



Improved MRI Scan Time through Rotating Angle Velocity Encoding

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing efficient methods for acquisition of multidimensional, phase-contrast magnetic resonance images.

Overview

Magnetic resonance imaging (MRI) utilizes the signal induced by excited spins when human tissue is subjected to a uniform magnetic field. The individual magnetic moments of the nuclear spins in the tissue attempt to align with the field, and the field is then terminated. A wide variety of measurement sequences exploit this nuclear magnetic resonance (NMR) phenomenon to produce images of the human vasculature and related physiological effects, including MR angiography (MRA). Phase contrast (PC) is a technique used to achieve the desired contrast for MRA.

PC MRA relies on a change in the phase shifts of flowing protons in a region of interest to create an image. Spins that are moving along the direction of a magnetic field gradient receive a phase shift proportional to their velocity. PC can evaluate average velocity in all three directions by placing a bipolar gradient before the acquisition. The accrued phase is proportional to velocity, and from the phase, velocity can be determined. To measure velocity in multiple dimensions, three to four sets of data must be acquired. Multiple acquisitions require long scan times, which increase with the desired number of dimensions in the acquired images. The operator must set a velocity-encoding sensitivity, which varies unpredictably depending on clinical factors. An improved system and method is needed for MR imaging techniques including those applicable to MRA to reduce scan times while maintaining image quality.

The Invention

UW–Madison researchers have developed a system and method for performing PC MRI with a substantially reduced acquisition time. Rather than performing separate acquisitions for each velocity encoding, the method allows multiple velocity encodings to be combined. A reconstruction method reconciles inconsistency in the resulting set of Fourier slices by determining the velocity components despite the combination of multiple velocity encodings per readout.

A set of reference projections of a subject is acquired having both stationary spins and non-stationary spins. A set of velocity-sensitive projections is acquired that is encoded to be velocity sensitive along multiple directions per readout. For each projection of the set of velocity-sensitive projections, directional velocity components are determined and a PC image is generated using the directional velocity components and the sets of reference projections and velocity-sensitive projections. Thus, to measure the velocity in two directions, only one set of velocity-sensitive projections is needed, whereas in traditional PC MRA, two are needed.

Applications

- PC MRA applications including flow measurements of the aorta, pulmonary artery and cerebrovascular arteries
- Quantification of blood flow
- Evaluation of vascular diseases and congenital lesions

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Key Benefits

- Reduces MRI scan time without significantly increasing reconstruction time

Tech Fields

- [Medical Imaging : MRI](#)

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

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