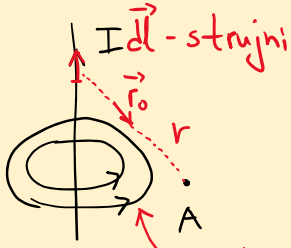
RN 01 – Predavanje 02 – 24.02.2021.

Studijski program: Energetika, elektronika i telekomunikacije (E1)

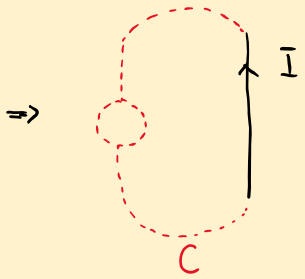
24.02.2021. godine

ELEKTROMAGNETIZAM

$I\vec{dl}$ - strujni element $\Rightarrow$ $d\vec{B}_A = \frac{\mu_0}{4\pi}\frac{I\vec{dl}\times\vec{r}_0}{r^2}$

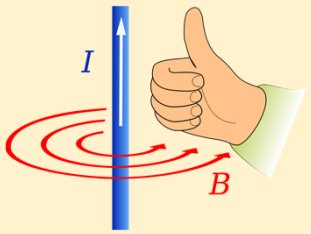


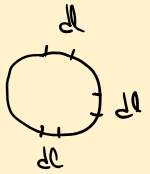
linije mag. polja su ZATVORENE krive

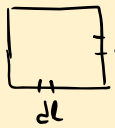


$\vec{B}_A^{uk} = \oint_C d\vec{B}_A = \frac{\mu_0}{4\pi}\oint_C \frac{I\vec{dl}\times\vec{r}_0}{r^2}$

- podintegralna funkcija je vektorska veličina !!!

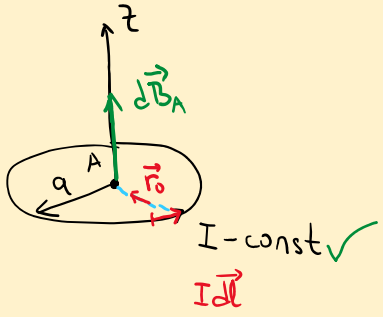


$\oint_C dl \Rightarrow$  $= 2\pi a$

$\oint_{\square} dl \Rightarrow$  $\Rightarrow 4a$

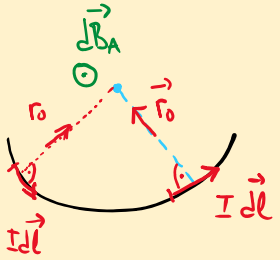
$\vec{B}_A$ - ? $\quad d\vec{B}_A = \frac{\mu_0}{4\pi}\frac{I\vec{dl}\times\vec{r}_0}{r^2} \Rightarrow dB_A = \frac{\mu_0}{4\pi}\frac{Idl\cdot 1\cdot \sin\sphericalangle(I\vec{dl},\vec{r}_0)}{r^2} = \frac{\mu_0}{4\pi}\frac{Idl\cdot 1\cdot \sin\frac{\pi}{2}}{a^2}$

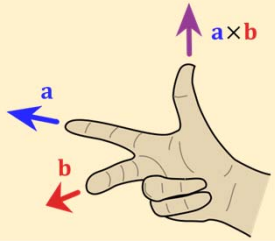
$dB_A = \frac{\mu_0}{4\pi}\frac{I\,dl}{a^2}$



