Optimization of Inductor Circuits via Geometric Programming

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We present an efficient method for optimal design and synthesis of CMOS inductors for use in RF circuits. This method uses the the physical dimensions of the inductor as the design parameters and handles a variety of specifications including fixed value of inductance, minimum self-resonant frequency, minimum quality factor, maximum value of resistance, minimum reactance, etc. Geometric constraints that can be handled include maximum and minimum values for every design parameter and a limit on total area. Our method is based on formulating the design problem as a special type of optimization problem called geometric programming, for which powerful efficient interior-point methods have recently been developed. This allows us to solve the inductor synthesis problem globally and extremely efficiently. Also, we can rapidly compute globally optimal trade-off curves between competing objectives such as quality factor and total inductor area. We have fabricated a number of inductors designed by the method, and found good agreement between the experimental data and the specifications predicted by our method.