Abstracts

Analysis of Curved and Angled Surfaces on a Cartesian Mesh Using a Novel Finite-Difference Time-Domain Algorithm

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The widely accepted finite-difference time-domain algorithm, based on a Cartesian mesh, is unable to rigorously model the curved surfaces which arise in many engineering applications, while more rigorous solution algorithms are inevitably considerably more computationally intensive. A nonintensive, but still rigorous, alternative to this approach has been to incorporate a priori knowledge of the behavior of the fields (their asymptotic static field solutions) into the FDTD algorithm. Unfortunately, until now, this method has often resulted in instability. In this contribution an algorithm (denoted 'SFDTD' for second-order finite difference time domain) is presented which uses the static field solution technique to accurately characterize curved and angled metallic boundaries. A hitherto unpublished stability theory for this algorithm, relying on principles of energy conservation, is described and it is found that for the first time a priori knowledge of the field distribution can be incorporated into the algorithm with no possibility of instability. The accuracy of the SFDTD algorithm is compared to that of the standard FDTD method by means of two test structures for which analytic results are available.

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