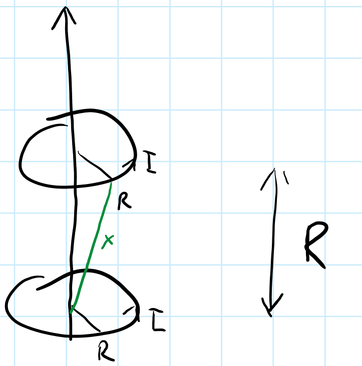
Ćwiczenia 9

wtorek, 4 grudnia 2018 11:00

Kolokwia: 22.01 / 29.01

(maszyny: 14)

1

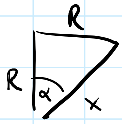


$x = \sqrt{2}R$

$dH_{12} = ?$

$z \in -4, +4$

$$dH = \frac{I}{4\pi}\frac{d\vec{l} \times \vec{x}}{r^3} = \frac{I}{4\pi}\frac{dl \sin\alpha}{x^3} = \frac{I}{4\pi}$$



$\sin\alpha = \frac{R}{x}$

$$H_{1.2} = \int_0^{2\pi R} \frac{I}{4\pi}\frac{dl R}{x^4} = \frac{IR}{4\pi x^4}\int_0^{2\pi R} dl = \frac{IR^2}{2x^4} = \text{błąd}$$

$\vec{dl} = (-R \sin d\alpha, R \cos d\alpha, 0)$

$\vec{r} = (R\cos\alpha, R\sin\alpha, -z)$

$\vec{dl} \times \vec{r} = (-zR\cos\alpha\, d\alpha, -zR\sin\alpha\, d\alpha, R^2 d\alpha)$

$H_x = 0 \quad H_y = 0 \quad H_z$

$x = \sqrt{z^2 + R^2}$

$$dH_{12} = \frac{I}{4\pi}\frac{\vec{dl} \times \vec{X}}{x^3} = \frac{I}{4\pi}\frac{R^2 d\alpha}{\sqrt{z^2+R^2}^3}$$

$$H_{12} = \int_0^{2\pi} \frac{I}{4\pi}\frac{R^2 d\alpha}{\sqrt{z^2+R^2}^3} = \frac{IR^2}{4\pi\sqrt{z^2+R^2}^3}\int_0^{2\pi} d\alpha = \frac{IR^2}{2\sqrt{R^2+z^2}^3}$$

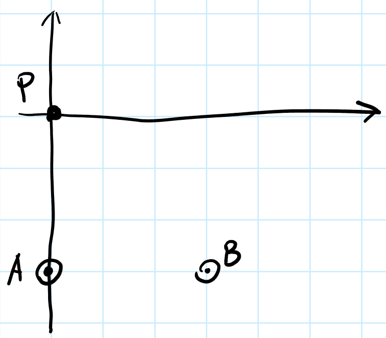
$$H_{1.2}(0) = \frac{IR^2}{2\sqrt{0+R^2}^3} = \frac{IR^2}{2R^3} = \frac{I}{2R}$$

$H_{.}(R) = \frac{IR^2}{\ldots} = \frac{IR^2}{\ldots} = \frac{I}{\ldots}$

$$H_{2,1}(R) = \frac{IR^2}{2\sqrt{R^2+R^2}^3} = \frac{IR^2}{4\sqrt{2}R^3} = \frac{I}{4\sqrt{2}R}$$

$$H = H_{12} + H_{21} = \frac{I}{2R} + \frac{I}{4\sqrt{2}R}$$

(2)



$$B = \frac{3\mu}{2\pi\rho}$$

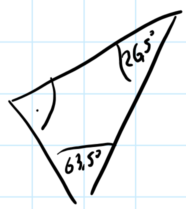
$$B_A = \frac{2kA\,\mu}{2\pi 0{,}3} = \frac{1000\mu}{0{,}3\pi}$$

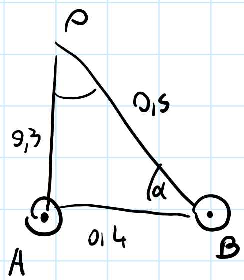
$$B_B = \frac{2kA\,\mu}{2\pi\,0{,}5} = \frac{1000\mu}{0{,}5\pi}$$

