Abstracts

Reflection analysis of FDTD boundary conditions. I. Time-space absorbing boundaries

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Time-space absorbing-boundary conditions (ABCs) are employed to truncate finite-difference time-domain (FDTD) computational domains and are predominantly used because of their simplicity. Their implementation requires only the calculation of a boundary-field value as a function of the local fields and their recent time history. A general method is described, which enables highly accurate calculation of the reflection properties of these boundary conditions for plane-wave incidence. A number of commonly used time-space ABCs are studied, and the technique is verified by way of FDTD simulation. It is demonstrated that the performance of time-space ABCs is substantially degraded by the influence of the finite-mesh discretizations. A technique is described, which enables these discretization inaccuracies to be overcome by correctly choosing the relevant ABC weighting parameters, thus enabling the various boundary conditions to perform precisely as desired. Solutions for these weighting parameters are provided for a number of common boundary conditions such that their absorption characteristics may be precisely configured to suit any level of mesh discretization. As a consequence, a performance equivalence is established amongst all time-space ABCs of the same order.

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