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Improved MRI Method Uses Temperature Rise Contraints (20150061, Dr. Moortele)

Technology No. 20150061

IP Status: Issued US Patent; **Application #:** 15/513,042

Parallel RF and Voxel Cluster in MRI Scans

A new method using parallel transmission radiofrequency (RF) pulses for magnetic resonance imaging (MRI) under strict temperature rise constraints is expected to provide safer and more powerful MRI exams. The method compresses a model for a subject to be scanned by the MRI system into voxel clusters. Each voxel cluster defines a virtual observation point with peak sensitivity to the local temperature rise for the voxel cluster. The parallel transmission RF pulse is then based on an approximation of a minimization criterion having a local temperature rise component based on the peak sensitivity of each virtual observation point. The approximation comprises a weighted sum of the local temperature rise values for each virtual observation point.

Current SAR Constraint Methods Pose Safety Concerns

Existing technologies address pulse design problems through SAR constraints, an easy technique but one that poses safety concerns. This new technology is safer and simulations show that it can also yield better RF pulse performance.

BENEFITS AND FEATURES:

- Safer and more powerful radiofrequency pulse sequences
- Temperature rise can be controlled directly and efficiently with the use of suitable compression schemes and powerful algorithms

APPLICATIONS:

- Ultra-High Field Magnetic Resonance Imaging (7T and 10.5T MRI)

Phase of Development - Proof of Concept: mathematical proof, numerical demonstration.

Researchers

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Publications

Direct control of the temperature rise in parallel transmission: simulations at 10.5 Tesla
Magnetic Resonance in Medicine, 2016 Jan;75(1):249-56
Radiofrequency pulse design in parallel transmission under strict temperature constraints
Magnetic Resonance in Medicine, 2014 Sep;72(3):679-88
On Variant Strategies to Solve the Magnitude Least Squares Optimization Problem in Parallel Transmission Pulse Design and Under Strict SAR and Power Constraints
IEEE Transactions on Medical Imaging, 33:739-748