$F = Q \times \vec{v}$ $\quad I = 2kA \quad \overrightarrow{AB} = 40cm \quad \overrightarrow{AP} = 30cm$

$$\vec{B} = \vec{B}_A + \vec{B}_B$$

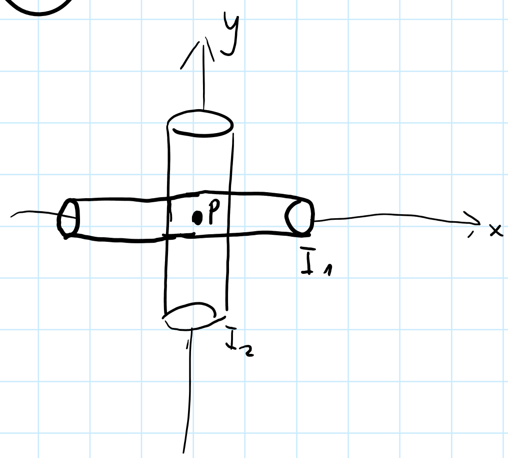
$$H = \frac{I}{2\pi\rho}$$





Odp: $H = \sqrt{(H_A + H_B \sin 37^\circ)^2 + (H_B \cos 37)^2}$

(3) $R_1 = 30cm$ $R_2 = 40cm$ $I_1 = N\,A$ $I_2 = I\,A$



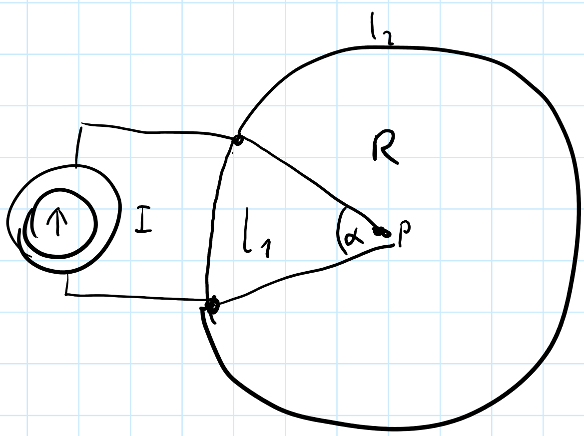
$B \to$ wartość, kierunek

$$H_1 = \frac{I_1}{4\pi R_1^2} \oint dl = \frac{I_1}{4\pi R_1^2} \cdot 2\pi R = \frac{I_1}{2R_1}$$

$$H_2 = \frac{I_2}{4\pi R_2^2} \oint dl = \frac{I_2}{4\pi R_2^2} \cdot 2\pi R = \frac{I_2}{2R_2}$$

$$B = \mu H = \mu |H_1 + H_2| = \sqrt{\frac{\mu^2 I_1^2}{4R_1^2} + \frac{\mu^2 I_2^2}{4R_2^2}}$$

(4)



$H_p = ?$ I, α

$$B = \frac{\mu I l}{4\pi r^2}$$

$$l = 2\pi r$$

$$l_1 = \frac{\alpha}{2\pi} \cdot 2\pi r = \alpha r$$

$$l_2 = \frac{2\pi - \alpha}{2\pi} 2\pi r = 2\pi r - \alpha r$$

$$B_1 = \frac{\mu I_1 \alpha}{4\pi r}$$

$$H_1 = \frac{I_1 \alpha}{4\pi r}$$

$$I = I_1 + I_2 \qquad I_1 = I \frac{R_1}{R_1 + R_2} \qquad R = \frac{\rho l}{S}$$

$$I_1 = I \frac{R_2}{R_1 + R_2} = I \frac{\frac{\rho l_2}{S}}{\frac{\rho l_1}{S} + \frac{\rho l_2}{S}} = I \frac{\frac{\rho l_2}{S}}{\frac{\rho l_1 + \rho l_2}{S}} = I \frac{\rho l_2}{\rho l_1 + \rho l_2} = I \frac{l_2}{l_1 + l_2}$$

