Self-Decoupled RF Coils for Optimized Magnetic Resonance Imaging

VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Summary

Magnetic resonance imaging (MRI) is one of the most important and versatile tools in the repertoire of diagnostics and medical imaging. Vanderbilt researchers have developed a novel, geometry independent, self-decoupling radiofrequency (RF) coil design that will allow MRI machines to generate images at a faster rate and with greater image quality.

Addressed Need

While RF arrays with a large number of independent elements are desirable for a higher signal-to-noise ratio and faster imaging, significant electromagnetic (EM) coupling interference occurs between elements as the number of coils increases, which can seriously degrade coil performance. The self-decoupling RF coil design presented here mitigates this problem by cancelling the EM coupling between coils, allowing for the inclusion of a more densely packed array of coils resulting in MRI machines with higher image quality.

Technology Description

Utilizing a combination of two or more tunable coils, the EM coupling between RF coils in a MRI machine is cancelled due to balanced induction currents without the use of any additional decoupling treatments. The variations in coil tuning make this technology applicable to complex RF arrays in both low and high tesla MRI machines.

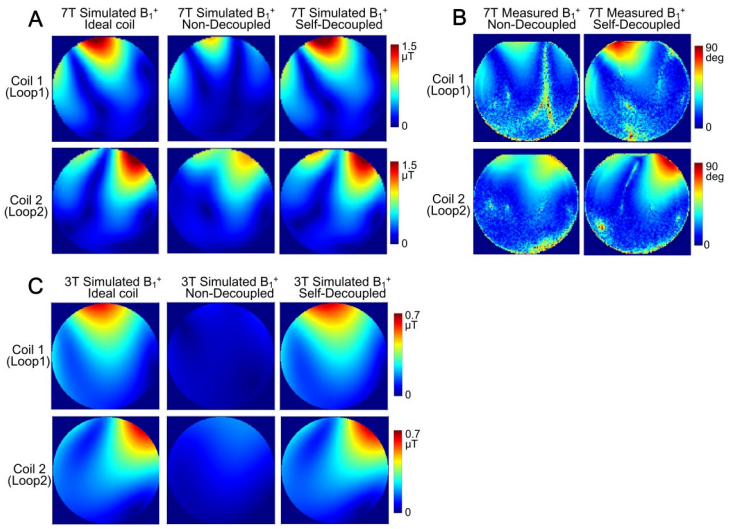

Figure 1: The B1 efficiency increase of the self-decoupled coil (right-most column in A, B, and C) is compared with a non-decoupled coil and an ideal coil at 3T and 7T, and the similarities between the self-decoupled coil and the ideal coil are clear. The self-decoupled coil reduces the transmit power while increasing the signal-to-noise ratio, yielding greater image quality.

Unique Features

- ◊ Provides higher signal-to-noise ratios, faster imaging, and, ultimately, a higher image quality in both 3T and 7T MRI machines
- ◊ Self-decouples without the use of additional decoupling treatments
- ◊ Geometry independent, allowing for flexible coil array design
- ◊ Effective for both adjacent and non-adjacent element interference as well as complex mixed arrays

Intellectual Property Status

A patent application has been filed.

CTTC CONTACT:
Chris Harris , PhD
(615) 343-4433
Chris.harris@vanderbilt.edu

INVENTORS:
John Gore, PhD
Xinqiang Yan, PhD
Will Grissom, PhD
Vanderbilt Institute of Imaging Science

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