Empirical Verification of COMSOL-Simulation of Resonance Frequency of an Archimedean Spiral Coil

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Abstract

An simple analytical model for the calculation of the resonance frequency of coils typical consists of a network of inductance, capacitance and resistance. Calculating these three parameters based on spatial geometry is not easy in most cases. The finite element method as used in COMSOL Multiphysics® therefore lends itself to approximating a solution to complex structures. In this paper the Radio Frequency module in its 3D Electromagnetic Waves, Frequency Domain formulation is used. The easiest way to calculate the resonance frequency is to use the Eigenfrequency study. In this case it should be noted that only external effects are considered. Influences based on the current distribution in the wire are neglected. In this work, the resonance frequency of an self-made Archimedean spiral coil was measured with a network analyzer to question and verify the simulation results of the COMSOL RF module. The simulation model of the coil was gradually adjusted closer to the geometry of the real coil to distinguish between partial influences. In addition, a parameter sweep was used to study the variation of wire radius, wire spacing, and relative permittivity.

Figures used in the abstract

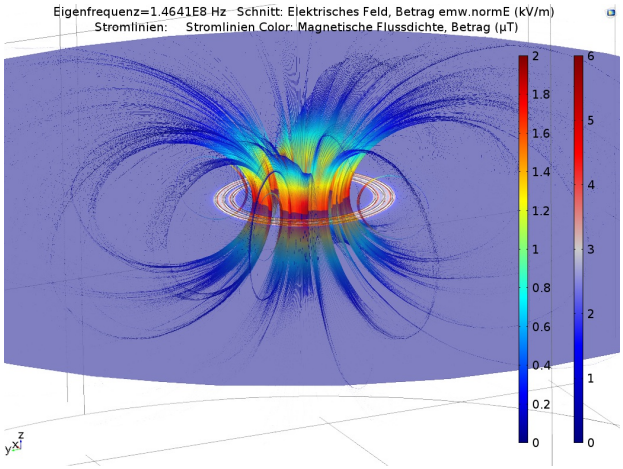

Figure 1: COMSOL-solution of the resonance frequency of simplified model of an Archimedean spiral coil.