Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **2143** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

Laplacian-Inspired Design of a Highly-Homogeneous, RF Shielded Magnet for Low-Field TRASE MRI (G)*

Tuesday, 12 June 2018 12:15 (15 minutes)

TRansmit Array Spatial Encoding (TRASE) is a Magnetic Resonance Imaging (MRI) method which uses phase gradients of the B_1 field –rather than magnitude gradients of the B_0 field –to achieve spatial encoding. The potential benefits and limitations of this technique are still being explored in both conventional and low-field magnets. This work designs a highly homogeneous, low-field magnet (<10 mT) to further studies of TRASE in this regime. The design method is novel and allows for ostensibly perfect field homogeneity. Furthermore, given that TRASE does not require the application of switched B_0 gradients, we propose to build the magnet on an aluminum housing which acts both as a heat sink and an effective low-frequency RF shield.

This talk will present the design method, convergence tests of this method, and the final design. The method is founded upon consideration of two coaxial cylindrical surfaces of finite lengths with surface currents on their bodies and end caps. Boundary conditions are set such that the outer surface perfectly shields the field created. Using finite element methods, the Laplacian of the magnetic scalar potential , and hence magnetic field B, is found in the region between the cylinders. One is free to specify any solution to the Laplace equation in the inner region, including $= -Bz/_o$, which gives a uniform field. By moving the outer surface farther and farther away, we are able to converge to a solution for a single, finite-length cylinder in free space with the perfectly uniform internal field of an infinitely long solenoid. The discontinuity of the scalar potential across the cylinder boundary is, in fact, equivalent to the stream function, and, as a result, evenly spaced contours of give the coil winding pattern. Because no current flows at the center of the end caps, access holes can be created in these regions.

Primary author: SMITH, K. M. (University of Manitoba)

Co-authors: Dr BIDINOSTI, C. P. (University of Winnipeg); Dr KING, Scott B. (Philips Healthcare)

Presenter: SMITH, K. M. (University of Manitoba)

Session Classification: T2-4 Medical Imaging 1 (DPMB) | Imagerie médicales 1 (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)