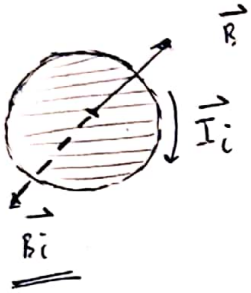
(1) * ZBOG TERMALNE EKSPANZIJE, POPREČNI PRESJEK KONDENZATORA SE POVEĆAO → MAGNETSKI FLUX SE POVEĆAO JER $\Phi_B \sim S$

* BUDUĆI SE Φ_B POVEĆAO, POVEĆAO SE I $|\vec{B}|$ JER $\Phi_B \sim B$ (ORGINALNI)

* ZBOG PROMJENE MAG. FLUXA, INDUCIRA NA JE STRUJA I_i, ONA IMA SMJER KAZALJKE NA SATU, PREMA TOME $\vec{B}_i$ IMA SMJER U PAPIR ($\otimes$) JER

↳ PRAVILO DESNOG VIJKA: SMJER STRUJE SU SVINUTI PRSTI, A SMJER MAG. POLJA JE PALAC



* AKO "ORGINALNI" $\vec{B}$ IMA SMJER U PAPIR, ONDA INDUCIRANI $\vec{B}_i$ IMA SUPROTAN SMJER ⇒ IZ PAPIRA!

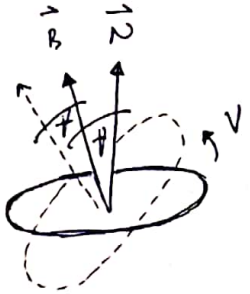
(2) $d = 10\ cm \Rightarrow r = 5\ cm$

$B = 0{,}5\ T$

$\varphi = 30°$

$\nu = 100\ \frac{okr}{min}$

$\mathcal{E} = ?$



Φ_B SE NE MIJENJA ZBOG ROTACIJE PETLJE: JEDNAKI "BROJ SILNICA" PROLAZI KROZ PETLJU BILO KAKO JU ZAROTIRAMO AKO SE φ NE MIJENJA.

PREMA TOME $\vec{E} = 0$ JER NIJE INDUCIRANA EL. STRUJA $\vec{I}_i$

(3) $D = 10\ cm = 0{,}1\ m$

$d = 2{,}5\ mm = 2{,}5 \cdot 10^{-3}\ m$

$\rho = 1{,}69 \cdot 10^{-8}\ \Omega m$

$I_i = 10\ A$

$\frac{dB}{dt} = ?$

$\vec{B} \perp \vec{N}_{PETLJA}$

$R = \rho \frac{L}{S} = \rho \frac{L}{r^2\pi}$ (L: ŽICA, S: ŽICA)

$R = 1{,}69 \cdot 10^{-8} \cdot \frac{\pi \cdot 0{,}10}{\pi \left(\frac{2{,}5 \cdot 10^{-3}}{2}\right)^2}$

$R = 1{,}1 \cdot 10^{-3}\ \Omega$

$I_i = \frac{|\mathcal{E}|}{R} = \frac{\left|\frac{d\Phi_B}{dt}\right|}{R} = \frac{\left|\frac{S \cdot dB}{dt}\right|}{R}$ (S: PETLJA)

$I_i = \frac{\left|\frac{r^2\pi \, dB}{dt}\right|}{R}$ (r²π: PETLJE)

$\Rightarrow \left|\frac{dB}{dt}\right| = \frac{I_i R}{\pi r^2}$

$= \boxed{1{,}4\ T/s}$

PODSJEĆANJE:

$R = \rho \frac{L}{S}$

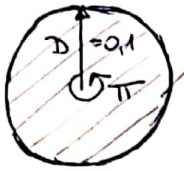
ρ = OTPORNOST

L = DULJINA ŽICE

S = POVRŠINA POP. PRESJEKA ŽICE

S ŽICE $= r^2\pi$ ↓ $\frac{2{,}5\cdot10^{-3}}{2}$

* AKO JE KRUŽNA PETLJA PROMJERA 0,1 m:



S PETLJE

ONDA JE DULJINA ŽICE $L = 0{,}1\cdot\pi$ TOLIKA KOLIKO JE POTREBNO DA ↑ (NA SLICI) OPIŠE JEDAN KRUG!

