# task_5efsj705cf97jxga_with_calculation

## Student Group

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lorentz force, magnetic field, exam ee2 SS2024

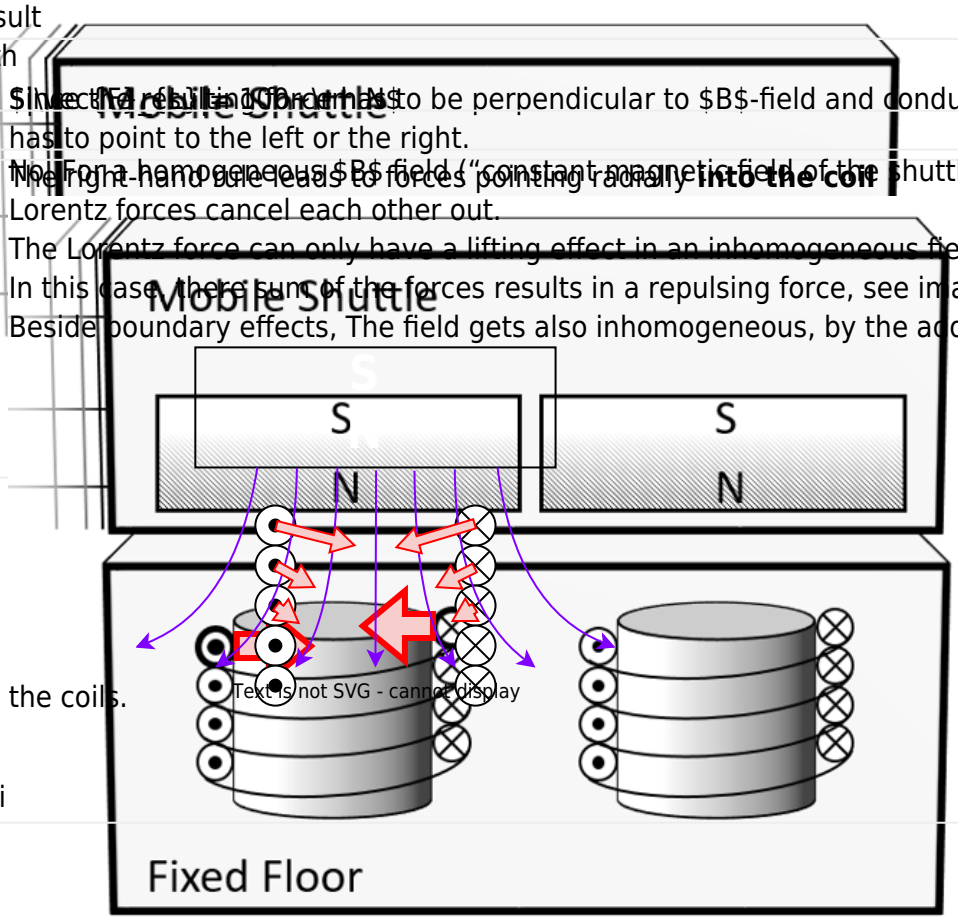
**Exercise E7 Lorentz Force**
**(written test, approx. 8 % of a 120-minute written test, SS2024)**

2. Draw the resulting force vectors into the image for each side of the shuttle (see image).

Result

Path

Since the resulting force has to be perpendicular to $B$-field and conductor, the force has to point to the left or the right.
The right-hand rule leads to forces pointing radially **into the coil**.
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, there sum of the forces results in a repulsing force, see image.
Beside boundary effects, The field gets also inhomogeneous, by the additional field of the coils.




- current $I = 1.6 ~\rm A$
- magnetic field of the shuttle of is homogeneous with $B=0.5 ~\rm T$

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 $$\begin{align*} |\vec{F}_{L}| &= I \cdot l \cdot B \cdot \cos(\angle \vec{B}, \vec{l}) \\ &= I \cdot (N \cdot 2\pi r) \cdot B \cdot \cos(\angle \vec{B}, \vec{l}) \\ &= \rm 1.6 ~A \cdot (500 \cdot 2\pi 40\cdot 10^{-3}~m) \cdot 0.5 ~T \cdot \cos 90° \end{align*}$$