# Impedance Evaluation of Integrated Circular Spiral Inductors

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## Abstract

This paper is a contribution to the numerical evaluation of the impedance, inductance and resistance, for planar circular spiral on-chip inductors.
For typical geometric dimensions of integrated spiral inductors, at very high frequency values (typically greater than 10 GHz), full wave electromagnetic numerical approaches must be applied. Otherwise, for a quasi-static point of view, capacitance, inductance and resistance effects may be considered as lumped elements. Empirical or semi-empirical approaches have been adopted. These representations, however, can not predict results for different configurations.
In this paper, field equations are solved in the frequency domain where capacitance effects may be neglected, but eddy currents inside conductors are taken into account. The moment method is developed using an integral operator obtained from the volume integral formulation for the magnetic vector potential. The approach is based on a 2D axisymmetric field configuration assuming the concentric-ring approximation of circular spiral inductors.
Results were obtained for the inductance and resistance. They were derived from the time averaged values of the stored magnetic energy and the dissipation power loss inside the conducting spiral inductor, respectively.
Comparison with experimental and numerical results, presented in the literature or given by other electromagnetic field solvers, shows that an efficient and accurate approach is achieved.