МАГНЕТИЗАМ

ε – диелектр. прем. $[F/m]$, $\varepsilon = \varepsilon_r \cdot \varepsilon_0$

EC – извор поља Q → $\vec{k}$ $[V/m]$ $(\vec{F} = \vec{k} \cdot Q)$ → $\vec{F}$ → $\vec{v}$

$\vec{H}$ – јачина магн. поља $[A/m]$

$\vec{B}$ – ј. магн. интензитет $[T]$

μ – магн. прем. $[H/m]$, $\mu = \mu_r \mu_0$

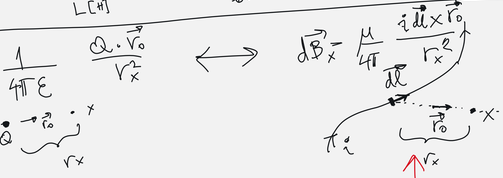
$\vec{H}, \vec{B}$ $[A/m]$ $[T]$ — МАГНЕТНО ПОЉЕ

$\vec{j}_c$ → $I[A]$, $i[A]$

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} \approx 300.000 \ \frac{km}{s}$$

$$\vec{k}_x = \frac{1}{4\pi\varepsilon} \frac{Q \cdot \vec{r}_0}{r_x^2} \longleftrightarrow d\vec{B}_x = \frac{\mu}{4\pi} \frac{i\, d\vec{l} \times \vec{r}_0}{r_x^2}$$

42:30

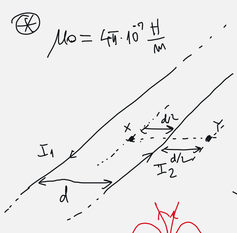


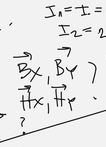
$\mu_0 = 4\pi \cdot 10^{-7} \ \frac{H}{m}$

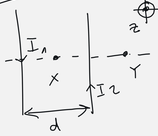
$I_1 = I = 1 \ mA$, $I_2 = 2I$, $d = 1 cm$

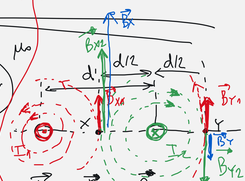
а) $\vec{B}_x, \vec{B}_y$? $\vec{H}_x, \vec{H}_y$?

б) $\vec{F}_{12}$?









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$\vec{B}_x = \vec{B}_{x1} + \vec{B}_{x2}$

$\vec{B}_{x1} = \frac{\mu_0 I_1}{2\pi d_{1x}} \cdot \vec{j} = \frac{\mu_0 I}{\pi d} \vec{j}$ (ПРЕТПОСТАВИМО!!!) изгубљено из $d/2$

$\vec{B}_{x2} = \frac{\mu_0 I_2}{2\pi d_{2x}} \vec{j}$, $I_2 = 2I$, $d_{2x} = d/2$

$\vec{B}_{x2} = \frac{2\mu_0 I}{\pi d} \vec{j}$

$\vec{B}_x = \ldots = \frac{3\mu_0 I}{\pi d} \vec{j} = \frac{3 \cdot 4\pi \cdot 10^{-7} \cdot 1mA}{\pi \cdot 1 \cdot 10^{-2} m} = 12 \cdot 10^{-7} T \vec{j} = 1{,}2 \ mT \vec{j}$

$\vec{B}_y = \vec{B}_{y1} + \vec{B}_{y2} = \frac{\mu_0 I_1}{2\pi d_{1y}} \vec{j} + \frac{\mu_0 I_2}{2\pi d_{2y}} (-\vec{j}) = \frac{\mu_0 I}{2\pi \cdot \frac{3d}{2}} \vec{j} + \frac{\mu_0 \cdot 2I}{2\pi \frac{d}{2}} (-\vec{j})$

$\vec{B}_y = \frac{\mu_0 I}{\pi d} \left(\frac{1}{3} - 2\right) \vec{j} = -\frac{5}{3} \frac{\mu_0 I}{\pi d} \vec{j} = \ldots$ ↳ $mT \vec{j}$

АДМ

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

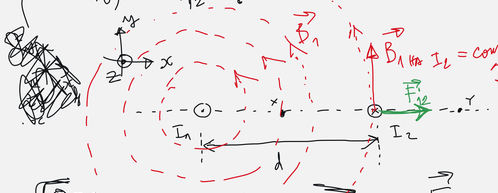
μ – const?

$\vec{H} = \frac{\vec{B}}{\mu} \Rightarrow \vec{H}_x = \frac{\vec{B}_x}{\mu_0} = \frac{3I}{\pi d} \vec{j} = \ldots$ ↳ $\frac{A}{m}$

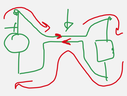
$\mu = \mu_0$ ↳ ваздух/вакуум

$\vec{H}_y = \frac{\vec{B}_y}{\mu_0} = -\frac{5}{3} \frac{I}{\pi d} \vec{j} = \ldots$ ↳ $\frac{A}{m}$

б) $\vec{F}_{12}$ = ?



