Abstracts

FAST Gradient Based Yield Optimization of Nonlinear Circuits

J.W. Bandler, Q.-J. Zhang, J. Song and R.M. Biernacki. "FAST Gradient Based Yield Optimization of Nonlinear Circuits." 1990 Transactions on Microwave Theory and Techniques 38.11 (Nov. 1990 [T-MTT]): 1701-1710.

This paper meets the challenge of yield optimization of nonlinear microwave circuits operating in the steady state under large-signal periodic excitations. Yield-driven design is formulated as a one-sided l/sub 1/ optimization problem. We introduce two novel, high-speed methods of gradient calculation, the integrated gradient approximation technique (IGAT) and the feasible adjoint sensitivity technique (FAST). IGAT utilizes the Broyden formula with special iterations of Powell to update the approximate gradients. FAST combines the efficiency and accuracy of the adjoint sensitivity technique with the simplicity of the perturbation technique. IGAT and FAST are compared with the simple perturbation approximate sensitivity technique (PAST) on the one extreme and the theoretical exact adjoint sensitivity technique (EAST) on the other. FAST, linking state-of-the-art optimization and efficient harmonic balance simulation, is the key to making our approach to nonlinear microwave circuit design the most powerful available. A FET frequency doubler example treats statistics of both linear elements and nonlinear device parameters. This design has six optimizable variables including input power and bias conditions, and 34 statistical parameters. Using either IGAT or FAST, yield is driven from 40% to 70%. FAST exhibits superior efficiency.

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