Methods for Reducing Fold-Over Artifacts in Magnetic Resonance Imaging

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Technology description

Cusp artifacts appearing alongside fast spin echo images in the sagittal or coronal directions interfere with image interpretation. Pulse sequence modification reduces this artifact without hardware change or coil sensitivity calibration by lowering overall signal detection in FSE echo train.

A "featherlike" artifact, termed a cusp artifact, is sometimes seen along the phase-encoding direction in sagittal or coronal fast spin echo images.

This artifact arises from the spins, at a location distant from the magnet isocenter, that are excited and aliased to the field of view because their precession frequency is similar to those at the isocenter. Such a situation is created due to a combination of excessive gradient nonlinearity and rapid change of the main magnetic field near the edge of the magnet where the artifact-producing spins are located.

The artifact is often observed on sagittal or coronal planes in spine and knee scans, and can interfere with image interpretation. With the present trend of short magnets in whole-body scanner designs, the problem of the FSE cusp artifact becomes increasingly important.

Current approaches to attack this problem involve substantial hardware modification, sophisticated image reconstruction, or use of metal shields which may cause localized RF power deposition. These approaches, while effective, may not be easily implementable on all MRI scanners.

UIC inventors have developed a technique to reduce the FSE cusp artifact by a simple pulse sequence modification. The technique does not involve any hardware change or coil sensitivity calibration, and raises no concerns on SAR or RF-induced local heating.

To reduce the FSE cusp artifact, UIC inventors modified a FSE pulse sequence so that the slice selected by the RF excitation pulse is slightly tilted with respect to the slice selected by the subsequent RF refocusing pulses. With this modification, peripheral magnetization that would cause the cusp artifact will not experience both RF excitation and refocusing pulses, leading to reduced contributions to the detected signals in the FSE echo train.

Application area

Reduction of the fold-over/cusp artifacts in MRI imaging that are commonly observed on sagittal or coronal planes in spine and knee scans

Advantages

The technique can be implemented on virtually any scanner without hardware modification, complicated calibration, sophisticated image reconstruction, or patient-handling alteration.

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