$\vec{B}_1$ на I_2 = const ако је $I_1 \| I_2$, d = const



EC: $\vec{F} = \vec{k} \cdot Q$ $\{(\vec{k} \ni \cdot Q)\}$

МАГ.: $d\vec{F} = I d\vec{l} \times \vec{B}$ $\{(\vec{B} \ni I d\vec{l})\}$

$\vec{F} = I \vec{l} \times \vec{B}$

хомогено $\vec{B}$, $\vec{B}$ = const

правол. пров $I, \vec{l}$

$\vec{F}_{12} = I_2 \vec{l} \times \vec{B}_{1 на 2} = I_2 l (-\vec{k}) \times \frac{\mu_0 I_1}{2\pi d} \vec{j}$

$\vec{F}_{12} = \frac{\mu_0 I_1 I_2 l}{2\pi d} \vec{i}$

$\vec{F}_{12} = I_2 \vec{l} \times \vec{B}_{1 на 2}$ = const

$\left(\vec{F}'_{12} = \frac{\vec{F}_{12}}{l}\right)$

$\vec{F}'_{12} = \frac{\vec{F}_{12}}{l} = \frac{\mu_0 I_1 I_2}{2\pi d} \vec{i}$ $\left(= \frac{\mu_0 I^2}{\pi d} \vec{i}\right)$

$-\vec{k} \times \vec{j} = -(-\vec{i}) = \vec{i}$

$\vec{i} \times \vec{j} = \vec{k}$

$\vec{j} \times \vec{k} = \vec{i}$

$\vec{k} \times \vec{i} = \vec{j}$

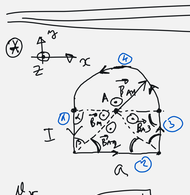
$\vec{k} \times \vec{j} = -\vec{i}$

$|\vec{i} \times \vec{j}| = 1 \cdot 1 \cdot \sin 90° = 1$

$\vec{i} \cdot \vec{j} = |\vec{i}| \cdot |\vec{j}| \cdot \cos 90° = 0$

$\vec{F}'_{12} = \frac{4\pi \cdot 10^{-7} \cdot 10 \cdot 20}{2 \cdot \pi \cdot 10^{-2}} \frac{N}{m} \vec{i} = 4 \cdot 10^{-3} \frac{N}{m} \vec{i}$

$= 4 \ mN/m \ \vec{i}$



$\frac{1}{2} \times \square_a + \frac{1}{2} \times \odot_{r = \frac{a}{2}}$

$a = 10 cm$, $I = 2A$, $\mu_r = 1000$, $\vec{B}_A = ?$

μ_r $\mu = \mu_r \mu_0$!

$\vec{B}_A = \vec{B}_{A1} + \vec{B}_{A2} + \vec{B}_{A3} + \vec{B}_{A4}$

$\vec{B}_{A1} = \frac{\mu_r \mu_0 I}{4\pi} \left(\cos\frac{\pi}{2} + \cos\frac{\pi}{4}\right) \vec{k} = \frac{\mu_r \mu_0 I \cdot \sqrt{2}}{4\pi a} \vec{k}$

$\vec{B}_{A2} = \frac{\mu_r \mu_0 I}{4\pi \, a/2} \left(\cos\frac{\pi}{4} + \cos\frac{\pi}{4}\right) \vec{k} = \frac{\mu_r \mu_0 I \sqrt{2}}{2\pi a} \vec{k}$

$\vec{B}_{A3} = \ldots = \vec{B}_{A1}$

$\vec{B}_{A4} = \frac{1}{2} \cdot \frac{\mu_r \mu_0}{2 \cdot a/2} \vec{k} = \frac{\mu_r \mu_0 I}{2a} \vec{k}$

$+$

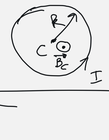
$\vec{B}_A = \ldots = \frac{\mu_r \mu_0 I \sqrt{2}}{\pi a} \vec{k} + \frac{\mu_r \mu_0 I}{2a} \vec{k} = \frac{\mu_r \mu_0 I}{a} \left(\frac{\sqrt{2}}{\pi} + \frac{1}{2}\right) \vec{k}$

$\vec{B}_{A1,2,3}$, ∪ $\quad$ $\vec{B}_{A4}$, ∩ $\quad$ ∪ < ∩

$= \ldots$ — $T \vec{k}$

ПРЕТПОСТАВКА (ПОНОВИТИ)

$\vec{B}_A = \frac{\mu \cdot I}{4\pi d_x} (\cos\alpha + \cos\beta)$



$\vec{B}_C = \frac{\mu \cdot I}{2 \cdot R}$