

METHOD AND DEVICE FOR DESIGNING SMOOTH SEQUENCES OF SPOKE ENDPOINTS IN MRI

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PATENT STATUS

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United States Of America	Published Application	20230349992	11/02/2023	2022-096

BRIEF DESCRIPTION

A key advantage of radial MRI is that it enables imaging in the presence of motion. Radial trajectories suitable for motion-tolerant imaging must order spoke directions to achieve uniform angular sampling quickly and to maintain consistent angular coverage for the full scan duration. Current motion-tolerant radial sampling strategies realize these characteristics by designing large angles between adjacent spokes. In certain MRI pulse sequences however, large spoke direction changes can exaggerate image artifacts due to eddy-current effects, introduce unintended contrast changes and artifacts due to incomplete magnetization spoiling, and/or increase acoustic noise.

SUGGESTED USES

There are a number of uses. The first is zero echo time (ZTE) imaging is a type of radial acquisition where closely-spaced spokes enable quiet operation, of potential interest for pediatric, sleep, and speech imaging. It has been demonstrated that the present embodiments enable quieter or shorter ZTE acquisitions with no loss in image quality.

The second use is improving the balanced steady-state free precession (bSSFP) imaging is used routinely for cardiac imaging, and radial variations are well-suited to compensate for cardiac motion. Motion-tolerant radial bSSFP imaging conventionally requires large gaps between spokes, but larger gaps amplify dark-band artifacts. The present embodiments advantageously reduce banding artifacts in balanced radial imaging without sacrificing on motion tolerance.

In the third use, we can improve ultrashort echo time (UTE) lung imaging, magnetization spoiling is required to avoid undesired contrast changes due to magnetization refocusing, but spoiling gradients reduce scan efficiency. Closely-spaced spokes also induce spoiling effects, but large gaps between spokes are typically needed for motion robustness. The present embodiments advantageously reduce or eliminate the need for spoiling gradients, thereby improving UTE lung imaging efficiency.

ADVANTAGES

The present disclosure advantageously provides novel systems and methods to design radial trajectories that achieve uniform k-space coverage without large jumps between adjacent spokes. The present embodiments consider radial trajectory design as an optimal path-finding problem on a sphere and extracts suitable spoke sequences from solutions. One demonstrated embodiment enables quieter imaging without loss in image quality. Other embodiments yield advantages in applications that are sensitive to eddy-currents, partial spoiling, and motion.

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Intrinsic Navigation from Velocity-Encoding Gradients in Phase-Contrast MRI](#)
- ▶ [Method for Motion Sensing in MRI Using Preamplifier RF Intermodulation](#)

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OTHER INFORMATION

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