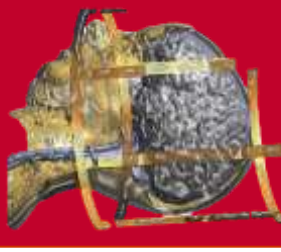
Hardware for Enhanced MRI Contrast

Simultaneous Excitation and Acquisition in MRI with an Automatic Active Cancellation System to Image Tissues with Short T2



Technology

Magnetic Resonance Imaging (MRI) provides excellent cross-sectional images of the soft tissues in the human body. In conventional MRI, the magnetization in tissue is first excited with a radio-frequency (RF) pulse, and the resultant echo signal is later acquired with an RF coil. MRI signal that decays between excitation and acquisition (T2 < 100 μs) cannot be measured, which is the case for tissues such as cortical bone or myelin.

A new RF hardware system was designed for truly simultaneous excitation and acquisition to overcome the signal loss. As the RF power levels during excitation and acquisition differ by several orders of magnitude, cancellation of unwanted excitation signal in the acquired MRI data is very important – here, a novel automatic cancellation system is realized to enable new imaging contrasts of tissues with ultra-short T2.

Innovation

- Active cancellation of RF excitation (transmit) signal during simultaneous acquisition
- Real-time self-interference cancellation system add-on for in-band full duplex operation in MRI

Application

- MRI of short-T2 tissues
- Bone signal detection for MR-guided radio-therapy
- Direct myelin MRI for demyelinating diseases
- MRI with low energy deposition in the patient
- Silent MRI acquisition

Developmental Status

- First measurements with probands in MRI-prototype
- 2015: Publication Özen AC, Bock M, Atalar E. *Active decoupling of RF coils using a transmit array system*. MAGMA 2015; 28(6):565-76.
- 2016: Proof-of-concept realization of active cancellation with experiments in phantoms and volunteers
- 2018: Publication Özen AC, Atalar E, Korvink JG, Bock M. *In vivo MRI with Concurrent Excitation and Acquisition using Automated Active Analog Cancellation*. Sci Rep. 2018; 8(1):10631.

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Medical Imaging, Hardware, MRI, Radio-frequency Technology

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