$\frac{0{,}1}{2}$ ↑

* $\mathcal{E} = \left|\frac{d\Phi}{dt}\right|$ TOK / VRIJEME , $\Phi = B\cdot S = B\cdot r^2\pi$ ↓ POVRŠINA PETLJE, ONA JE KONSTANTA PA $\frac{d}{dt}$ NE UTJEČE NA TU VARIJABLU

④ $R_1 = 0{,}2$ m $\quad B_1 = 50\cdot10^{-3}$ T U PAPIR (−) $\quad \frac{dB_1}{dt} = \frac{dB_2}{dt} = 8{,}5\cdot10^{-3}$ T/s

$R_2 = 0{,}3$ m $\quad B_2 = 75\cdot10^{-3}$ T IZ PAPIRA (+)

a) $\int_1 \vec{E}\,d\vec{s} = -\frac{d\Phi_{B1}}{dt} = \frac{d}{dt}(B_1\cdot S_1) = S_1\frac{dB_1}{dt} = R_1^2\pi\cdot\frac{dB_1}{dt} = -1{,}07\cdot10^{-3}$ V

DEFINICIJA

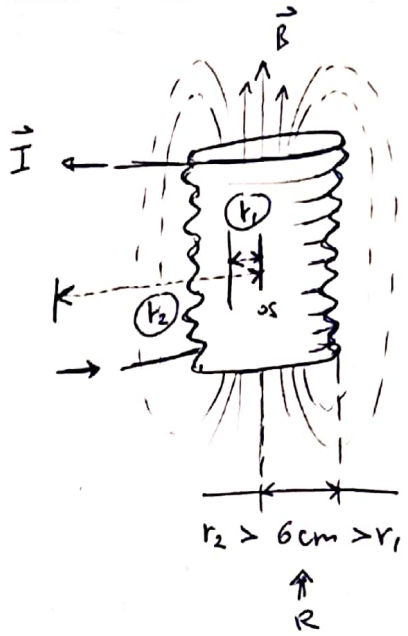
b) $\int_2 \vec{E}\,d\vec{s} = -\frac{d\Phi_{B1}}{dt} = S_2\frac{dB_1}{dt} = R_2^2\pi\frac{dB_2}{dt} = -2{,}4\cdot10^{-3}$ V

c) $\int_S \vec{E}\,d\vec{s} = \int_1 \vec{E}\,d\vec{s} - \int_2 \vec{E}\,d\vec{s} = -1{,}07\cdot10^{-3} - (-2{,}4\cdot10^{-3}) = 1{,}33\cdot10^{-3}$ V

(5) $D = 12\ cm \Rightarrow 6\ cm = R$, $r_1 = 2{,}2\ cm$

$B = 30\ mT$ $r_2 = 8{,}2\ cm$

$\frac{dB}{dt} = 6{,}5\ \frac{mT}{s}$



$E = ?$

UNUTAR ZAVOJNICE

$E_u = \frac{1}{2}\frac{dB}{dt} r_1 = 7{,}15 \cdot 10^{-5}\ V/m$

IZVAN ZAVOJNICE

$E_I = \frac{1}{2}\frac{dB}{dt}\frac{R^2}{r_2} = 1{,}43 \cdot 10^{-4}\ V/m$

(6) $r = 50\ mm = 50 \cdot 10^{-3}\ m$

$I = 10\ A$

B, $\mu_B = ?$

MAGNETSKA INDUKCIJA U SREDIŠTU PETLJE $B = \frac{\mu_0 I}{2r} = 1{,}3 \cdot 10^{-3}\ T$

GUSTOĆA ENERGIJE NEPOSREDNO U BLIZINI SREDIŠTA PETLJE $\mu_B = \frac{B^2}{2\mu_0} = 0{,}63\ \frac{J}{m^3}$

(7)

LJUBIČASTI GRAF ⇒ ŽICA

PLAVI GRAF ⇒ KONDENZATOR

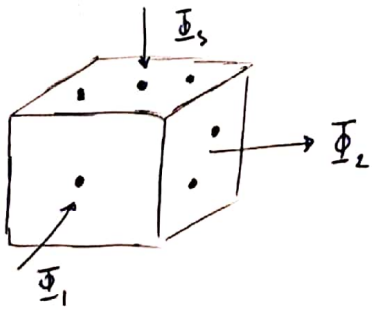
1 – TOČKA a

2 – TOČKA b

3 – TOČKA c i d

(8) $\Phi_0 = \pm N\ Wb$, $N = 1 \ldots 5$ $\Phi_B(N=6) = ?$ ZNAMO DA MORA BITI + !

