

FH Aachen

Faculty Electrical Engineering and Information Technology

Information Systems Engineering

Field of specialisation Systems and management

Master Thesis

**Development of a hardware and software framework for the automated
characterization of permanent magnets for low-field MRI systems**

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01.01.2024

dank

Erklärung

I hereby declare that I have prepared this thesis independently and without outside assistance. Text passages, which are based literally or in the sense on publications or lectures of other authors, are marked as such. The work has not yet been submitted to any other examination authority and has not yet been published.

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Abstract

Especially in the construction of low-field MRI devices based on permanent magnets, a large number of magnets are used. In order to realize a homogeneous B0 field with these magnets, which is necessary for many setups, the magnetic properties of these magnets should be as similar as possible.

Due to the complex manufacturing process, especially of neodymium magnets, the different properties, especially the direction of magnetization, can deviate from each other, which affects the homogeneity of the field.

To adjust the field afterwards, a passive shimming process is typically performed, which is complex and time-consuming and requires manual corrections to the magnets used.

To avoid this process, magnets can be systematically measured in advance. However, in this methodology, the recording, data storage and subsequent evaluation of the data play an important role.

The various existing solutions implement individual aspects, but do not provide a data pipeline from acquisition to analysis.

For this use case, the MagneticReadoutProcessing library was created, which implements different aspects of data acquisition, data storage, analysis, and each intermediate step can be customized by the user without having to create everything from scratch, favoring an exchange between different user groups.

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