OPERA: Optimization with Ellipsoidal Uncertainty for Robust Analog IC Design

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As the design-manufacturing interface becomes increasingly complicated with IC technology scaling, the corresponding process variability poses great challenges for nanoscale analog/RF design. Design optimization based on the enumeration of process corners has been widely used, but can suffer from inefficiency and overdesign. In this paper we propose to formulate the analog and RF design with variability problem as a special type of robust optimization problem, namely robust geometric programming. The statistical variations in both the process parameters and design variables are captured by a pre-specified confidence ellipsoid. Using such optimization with ellipsoidal uncertainty approach, robust design can be obtained with guaranteed yield bound and lower design cost, and most importantly, the problem size grows linearly with number of uncertain parameters. Numerical examples demonstrate the efficiency and reveal the trade-off between the design cost versus the yield requirement. We will also

demonstrate significant improvement in the design cost using this approach compared with corner-enumeration optimization.