$$I_1 = I\frac{R_2}{R_1+R_2} = I\frac{\frac{\rho l_2}{S}}{\frac{\rho l_1}{S}+\frac{\rho l_2}{S}} = I\frac{\frac{\rho l_2}{\cancel{S}}}{\frac{\rho l_1+\rho l_2}{\cancel{S}}} = I\frac{\rho l_2}{\rho l_1+\rho l_2} = I\frac{l_2}{l_1+l_2}$$

$$I_1 = I\frac{2\pi r-\alpha r}{2\pi r} = I\frac{2\pi-\alpha}{2\pi}$$

$$I_2 = I\frac{\alpha}{2\pi}$$

$$H_1 = \frac{I_1\alpha}{4\pi r} = \frac{\left(\frac{I(2\pi-\alpha)}{2\pi}\right)\alpha}{4\pi r}$$

$$H_2 = \frac{I_2\alpha}{4\pi r} = \frac{\left(\frac{I\alpha}{2\pi}\right)\alpha}{4\pi r^2}(2\pi r-\alpha r)$$

wynik

$$H = H_1 - H_2 = \frac{\frac{I(2\pi\alpha-\alpha^2)}{2\pi}}{4\pi r} - \frac{\frac{I\alpha^2}{2\pi}}{4\pi r^2}(2\pi r-\alpha r) = 0$$

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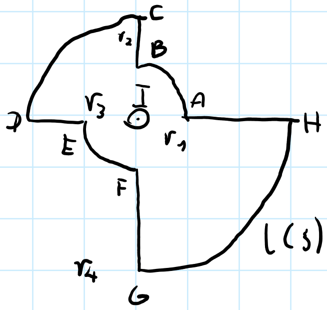
I, $\alpha = \frac{\pi}{3}$



$$H_{AB} = \int_0^{\frac{\pi}{2}}\frac{I}{2\pi r_1}r_1\,d\alpha = \frac{I}{2\pi}\int_0^{\frac{\pi}{2}}d\alpha = \frac{I}{2\pi}\left(\frac{\pi}{2}\right) = \frac{I}{4}$$

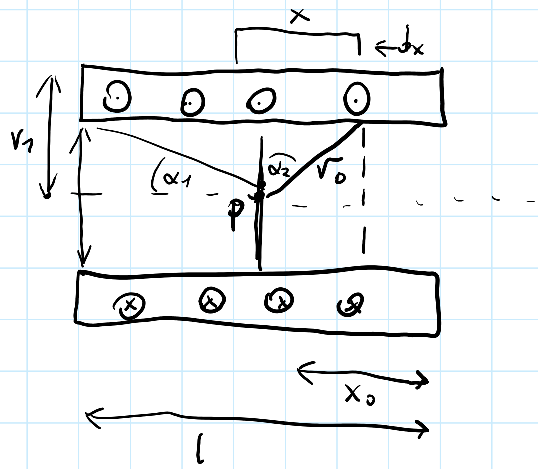
$$H_{CD} = \int_{\frac{\pi}{2}}^{\pi}\frac{I}{2\pi r_2}r_2\,d\alpha = \frac{I}{4}$$

$$H_{EF}\int_{\pi}^{\frac{3}{2}\pi}\frac{I}{2\pi r_3}r_3\,d\alpha = \frac{I}{4}$$

$$I = 4H = I$$

$$H_{GH}\int_{\frac{3}{2}\pi}^{2\pi}\frac{I}{2\pi r_4}r_4\,d\alpha = \frac{I}{4}$$

6



$$H = \frac{nIr_1^2}{2l}\int_{l-x_0}^{x_0} \frac{dx}{(r_1^2 + x_2^2)^{\frac{3}{2}}} = \frac{nI}{2l}\left(\frac{x_0}{\sqrt{r_1^2 + x_0^2}} + \frac{l-x_0}{\sqrt{r_1^2 + (l-x_0)^2}}\right)$$

$$H = \frac{nI}{2l}(\cos\alpha_1 - \cos\alpha_2)$$

Toroid odp: $H = 2\pi\rho = nI$

$$H = \frac{nI}{2\pi\rho}$$