \int_{d+e}^{d+2e} \frac{\mu_0 I}{2\pi z} h \, dz = \frac{\mu_0 I h}{2\pi} \ln\left(\frac{d+2e}{d+e}\right)$$

$$\Phi_{in} = -\frac{\mu_0 I h}{2\pi} \ln\left(\frac{d+e}{d}\right)$$

$$Q = -\frac{\mu_0 I h}{2\pi R}\left[\ln(d+2e) - \ln(d+e) + \ln(d+e) - \ln(d)\right]$$

$$Q = -\frac{\mu_0 I h}{2\pi R} \ln\left(\frac{d+2e}{d}\right)$$ $\square$

5

$$E = E_0 \cos(ky - \omega t)$$
$$B = B_0 \cos(ky - \omega t \qquad k = \frac{2\pi}{\lambda}$$

$$f = \oint \bar{E} \cdot d\bar{l} = -E_0 l \cos \omega t + E_0 l \cos(kl - \omega t)$$

$$f = 0 \Rightarrow \cos(kl - \omega t) = \cos(\omega t)$$

$$\Rightarrow \frac{2\pi}{\lambda} l = 2\pi n$$

$$\Rightarrow l = n\lambda \quad , n \text{ intero};$$

$\square$