Universität Stuttgart
Institut für Intelligente Sensorik und Theoretische Elektrotechnik

Bachelor Thesis

Additively Manufactured RF Solenoid Coil Array Design and Coupling Analysis for Multi-Channel NMR

This project develops a multi-channel RF solenoid coil system for NMR in which every coil is fabricated to the same nominal resonance frequency and produced reproducibly using 3D printing. Precise control of solenoid geometry, winding pitch, and conductor placement using Additive Manufacture Electronic method ensures near-identical self-inductance and predictable parasitic capacitance for each channel. Finally, fine-tuning and matching are achieved with small lumped or distributed capacitors so all coils sit on the same resonance. The identically tuned coils are assembled into an array and characterized with a vector network analyzer: Measured coupling data guide design adjustments (spacing, coil orientation, local shielding, or decoupling networks) to minimize mutual inductance and preserve stable resonance across the array. The result should be a reproducible, 3D-printed solenoid array with uniform resonance, reduced inter-channel interference, and improved B-field uniformity and sensitivity for multi-channel NMR experiments.

Required:

- ✓ Basic knowledge of Electrodynamic
- ✓ Basic know-how of COMSOL.
- ✓ Language: English/German

What we offer: A complete journey through the system design cycle, participant guidance and explanation, and an open, supportive research environment.

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