MODEL OF DOUBLE-LAYER SPIRAL RESONATORS

by

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ABSTRACT

A novel circuit model of a general kind of spiral resonator (SR) is presented, a double-layer spiral (DLS). A DLS is a spiral resonator formed of two electrically separate or connected spirals whose planes are parallel. In this thesis, only DLSs whose spirals are oppositely wound are considered. The general topology of the circuit model is suited for multiple spiral shapes such as square spirals and Archimedes' spirals. The model of the electrically unconnected DLS can be simply modified to model the connection of the inner or outer leads of the spirals, such as by a via in PCB terminology. In addition, the model can account for the effect of a dielectric slab placed between the two spirals composing the DLS, such as in a PCB design. In this paper an initial verification of the model is presented through a comparison with numerical electromagnetic simulations using Sonnet. The development of the DLS circuit model was motivated by its use as a wirelessly powered force sensor, and as a transmitter and receiver in wireless power transfer through resonant-based magnetic induction. The presented circuit model may be used to predict the resonant frequencies of a DLS. Thus, it is useful in the design of DLSs with a specified resonant frequency, as is the case in the aforementioned applications.