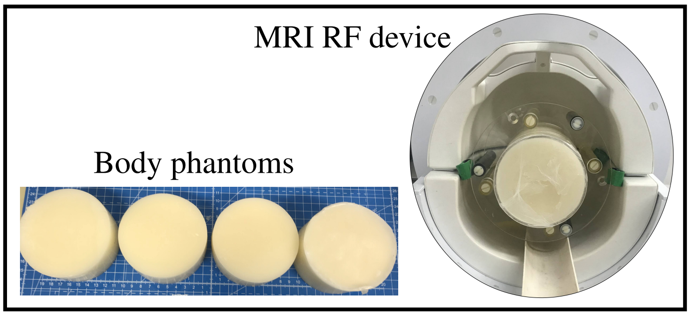
Bachelor Thesis

Research-related and Interesting

Study the Generated Heat within Various Body Tissues Due to the Magnetic Field of MRI Devices



Magnetic Resonance Imaging (MRI) is a non-invasive, high-contrast imaging technique, which is widely used in diagnosis as well as biological research. The MRI works based on tissue magnetization due to the presence of hydrogen nuclei, in a constant external main magnetic field in conjunction with a second magnetic field generated by a radio frequency (RF) coil. The recording of this magnetization is based on Faraday's law of induction. To improve the signal and signal to noise ratio of MRI devices and hence reach higher resolution images, strong external magnetic fields are required. Such strong external magnetic fields (namely e.g. 7T), although non-ionizing and hence safe, can result in unwanted heating within the targeted tissues and accordingly cause some side effects. Correspondingly, the increased tissue temperature in relation to time spent within such MRI devices has to be studied, to determine the safety limits and potential side effects.

To carry on such study, and in the framework of a collaborative project with Westphalian University of Applied Sciences, different phantoms mimicking material properties of various human tissues such as muscle, fat, brain, and etc will be made, and afterwards their temperature within a 7T MRI device at various time intervals will be measured. In parallel, the phantoms within the MRI device should be simulated, and the generated heat within the tissue be determined. The simulations will then provide insights on the mechanisms responsible for the generated heat and also the heat distribution.

The current bachelor project will deal with the simulation of the mentioned phantoms in the magnetic field of the 7T MRI device, using the simulation software COMSOL Multiphysics, and determining the resulting temperature increase within the tissues. A multiphysics model, containing both radio frequency together with bioheat transfer physics, should be set, and through investigating the induced eddy currents within the tissues, the resulting temperature increase should be determined.

Got curious? Simply contact us for an informal meeting discussing the topic or send a thesis request per email to us.

Requirements:	Knowledge of electromagnetic field theory, interest in modelling and simulation of electromagnetic systems and bioelectromagnetics, knowledge of numerical simulation is preferred.
Character of the project:	30% Theory / 70% Simulation
We offer:	An interesting bachelor project at the edge of science in a friendly research environment.
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