Medical Imaging

Removal of Chemical Shift Artifacts in Magnetic Resonance Images with Alternating Readout Gradients

View U.S. Patent No. 7,375,522 in PDF format.

WARF: P06231US

Inventors: Scott Reeder

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to remove chemical shift artifacts from MR images.

Overview

Magnetic resonance (MR) imaging technology is used to measure nuclear magnetic resonance (NMR) from various substances in human tissue to produce medical images for qualitative and quantitative assessments. These various substances in human tissue emit NMR when a magnetic field is applied at the substance's Larmor frequency.

Water is the most important substance in human tissue for NMR detection and imaging due to its abundance and specific properties. Fat also emits NMR, but at a different Larmor frequency than water. This difference is termed the "chemical shift" and causes blurring or multiple edges to appear in the reconstructed images. This is of particular concern for techniques such as fast spin-echo (FSE), steady-state free precession (SSFP) and gradient echo (GRE) imaging, where fat obscures images due to its brightness.

Many techniques have been developed to suppress fat signals for clearer imaging. Short-TI inversion recovery (STIR) provides uniform fat suppression, but increases the signal-to-noise ratio. The "In and Out of Phase" imaging method exploits the chemical shifts between water and fat to produce separate images. This method has been developed further, but still suffers from blurring and the appearance of multiple edges. These problems are especially troublesome at higher magnetic field strengths and lower bandwidth.

The Invention

A UW–Madison researcher has developed a method to remove chemical shift artifacts from MR images. Images are acquired using opposite polarity readout gradients to completely suppress chemical shift artifacts. The method uses a two-point acquisition to produce two images, one in phase and one out of phase. The k-space data is acquired from left to right and then from right to left. Using the chemical shift, the images are realigned to represent either water or fat. This removes normal chemical shift artifacts, and also is suitable for MR imaging using higher magnetic field strengths with larger chemical shifts and lower bandwidths to improve signal-to-noise ratios.

Applications

- MRI systems where chemical shift blurring or multiple edges occur
- Fast spin-echo (FSE)
- Steady-state free precession (SSFP)
- Gradient echo (GRE) imaging

Key Benefits

- Suppresses water and fat chemical shift blurring and multiple edges
- Works with high magnetic field strengths and low bandwidths

Additional Information

For More Information About the Inventors

- Scott Reeder

Related Intellectual Property

- View Continuation-in-Part Patent in PDF format.

Tech Fields

- Medical Imaging : MRI

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846