A bipolar junction transistor EMC modeling method based on physical characteristic measurement and simplex optimization

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May 8, 2023

Abstract

Bipolar junction transistors (BJTs) are widely used in various electronic systems, and the establishment of the electromagnetic compatibility (EMC) model for BJTs is crucial for EMC analysis of these systems, such as high-frequency circuits. In this paper, a BJT EMC model that satisfies both functionality and EMC analysis requirements was established based on physical characteristic measurement. Firstly, comprehensive and systematic methods for measurement and extracting SPICE parameters based on physical BJTs are presented, including a proposed curve-fitting calculation method for extracting barrier capacitance parameters. Secondly, an analysis of the impact of major BJT electrical characteristics parameters was conducted, leading to the identification of important model parameters affecting BJT functionality and EMC. Finally, the primary BJT model was optimized using the simplex method, and a method for EMC analysis and verification of the BJT model was presented. The experimental and simulation results are in good agreement, and the established model meets the accuracy requirements for both EMC and functionality. Therefore, the proposed method is feasible and suitable for the EMC modeling of BJTs.

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