

# task\_5efsj705cf97jxga\_with\_calculation

## Student Group

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lorenz force, magnetic field, exam ee2 SS2024

**Exercise E1 Lorentz Force**

**(written test, approx. 8 % of a 120-minute written test, SS2024)**

2. Describe the system for the lift from the task for a homogeneous constant field to find the force  $F$  on a coil. Result: the resulting force repels the coil from the image for a fixed mobile shuttle (see image).

Result

Path

Since the result of the force has to be perpendicular to  $B$ -field and conductor, the force has to point to the left or the right.

For a homogeneous  $B$ -field ("constant magnetic field of the shuttle"), the Lorentz forces cancel each other out.

The Lorentz force can only have a lifting effect in an inhomogeneous field. In this case, the sum of the forces results in a repulsing force, see image. Besides boundary effects, the field gets also inhomogeneous, by the additional field of the coils.

Fixed Floor

- current  $I = 1.6 \text{ A}$
- magnetic field of the shuttle is homogeneous with  $B = 0.5 \text{ T}$

1. Calculate the magnitude of the resulting force on one coil!

Path

The Lorentz force on a conductor the length  $l$  and the current  $I$  in a  $B$ -field is

$$|\vec{F}_L| = I \cdot l \cdot B \cdot \cos(\angle \vec{B}, \vec{l})$$

$$= I \cdot (N \cdot 2\pi r) \cdot B \cdot \cos(\angle \vec{B}, \vec{l})$$

$$= 1.6 \text{ A} \cdot (500 \cdot 2\pi \cdot 40 \cdot 10^{-3} \text{ m}) \cdot 0.5 \text{ T} \cdot \cos 90^\circ$$

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