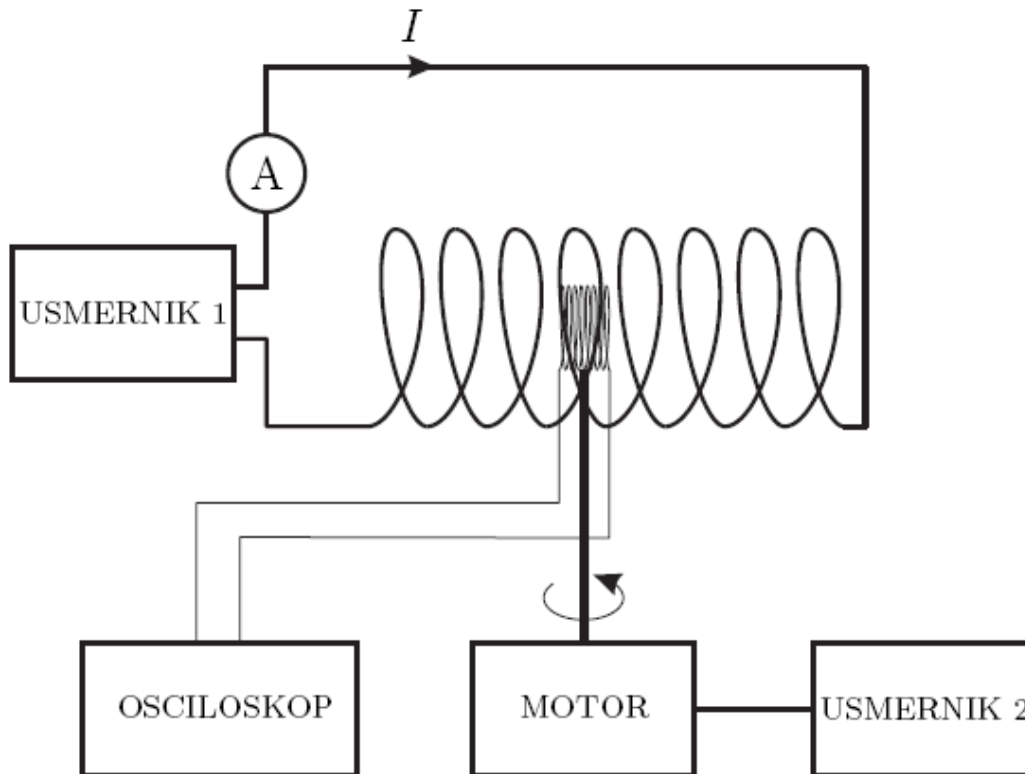


Vaja 5: Magnetna indukcija

Skica poskusa:



Uporabljene enačbe:

$$B = \mu_0 \frac{IN_V}{\sqrt{L_V^2 + d_V^2}}$$

Če $L_V \gg d_V$

$$B = \mu_0 \frac{IN_V}{L_V}$$

$$U_i = \omega N_m S_m B \sin(\omega t)$$

$$U_0 = \omega N_m S_m B$$

$$\omega = \frac{2\pi}{t_0}$$

Rešitev naloge:

$$L_V = 490\text{mm} = 0,49\text{m}$$

$$d_V = 90\text{mm} = 0,09\text{m}$$

$$N_V = 120$$

$$d_m = 50\text{mm} = 0,05\text{m}$$

$$N_m = 1300$$

$$I = 8\text{A}$$

$$U_0 = 405\text{mV} = 0,405\text{V}$$

$$t_0 = 85\text{ms} = 0,085\text{s}$$

$$U'_0 = 7,5\text{mV} = 0,0075\text{V}$$

$$t'_0 = 85\text{ms} = 0,085\text{s}$$

$$S_m = \pi \left(\frac{d_m}{2} \right)^2 = \pi \left(\frac{0,05\text{m}}{2} \right)^2 = \underline{\underline{0,00196\text{m}^2}}$$

1.

$$B_{\text{točen}} = \mu_0 \frac{IN_V}{\sqrt{L_V^2 + d_V^2}} = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}} \cdot \frac{8\text{A} \cdot 120}{\sqrt{0,2401\text{m}^2 + 0,0081\text{m}^2}} \doteq \underline{\underline{2,42 \cdot 10^{-3}\text{T}}}$$

$$B_{\text{približno}} = \mu_0 \frac{IN_V}{L_V} = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}} \cdot \frac{8\text{A} \cdot 120}{0,49\text{m}} \doteq \underline{\underline{2,46 \cdot 10^{-3}\text{T}}}$$

$$\frac{B_{\text{približno}} - B_{\text{točen}}}{B_{\text{točen}}} \doteq \underline{\underline{0,0165 = 1,65\%}}$$

2.

$$\omega = \frac{2\pi}{t_0} = \frac{2\pi}{0,085\text{s}} = \underline{\underline{73,92\text{s}^{-1}}}$$

$$B_m = \frac{U_0}{\omega N_m S_m} = \frac{0,405\text{V} \cdot \text{s}}{73,92 \cdot 1300 \cdot 0,00196\text{m}^2} \doteq \underline{\underline{2,15 \cdot 10^{-3}\text{T}}}$$

$$\frac{B_m - B_{\text{točno}}}{B_{\text{točno}}} \doteq \underline{\underline{0,1116 = 11,16\%}}$$

Do razlik prihaja zaradi netančnega merjenja dimenzij tuljav in nenatančnega odčitavanja z osciloskopa.

3.

$$\omega = \frac{2\pi}{t'_0} = \frac{2\pi}{0,085s} \doteq \underline{\underline{73,92s^{-1}}}$$

$$B_Z = \frac{U'_0}{\omega N_m S_m} = \frac{0,0075V \cdot s}{73,92 \cdot 1300 \cdot 0,00196m^2} \doteq \underline{\underline{39,82 \cdot 10^{-6}T}}$$

$$B_{Z,literatura} = \underline{\underline{22,06 \cdot 10^{-6}T}}$$

$$\frac{B_Z - B_{Z,literatura}}{B_{Z,literatura}} \doteq \underline{\underline{0,8051 = 80,51\%}}$$

$$r_B = \frac{B_{Z,literatura}}{B_{približen}} \doteq \underline{\underline{0,00897 = 0,897\%}}$$

Napaka zaradi neupoštevanja vodoravne komponente magnetnega polja Zemlje je 0,897%.