Abstracts

Development of three-dimensional unconditionally stable finite-difference time-domain methods

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The finite-difference time-domain (FDTD) method has been widely applied in solving electromagnetic problems. Its capability of handling electrically large or high-Q structure problems is, however, limited by the requirements of large computation memory and time. Such requirements are due to the numerical dispersion errors and the CFL stability condition. So far, most of the research efforts have been focused in developing schemes such as MRTD and PSTD that possess low numerical dispersion and therefore require low computation memory. In this paper, we will present another direction in improving the FDTD computation efficiency: removal of the CPL stability condition. In other words, we will present an unconditionally stable 3D finite-difference time-domain method where the FDTD time step, is no longer restricted by the CPL stability condition but by the modelling accuracy of the FDTD algorithm only. As a result, FDTD iteration number and CPU time are reduced. To further reduce numerical dispersion, anisotropy and memory of the method, a high-order scheme is also presented. Theoretical studies and numerical examples will be presented to validate the proposed schemes.

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