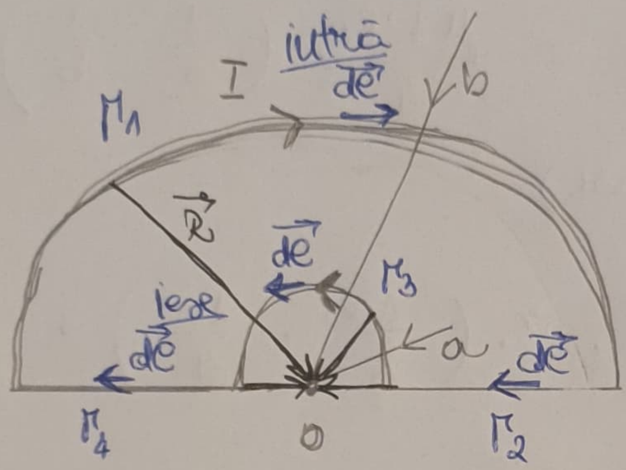
Temă seminar 5

(1) conductor filiform plasat în aer

$I = 5A$, $a = 2cm$, $b = 4cm$, $\mu_0 = 4\pi\cdot 10^{-7}\ H/m$.

Calc. $\vec{B}, \vec{H}$ în punctul O



$$\vec{H}(O) = \frac{I}{4\pi}\int_{\Gamma}\frac{\vec{dl}\times\vec{R}}{R^3}$$

$$\vec{B}(O) = \mu\cdot\vec{H}(O) = \frac{\mu\cdot I}{4\pi}\int_{\Gamma}\frac{\vec{dl}\times\vec{R}}{R^3}$$

$$\Gamma = \Gamma_1 \cup \Gamma_2 \cup \Gamma_3 \cup \Gamma_4$$

Γ_1: $\vec{dl} \perp \vec{R} \Rightarrow \vec{dl}\times\vec{R} = |dl|\cdot|R|\cdot\sin 90^\circ = dl\cdot R\cdot(\vec{k})$

Γ_3: $\vec{dl} \perp \vec{R} \Rightarrow \vec{dl}\times\vec{R} \overset{\cdot(-\vec{k})}{=} dl\cdot R\cdot(+\vec{k})$

Γ_2: $\vec{dl} \parallel \vec{R} \Rightarrow \vec{dl}\times\vec{R} = |dl|\cdot|R|\cdot\sin 180^\circ = 0.$

Γ_4: $\vec{dl} \parallel \vec{R} = \vec{dl}\times\vec{R} = 0.$

$$B(O) = \frac{I\cdot\mu}{4\pi}\left(\int_{\Gamma_1}\frac{\vec{dl}\times\vec{R}}{R^3} + \cancel{\int_{\Gamma_2}\frac{\vec{dl}\times\vec{R}}{R^3}} + \int_{\Gamma_3}\frac{\vec{dl}\times\vec{R}}{R_3} + \cancel{\int_{\Gamma_4}\frac{\vec{dl}\times\vec{R}}{R^3}}\right)$$

$\Gamma_1 : R = b \quad ; \quad \Gamma_2 : R = a$

$$\vec{B}(0) = \frac{\mu I}{4\pi}\left(\int_{\Gamma_1} \frac{dl}{b^2}\cdot(-\vec{k}) + \int_{\Gamma_2} \frac{dl}{a^2}\cdot\vec{k}\right) =$$

$$= \frac{\mu I}{4\pi}\left(\frac{1}{b^2}\cdot \pi \cancel{b}\cdot(-\vec{k}) + \frac{1}{a^{\cancel{2}}}\cdot\pi\cancel{a}\cdot\vec{k}\right) =$$

$$= \frac{\mu I}{4\cancel{\pi}}\cdot \vec{k}\cancel{\pi}\left(-\frac{1}{b}+\frac{1}{a}\right) = \frac{\mu I\cdot\vec{k}}{4}\left(\frac{1}{a}-\frac{1}{b}\right)$$

$\mu = \mu_0$ ($\mu_r = 1$ pt aer)

$$\vec{B}(0) = \frac{\cancel{4}\pi\cdot 10^{-7}\cdot 5}{\cancel{4}}\cdot\vec{k}\cdot\left(\frac{100}{2}-\frac{100}{4}\right) =$$

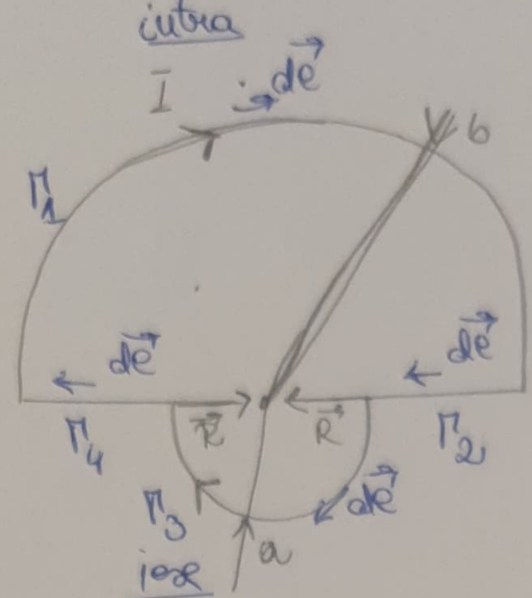
$$= 125\cdot 10^{-7}\,\pi\cdot\vec{k}\ [T]$$

② conductor filiform plasat în aer.

$a = 2\,cm$, $b = 4\,cm$, $\mu_0 = 4\pi\cdot 10^{-7}\,\frac{H}{m}$.

$\vec{B}(0) = ?$, $\vec{H}(0) = ?$

$$\vec{H}(0) = \frac{1}{\mu}\cdot\vec{B} = \frac{1}{\cancel{\mu}}\cdot\frac{\cancel{\mu}I\vec{k}}{4}\left(\frac{1}{a}-\frac{1}{b}\right) = \frac{I}{4}\cdot\vec{k}\left(\frac{1}{a}-\frac{1}{b}\right).$$



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$\mu = \mu_0$ ($\mu_r = 1$ pt aer)

$\vec{B} = \mu \vec{H}$.

Γ_1 : $\vec{dl} \perp \vec{R} \Rightarrow \vec{dl} \times \vec{R} = R \cdot dl \cdot (-\vec{k})$

Γ_2 : $\vec{dl} \parallel \vec{R} \Rightarrow \vec{dl} \times \vec{R} = 0$

Γ_3 : $\vec{dl} \perp \vec{R} \Rightarrow \vec{dl} \times \vec{R} = R \cdot dl \cdot (\vec{k})$

Γ_4 : $\vec{dl} \parallel \vec{R} \Rightarrow \vec{dl} \times \vec{R} = 0$.

$\Gamma_1 : R = b$, $\Gamma_3 = R = a$

$$\vec{B}(0) = \frac{\mu I}{4\pi} \left(\int_{\Gamma_1} \frac{R \cdot dl}{R^3} \cdot (-\vec{k}) - \int_{\Gamma_3} \frac{R \cdot dl}{R^3} \cdot \vec{k} \right)$$