Chair of Imaging and Computer Vision | RWTH AACHEN UNIVERSITY

Master/- Bachelor Thesis

Automatic Resonance and Matching Retuning of Low-Field MRI RF Coils Under Temperature and Proximity Perturbations

Univ.-Prof. Dr.-Ing. Volkmar Schulz
Lehrstuhlinhaber

Marcel Ochsendorf
Wissenschaftlicher Mitarbeiter

Raum 140
Kopernikusstr. 16
52074 Aachen

Telefon: +49 241 80-27864
marcel.ochsendorf@lfb.rwth-aachen.de
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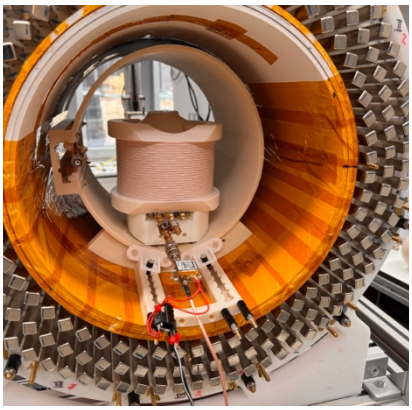
Keywords

Low-Field MRI | **RF** | **Hardware** | **Simulation**

Background



Magnetic resonance imaging (MRI) is an imaging technique that uses magnetic fields and radio waves to create detailed images of the inside of the body. Low-field MRI systems work with a weaker magnetic field. In the DeLoRi project, together with the Fraunhofer MEVIS Institute, we are developing a low-field MRI device to support cancer diagnostics. To enable reliable operation in realistic clinical and lab environments, the system must tolerate environmental changes (e.g., temperature drift and nearby conductive objects) that can detune the RF coils and trigger repeated calibration. Reducing or eliminating manual retuning is therefore a key step toward shortening overall system calibration time and improving scan readiness.

Tasks

The aim of this work is to develop an automatic RF coil tuning and matching framework for a low-field MRI system to reduce calibration time under environmental and load-induced detuning. Depending on your interests, you will implement a reflected-power–based control loop that detects mismatch and retunes the coil using an electronically adjustable matching network. Optionally, you will design and evaluate the tuning hardware (e.g., switched capacitor banks or varactor networks) under MRI-compatibility constraints and robustness to temperature and nearby conductive objects. The system will be validated on the MRI setup with controlled perturbations, quantifying retuning speed, stability, and the reduction in manual calibration effort.

Your Profile

For the successful implementation of the project, you should have an interest in one or more of the following subject areas:

- RF-Networks up to 5 Mhz
- Python
- General Hardware Interest

Our Offer

We offer a collaborative culture in a dynamic team of students, PhD candidates, and postdocs that values new ideas and lively discussion. A workstation can be provided in our student office, together with modern IT infrastructure that includes around 2000 CPU cores and 100 GPUs. You will also have access to a workshop and rapid prototyping facilities, to support fast iteration from design to hardware.