Thesis Project Offer

Joint Research and Education Programme “Palestinian-German Science Bridge PGSB”
Forschungszentrum Jülich GmbH & Palestine Academy for Science and Technology

Thesis type*

☐ BSc ☒ MSc ☐ PhD

Intended starting date (approx.): 

Contact details of supervisor/responsible host at Forschungszentrum Jülich

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<td>Mr.</td>
<td>Prof.</td>
<td>Dr. Ghaleb</td>
<td>Natour</td>
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Phone* E-mail*

+49 2461 615045  g.natour@fz-juelich.de

Function* Institute and homepage of institute*

Director Central Institute of Engineering, Electronics and Analytics – Engineering and Technology (ZEA-1) http://www.fz-juelich.de/zea/zea-1/EN

University affiliation in Germany*

RWTH Aachen, Faculty for Mechanical Engineering

Co-Supervisor at Palestinian university (if applicable)

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University/institution Department/faculty/institute

Project description*

Optimization of the homogeneity of magnetic fields using permanent magnets for novel NMR and MRT-spectrometers.

The Central Institute of Engineering, Electronics and Analytics – Engineering and Technology (ZEA-1) is a scientific technical institute of the Forschungszentrum Jülich GmbH. Mission of ZEA-1 is the design, the development, and the fabrication of scientific and technical equipment, instruments, and processes that are essential for excellent science but are not commercially available.

The core competencies of ZEA-1 are technology development and mechanical engineering of equipment, spectrometers and other components for research using neutron, photon, and hadron beams, for energy and environment research, for soil and plant investigations and for the neuroscience. ZEA-1 has broad and longtime experiences in innovative manufacturing techniques, joining technologies, measurement technologies, automation, and calculation and numerical simulation methods.

In the framework of the “Palestinian-German Science Bridge” education program we offer a fellowship for a master thesis:
Optimization of the homogeneity of magnetic fields using permanent magnets

Very homogeneous magnetic fields which are essential for nuclear spin resonance (NMR) or magnetic resonance tomography (MRT) measurements are normally produced using high electrical currents which are circulate through electrical coils. Nowadays, it is well known that one can create homogeneous magnetic fields also by the use of permanent magnets (see for example: K. Halbach: “Design of permanent multipole magnets with oriented rare earth cobalt material.” Nuclear Instruments and Methods, vol. 169, no. 1 (1980), pp. 1 - 10 or H. Soltner, P. Blümler: „Dipolar Halbach magnet stacks made from identically shaped permanent magnets for magnetic resonance“, Concepts in Magnetic Resonance Part A, vol. 36, no. 4 (2010), pp. 211 - 222.)

In practice the achieved homogeneity of the magnetic field is in the order of 10⁻⁴ which is for most applications enough. Goal of the thesis work is to study the improvement of the magnetic field homogeneity by optimization of the geometry of the arranged magnets and by using magnetizable materials like soft iron.

Both numerical simulations as well as experiments have to be performed.

Date*       Signature*
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27.10.2017  Prof. Dr. G. Natour

* required field