I - const ✓

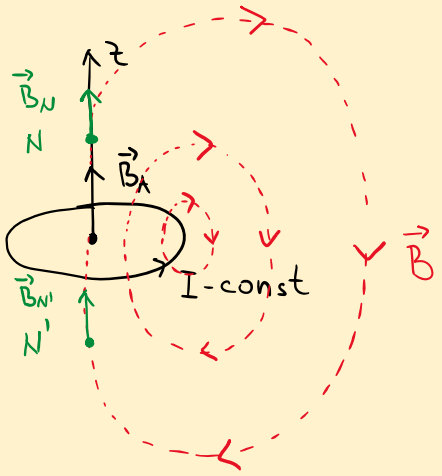
$I\vec{dl}$





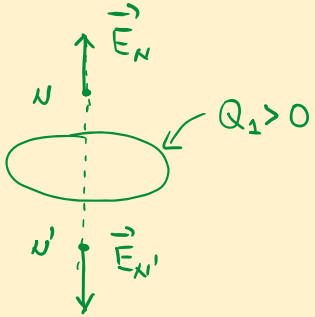
$\Rightarrow B_A^{uk} = \oint_C dB_A = \frac{\mu_0}{4\pi}\oint_C \frac{I\,dl}{a^2} = \frac{\mu_0}{4\pi}\frac{I}{a^2}\oint_C dl$

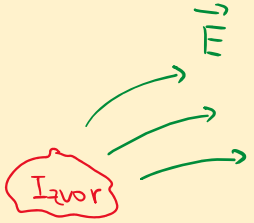
$= \frac{\mu_0}{4\pi}\frac{I}{a^2}2\pi a \Rightarrow \vec{B}_A^{uk} = \frac{\mu_0}{2}\frac{I}{a}(+\vec{i}_z)$

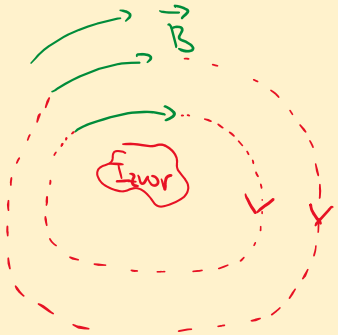


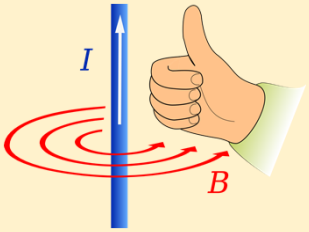
$B_N \equiv B_{N'}$

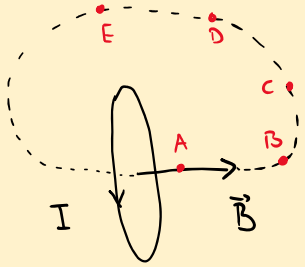
$d_N \equiv d_{N'}$





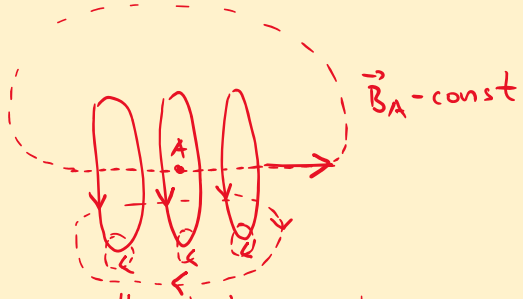






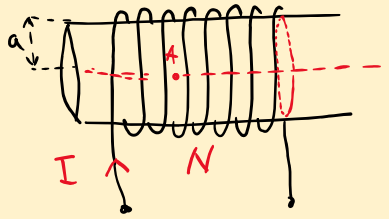
$B_A > B_B > B_C > B_D \Rightarrow B = f(r) \neq \text{const.}$ – nehomogen.

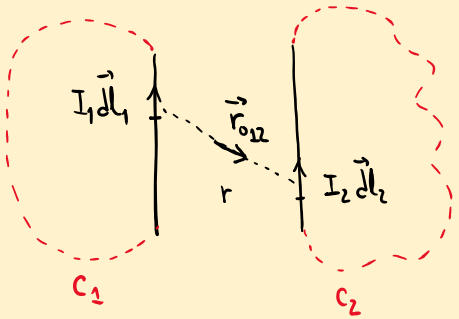
$\vec{B}$-const – homogeneno mag. polje



Helmholcovi kalemovi

$\Rightarrow$





$$d\vec{F}_{m12} = \frac{\mu_0}{4\pi} \frac{I_2 d\vec{l}_2 \times (I_1 d\vec{l}_1 \times \vec{r}_{12})}{r^2} = I_2 d\vec{l}_2 \times \left[\frac{\mu_0}{4\pi} \frac{I_1 d\vec{l}_1 \times \vec{r}_{12}}{r^2} \right]$$

