ABSTRACT

Two novel finite-difference time-domain (FDTD) algorithms are proposed to reduce numerical dispersion error. One is to minimize the dispersion error at arbitrary angles. The other is to minimize the maximum dispersion error for all angles. Generic filtering schemes are further developed to improve the performances in broadband simulations. To deal with very large-scale, locally fine problems, the accuracy and stability of FDTD subgridding schemes are numerical studied. A systematic approach is developed to optimize the spatial interpolation coefficients. Unstructured/structured hybrid mesh is further examined as an alternative approach. Composite elements and implicit FDTD method are proposed to facilitate mesh generation and hybridize with Finite-Element Time-Domain (FETD) methods respectively. The stability of FETD/FDTD hybrid methods and the effectiveness of using FDTD as a predictor for FETD, are also examined. Finally, we develop two novel Perfectly Matched Layers (PML) implementations for Alternating-Direction Implicit (ADI) and FETD methods respectively, which exhibit largely reduced reflection errors. In addition, the PML for FETD shows stable late-time behavior in our numerical tests.