

task_ti7loik6aurfewkb_with_calculation

Student Group

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Exercise E2 Magnetic Flux Density (written test, approx. 6 % of a 120-minute written test, SS2021)

A) The electric water is operated for an experiment in the laboratory. A series circuit with a current source of $\hat{I} = 100 \text{ A}$ is operated.

What is the distance to the cable and the cable to the cable? (3 points, independent)

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

Path $B = 0.2 \text{ m}$ in T

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

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

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:

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

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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