$$\Rightarrow d\vec{F}_{m12} = I_2 d\vec{l}_2 \times d\vec{B}_1$$

$$\Rightarrow \vec{F}_{m12}^{uk} = \oint_{C_2} \left[I_2 d\vec{l}_2 \times \oint_{C_1} d\vec{B}_1 \right] = \oint_{C_2} \oint_{C_1} (I_2 d\vec{l}_2 \times d\vec{B}_1)$$

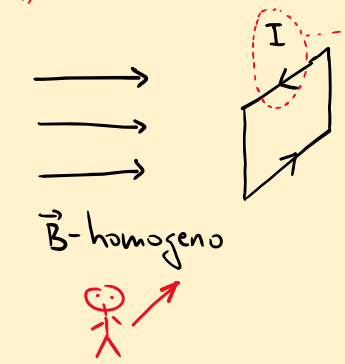
Q_1 Q_2 $\quad F_e = \frac{1}{4\pi\varepsilon_0} \frac{Q_1 Q_2}{r^2}$

I_1 I_2 $\quad F_m = \frac{\mu_0}{4\pi} \frac{I_1 I_2}{r^2}$

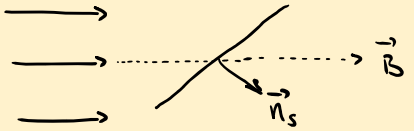
$F_m >>> F_e$

---

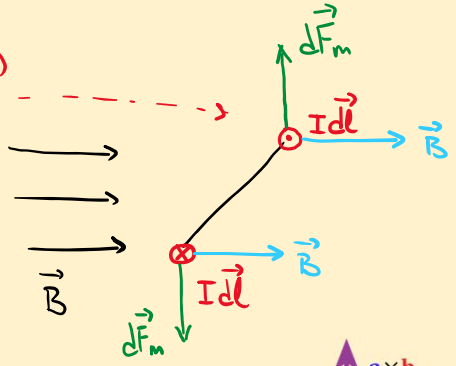
a)

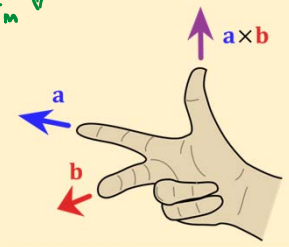


b)

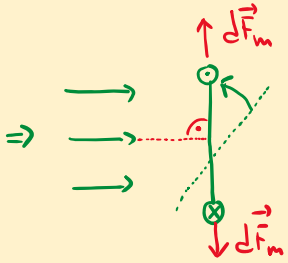


c)



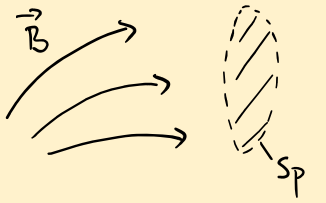


d)



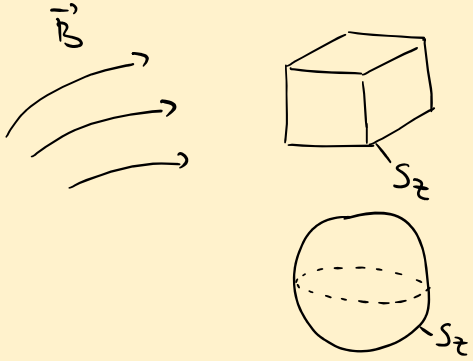
mag. sile postavljaju konturu tako da je ona $\perp$ na $\vec{B}$!

