Homogenization of the Magnetic Field in an MRI System

Principal Inventor:
Leon Axel
Department of Radiology
NYU School of Medicine
New York University

Description of Technology:
This technology provides a fast, flexible, and non-iterative method for homogenizing the magnetic field of an MRI system.

The magnetic fields of MRI systems should be approximately uniform or homogenous in order to perform high quality magnetic resonance imaging. While magnets used to produce the strong magnetic fields of MRI machines are specifically designed and manufactured to achieve fairly high levels of homogeneity, typically additional local supplemental magnetic fields (shim fields) are added to achieve the final desired level of magnetic field homogeneity. The shims are needed because of the residual field variations resulting from the magnet's manufacturing as well as due to alteration of the magnetic field resulting from the presence within the magnet of the subject to be imaged. These subject-dependent effects are particularly important at higher magnetic field strengths, which are increasingly being used.

Current MRI systems may provide active shimming capabilities where current can be adjusted through conducting elements, called shim coils, contained in magnetic housings that generate locally varying magnetic field patterns whose overall strength is proportional to the current.

Previous methods for determination of the optimal combination of shim currents to compensate for the main field inhomogeneity have focused on iterative or least squares type approaches.

This new technology provides a method that has a key speed advantage over previous methods in that it is not iterative and yet provides a high precision optimal result. Furthermore, this method offers the flexibility to restrict the shim fitting to any desired region of interest or subvolume of the MRI system. The ability to rapidly shim over a desired region of interest may be useful for spectroscopy and imaging, particularly for imaging methods that are sensitive to field inhomogeneity, such as echoplanar or steady state free precession imaging. This is particularly the case at higher magnetic field strengths, where susceptibility effects of the objects to be imaged may be more pronounced, as well as in regions of the body that are more magnetically inhomogeneous, such as near air-filled regions.

Patent Status:
U.S. patent pending.

Contact Information:
Office of Industrial Liaison/Technology Transfer
650 First Avenue, 6th Floor
New York, NY 10016
Phone: (212) 263-8178 Fax: (212) 263-8189