Abstracts

Hybrid finite-difference/finite-volume time-domain analysis for microwave integrated circuits with curved PEC surfaces using a nonuniform rectangular grid

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In this paper, we present a hybrid algorithm that combines the finite-difference time-domain (FDTD) and finite-volume time-domain (FVTD) methods to analyze microwave integrated-circuit structures that may contain curved perfect electric conductor (PEC) surfaces. We employ the conventional nonuniform FDTD in regions where the objects are describable with a rectangular mesh, while applying the FVTD method elsewhere where we need to deal with curved PEC configurations. Both the FDTD and FVTD quantities are defined in the mutually overlapping regions, and these fields from the respective regions are interpolated by using their nearest neighbors. We validate this algorithm by analyzing the scattering parameters of a stripline with one or more adjacent cylindrical vias, whose geometries are frequently encountered in printed-circuit-board designs. It is found that the hybrid FDTD-FVTD approach requires little increase in central processing unit time and memory in comparison to the conventional FDTD, while its computational accuracy is significantly improved over a wide range of frequencies. Specifically, this accuracy is found to be comparable to that achieved by doubling the mesh density of the staircased FDTD.

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