ZNAMO DA JE $\sum \Phi_B = 0$!



$\Phi_6 = -\sum_{i=1}^{5} \Phi_B(n) = -(-1+2-3+4-5) = +3\ Wb$

(9) $B = 6 \cdot 10^{-7}\ T$ $\quad \mu_0 = 4\pi \cdot 10^{-7}\ \frac{Tm}{A}$

$R = 3\ mm = 3 \cdot 10^{-3}\ m$ $\quad \varepsilon_0 = 8{,}85 \cdot 10^{-12}\ \frac{C^2}{Nm^2}$

$r = 6\ mm = 6 \cdot 10^{-3}\ m$

$\frac{dE}{dt} = ?$

IZMEĐU PLOČA NEMA NABOJA, ALI SE EL. POLJE MIJENJA, VRIJEDI $\vec{B} \perp d\vec{s}$

$$\oint_S B\,dS = \mu_0 \varepsilon_0 \frac{d\Phi_E}{dt} = B \cdot S_{PLOHA}$$

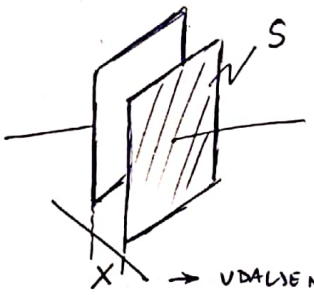
$$B \cdot 2r\pi = \mu_0 \varepsilon_0 \frac{d(E \cdot S)}{dt} = \mu_0 \varepsilon_0 S \frac{dE}{dt}$$

$$\Rightarrow \frac{dE}{dt} = \frac{B \cdot 2r\pi}{\mu_0 \varepsilon_0 R^2 \pi} = \frac{2Br}{\mu_0 \varepsilon_0 R^2} = 2{,}4 \cdot 10^{13}\ \frac{V}{ms}$$

(10) $C = 2 \cdot 10^{-6}\ F$

$I_d = 1{,}5\ A$

$\frac{dV}{dt} = ?$



KAPACITET PLOČASTOG KONDENZATORA $\quad C = \varepsilon \frac{S}{x}$

EL. POLJE IZMEĐU PLOČA $\quad E = \frac{q}{\varepsilon_0 S} = \frac{CV}{\varepsilon_0 S}$ (1)

$$I_d = \varepsilon_0 \frac{d\Phi_E}{dt} = \varepsilon_0 \frac{d}{dt}(E \cdot S) \quad (2)$$

(1) → (2)

$$I_d = \varepsilon_0 \frac{d}{dt}\left(\frac{CV}{\varepsilon_0 S} S\right) = C \frac{dV}{dt} \Rightarrow \frac{dV}{dt} = \frac{I_d}{C}$$

$$\frac{dV}{dt} = 7{,}5 \cdot 10^5\ \frac{V}{s}$$

(11) POKAZATI

$$j_d = \varepsilon_0 \frac{dE}{dt} \quad \text{za} \quad r \leq R$$

MAXWELLOVA JEDNADŽBA:

$$I_d = \varepsilon_0 \frac{d\Phi_E}{dt} = \varepsilon_0 \frac{d(E \cdot S)}{dt} = \varepsilon_0 \cdot S \frac{dE}{dt} \quad (1)$$

DEFINICIJA GUSTOĆE STRUJE

$$j_d = \frac{I_d}{S} \quad (2)$$

(2) → (1)

$$j_d = \frac{\varepsilon_0 S}{S} \cdot \frac{dE}{dt} = \varepsilon_0 \frac{dE}{dt} \quad //$$

(12)

$$I_d = \varepsilon_0 \frac{d\Phi_E}{dt} = \varepsilon_0 \frac{d(E \cdot S)}{dt} = \varepsilon_0 S \frac{dE}{dt}$$

$E = \frac{V}{d}$, GDJE JE d UDALJENOST IZMEĐU PLOČA

$$\Rightarrow I_d = \varepsilon_0 \cdot S \left(\frac{d \frac{V}{d}}{dt} \right) = \boxed{\frac{\varepsilon_0 S}{d}} \left(\frac{dV}{dt} \right) = C \frac{dV}{dt} \quad //$$

KAPACITET PLOČASTOG KONDENZATORA