

task_ti7loik6aurfewkb_with_calculation

Student Group

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Exercise E3 Magnetic Flux Density

(written test, approx. 6 % of a 120-minute written test, SS2021)

A thin wire is placed for an experiment in the laboratory. A current $I = 100\text{ A}$ with an amplitude of $\hat{I} = 100\text{ A}$ is operated.

Now stand next to it and think about what this value means for you! (3 points, independent)

The figure below shows the top view of the laboratory with the supply line between A and B.

Path B = 0.2 m

$\mu_0 = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}}$, $\mu_r = 1$

The formula for the magnetic field strength can be rearranged:
$$H = \frac{I}{2\pi \cdot r} \quad r = \frac{I}{2\pi \cdot H}$$

Again, the magnetic flux density B is given as: $B = \mu_0 \mu_r H$

Therefore:
$$r = \frac{\mu_0 \mu_r I}{2\pi B} \quad r = \frac{4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}} \cdot 100\text{ A}}{2\pi \cdot 100 \cdot 10^{-6} \text{ T}}$$

a) What is the highest magnetic flux density through the line in your body? (3 points)

Path

The magnetic field strength for a conducting wire is given as:

$$\begin{aligned} H &= \frac{I}{2\pi \cdot r} \end{aligned}$$

The magnetic flux density B is given as: $B = \mu_0 \mu_r H$

Here, the maximum current is $\hat{I} = 100 \text{ ~\rm A}$ and the distance to the cable is $r = \sqrt{(0.1 \text{ ~\rm m})^2 + (0.4 \text{ ~\rm m})^2} = 0.412... \text{ ~\rm m}$.

Therefore:
$$B = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}} \cdot 1 \cdot \frac{100 \text{ ~\rm A}}{2\pi \cdot 0.412... \text{ ~\rm m}}$$

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