Aprēķini

3.) Aprēķināt B_0 pie katra strāvas stipruma ņemot vidējo leņķi.

$$\boxed{B_0 = \frac{\mu_0 n I}{2R \operatorname{tg} \varphi}}$$

1) $B_0 = \frac{12,57 \cdot 10^{-7} \cdot 3 \cdot 1}{2 \cdot 0,18 \cdot \operatorname{tg} \frac{33^\circ + 32^\circ}{2}} \approx 1,6442 \cdot 10^{-5}$ T

2*) $B_0 = \frac{12,57 \cdot 10^{-7} \cdot 3 \cdot 2}{2 \cdot 0,18 \cdot \operatorname{tg} \frac{51^\circ + 42^\circ}{2}} \approx 1,9881 \cdot 10^{-5}$ T

3) $B_0 = \frac{12,57 \cdot 10^{-7} \cdot 3 \cdot 3}{2 \cdot 0,18 \cdot \operatorname{tg} \frac{62^\circ + 64^\circ}{2}} \approx 1,6019 \cdot 10^{-5}$ T

4) $B_0 = \frac{12,57 \cdot 10^{-7} \cdot 3 \cdot 4}{2 \cdot 0,18 \cdot \operatorname{tg} \frac{68^\circ + 70^\circ}{2}} \approx 1,6084 \cdot 10^{-5}$ T

5) $B_0 = \frac{12,57 \cdot 10^{-7} \cdot 3 \cdot 5}{2 \cdot 0,18 \cdot \operatorname{tg} \frac{72^\circ + 76^\circ}{2}} \approx 1,5018 \cdot 10^{-5}$ T

4.) Kļūdu aprēķini

φ, R un I ir tiešo mērījumu kļūdas.
B_0 ir netiešo mērījumu kļūdas

$$\overline{\varphi} = \frac{1}{5}\left(\frac{32+33}{2} + \frac{51+42}{2} + \frac{62+64}{2} + \frac{68+70}{2} + \frac{72+76}{2}\right) =$$
$$= \frac{1}{5}(32,5 + 46,5 + 63 + 69 + 74) = 57^\circ$$
$$S_\varphi = \sqrt{\frac{(57-32,5)^2 + (57-46,5)^2 + (57-63)^2 + (57-69)^2 + (57-74)^2}{5 \cdot 4}} \approx 7,6795$$
$$\Delta\varphi_\text{s} = \frac{1}{3} \cdot 1,96 \approx 0,6533$$
$$\Delta\varphi_\text{g} = S_a \cdot t_\beta(5) = 7,6795 \cdot 2,78 = 21,349$$
$$\Delta\varphi = \sqrt{(\Delta a_\text{s})^2 + (\Delta a_\text{g})^2} = \sqrt{0,6533^2 + 21,349^2} \approx 21,359$$
$$\varepsilon_\varphi = 21,359 : 57 \approx 37,47\%$$
$$\boxed{\varphi = (57 \pm 21,359)^\circ \text{ pie } \beta = 0,95 \text{ un } \varepsilon_\varphi = 37,47\%}$$

$$\Delta R = \sqrt{(\Delta R_\text{s})^2} = \frac{\delta_n}{3} \cdot 1,96 = \frac{0,005}{3} \cdot 1,96 \approx 0,0033$$
$$\varepsilon_R = \frac{\Delta R}{R} = \frac{0,0033}{0,18} = 1,83\%$$
$$\boxed{R = (0,18 \pm 0,0033) \text{ m pie } \beta = 0,95 \text{ un } \varepsilon_\varphi = 1,83\%}$$

$\overline{I} = 3$

$S_I = \sqrt{\dfrac{(5-3)^2 + (4-3)^2 + (3-3)^2 + (2-3)^2 + (1-3)^2}{5 \cdot 4}} =$

$= \sqrt{\dfrac{1}{2}} \approx 0,7071$

$\Delta I_{\text{s}} = \dfrac{0,075}{3} \cdot 1,96 \approx 0,049$

$\Delta I_{\text{g}} = S_I \cdot t_\beta(5) = 0,7071 \cdot 2,78 \approx 1,9657$

$\Delta I = \sqrt{(\Delta I_{\text{s}})^2 + (\Delta I_{\text{g}})^2} \approx 1,9663$

$\varepsilon_I = \dfrac{\Delta I}{\overline{I}} = \dfrac{1,9663}{3} = 65,54\%$

$\boxed{I = (3 \pm 1,9663) \text{ A pie } \beta = 0,95 \text{ un } \varepsilon_\varphi = 65,54\%}$

$\overline{B_0} = \dfrac{\mu_0 n \overline{I}}{2R \operatorname{tg} \overline{\varphi}} = \dfrac{12,57 \cdot 10^{-7} \cdot 3 \cdot 3}{2 \cdot 0,18 \cdot \operatorname{tg} 57^\circ} \approx 2,0408 \cdot 10^{-5} \text{ T}$

$\Delta B_0^* = \sqrt{\left(\dfrac{\partial B_0}{\partial I} \cdot \Delta I\right)^2 + \left(\dfrac{\partial B_0}{\partial R} \cdot \Delta R\right)^2 + \left(\dfrac{\partial B_0}{\partial \varphi} \cdot \Delta \varphi\right)^2} =$

$= \sqrt{\left(\dfrac{\mu_0 n}{2R \operatorname{tg} \varphi} \cdot \Delta I\right)^2 + \left(\dfrac{-\mu_0 n I}{2R^2 \operatorname{tg} \varphi} \cdot \Delta R\right)^2 + \left(\dfrac{-\mu_0 n I}{2R \sin^2 \varphi} \cdot \Delta \varphi\right)^2} =$

$= \sqrt{\left(\dfrac{12,57 \cdot 10^{-7} \cdot 3}{2 \cdot 0,18 \cdot \operatorname{tg} 46,5^\circ} \cdot 1,9663\right)^2 + \left(\dfrac{-12,57 \cdot 10^{-7} \cdot 3 \cdot 2}{2 \cdot 0,18^2 \cdot \operatorname{tg} 46,5^\circ} \cdot 0,0033\right)^2 +}$

$+ \left(\dfrac{-12,57 \cdot 10^{-7} \cdot 3 \cdot 2}{2 \cdot 0,18 \cdot \sin^2 46,5^\circ} \cdot 21,359\right)^2 \approx 8,5066 \cdot 10^{-4}$

$\varepsilon_{B_0^*} = \dfrac{\Delta B_0}{\overline{B_0}} \approx 4168,26\%$

$\boxed{B_0^* = (1,9881 \cdot 10^{-5} \pm 8,5066 \cdot 10^{-4}) \text{ T pie } \beta = 0,95 \text{ un } \varepsilon_{B_0^*} = 4168,26\%}$

5.) Secinājumi