On the simulation in time and frequency domain of a fractional-order model of an electrical coil within resonance frequency

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As windings of an electrical coil are only separated by a thin insulating layer, there are inherent tiny capacitors formed between those windings. These tiny capacitors are added up to form together the parasitic capacitance of the coil. Thus as number of windings for a specific coil increases, the inductance and in a less manner the parasitic capacitance of the coil will also proportionally increase.
At frequencies which lie within almost a decade from the self-resonant frequency, this parasitic „stray“ capacitance will also affect the total impedance of the coil [1]. In this talk we will analyze the fractional-order model of a laboratory coil within resonance frequency. The corresponding multi-order fractional differential equation (MoFDE) will be solved numerically in time domain. In order to investigate the accuracy of the proposed solution, the results in time domain shall be compared with the exact solution in frequency domain.
Simulation results of the fractional-order model will be compared with experimental results whereas unknown parameters of the model are to be identified through an optimization process that is based on the method of least squares.

[1] T. Abuaisha, J. Kertzscher, *Fractional-order Impedance Modeling and Parameter Identification of an Electrical Coil with Interchangeable Core*, Fractional Differentiation and Its Applications (ICFDA), International Conference on, TU Bergakademie Freiberg, 2018 (in press)