FLUKS VEKTORA MAG. INDUKCIJE

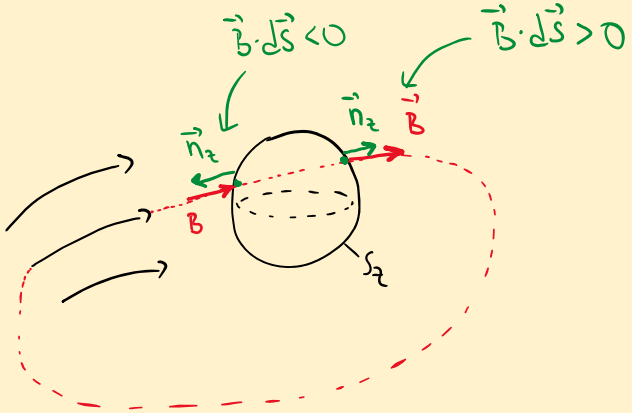


$$\Phi_m = \int_{S_p} \vec{B}\cdot d\vec{S} \quad \begin{matrix} =0 \\ \neq 0 \end{matrix}$$

$\Rightarrow$



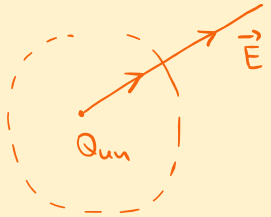
$$\oint_{S_z} \vec{B}\cdot d\vec{S} = 0$$

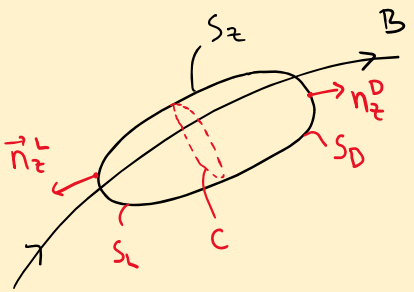


$$\oint_{S_z} \vec{B}\cdot d\vec{S} = 0$$ zakon održanja mag. fluksa

$$\oint_{S_z} \vec{J}\cdot d\vec{S} = 0$$

$$\oint_{S_z} \vec{E}\cdot d\vec{S} = \frac{Q_{un}\, S_z}{\varepsilon_0}$$





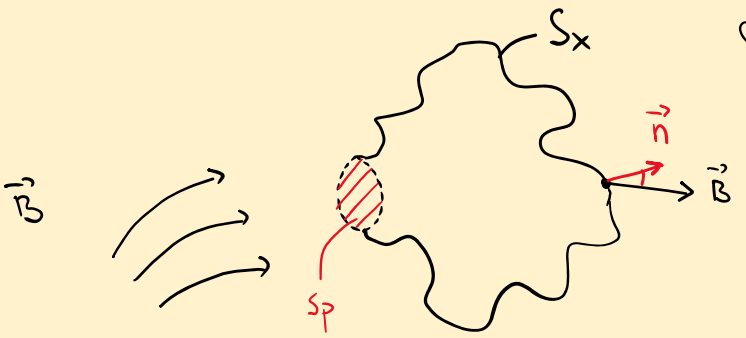
Φ_{mL} Φ_{mD}

$\sphericalangle(\vec{n}_z^L, \vec{B}) \approx \pi$ $\sphericalangle(\vec{n}_z^D, \vec{B}) \approx 0$

$$\oint_{S_z} \vec{B}\cdot d\vec{S} = 0 = \int_{S_L} \vec{B}\cdot d\vec{S} + \int_{S_D} \vec{B}\cdot d\vec{S} = -|\Phi_{mL}| + |\Phi_{mD}|$$

$$\Rightarrow |\Phi_{mL}| \equiv |\Phi_{mD}|$$

$\Downarrow$



$$\Phi_{mx} = \int_{S_x} \vec{B}\cdot d\vec{S}$$

$S_p + S_x = S_z$

$\Rightarrow \Phi_{mx} = \Phi_{mp}$

- sami možemo kontrolisati dodavanje S_p kako bi se lako izračunao Φ_{mx}