Medical Imaging

Clearer MRI Near Metallic Implants

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WARF: P140004US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing multiband, fully phase-encoded MRI for distortion-free imaging near metal.

Overview

More than a million joint replacements were performed in the Unites States in 2012 and more than four million implant surgeries are expected in 2030. Such implants pose a challenge to magnetic resonance imaging (MRI) because metal causes severe off-resonance in nearby tissue. Off-resonance leads to signal loss and distortion, and makes clinical diagnosis very difficult.

Imaging techniques called SEMAC and MAVRIC have been developed to mitigate these issues. However, distortion remains a problem because both techniques use frequency-encoding.

The Invention

UW–Madison researchers have developed a new technique for faster, fully phase-encoded 3-D MRI that enables distortion-free imaging near metallic implants.

In the technique, multiple spectral bands associated with different resonance frequency offsets are simultaneously excited using a multiband excitation scheme. The MR signals generated in response to this excitation then are spatially encoded using phase-encoding along three dimensions. In other words, no frequency-encoding gradients are used.

The new technique can be referred to as multiband, fully phase-encoded (MB-FPE) imaging.

Applications

- MRI
- Diagnosing infections and other complications due to implanted metallic prostheses (e.g., hit/knee/shoulder replacements, rods, screws, plates, etc.)

Key Benefits

- Distortion-free visualization of tissue in close proximity to metal
- Accelerated fully phase-encoded imaging near metal
- High spatial resolution and good volumetric coverage
- Spectral decomposition, allowing estimation of B_0 inhomogeneity and R2*
- Spectral data improves signal-to-noise ratio

Additional Information

For More Information About the Inventors

- Scott Reeder

Related Technologies

- WARF reference number P120191US01describes a method to eliminate encoding distortion for clearer MRI near metal.

Publications

- Artz N.S., Hernando D., Taviani V., Samsonov A., Brittain J.H. and Reeder S.B. 2014. Spectrally Resolved Fully Phase-Encoded 3-D Fast Spin-Echo Imaging. Magn Reson Med. 71, 681-690.
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- Smith M.R., Artz N.S., Wiens C.N., Hernando D. and Reeder S.B. 2014. Characterizing the Limits of Magnetic Resonance Imaging Near Metallic Prostheses. Magn Reson Med (In Press)
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- Artz et al. 2015. In-Vivo Fully Phase-Encoded Magnetic Resonance Imaging in the Presence of Metal using Multiband RF Excitation. Proceedings of the 23rd Annual Meeting of the International Society for Magnetic Resonance in Medicine, Toronto, Ontario, Cana
- Artz N.S., Wiens C.N., Smith M.R., Hernando D., Samsonov A. and Reeder S.B. 2016. Accelerating Fully Phase-Encoded MRI Near Metal Using Multiband Radiofrequency Excitation. Magn Reson Med. Epub.

Tech Fields

- Medical Imaging : MRI

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