Faculty Name:

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Lab:

MR Science Lab

Project Title:

Design of RF chokes to enable B0 shimming capability of RF coils for MRI

Description:

"We demonstrated that a set of simple, localized coils can be converted to a powerful magnetic field modeling system when the electrical coils are driven individually (1). The MRI B0 homogeneity we achieved in the human brain using dedicated multicoil (MC) hardware separate from the radio frequency (RF) coil remains unrivaled (2). However, our proof-of-principle setup suffered from sensitivity loss due to coupling with the RF coil, which is not acceptable in day-to-day applications. The generation of MC shim fields by driving elements of an RF phased array with DC currents has recently been shown to possess significant promise (3). The use of the identical coil hardware for both purposes is appealing since bore space is notoriously limited.

Shimming capability can be achieved with the use of inductive chokes (or RF chokes) in parallel with the tuning capacitors, to bridge direct current into an RF loop. The stray capacitance between the wire turns of the RF chokes resonates with the inductance, forming a high impedance at the self-resonant frequency (SRF). When the SRF very close to the Larmor frequency (i.e. the resonance frequency of the RF coil), the choke essentially looks like an open circuit and there is very little shift in coil frequency; this indicates that the choke’s impact on the RF coil has been minimized.

To achieve a SRF of 123 MHz (i.e. the Larmor frequency for 3T MRI systems) large inductance values (~1uH) need to be achieved. This translates to large size inductors, which are bulky and present practical challenges. Alternatively, increasing the inductor's stray capacitance by varying the permittivity of the support material could allow to manufacture smaller inductors. You will be involved in researching and testing possible alternative MR-compatible materials to what we currently have used (primarily 3D-printed plastic)."

Location of Research:

On-Site

# of hrs/week:

15

Department/Program:

Biomedical Engineering

Eligibility:

BS, Second Year, BS, Third Year, BS, Fourth Year, MS

To apply, please contact:

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