Abstracts

Toward the development of a three-dimensional unconditionally stable finite-difference time-domain method

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In this paper, an unconditionally stable three-dimensional (3-D) finite-difference time-method (FDTD) is presented where the time step used is no longer restricted by stability but by accuracy. The principle of the alternating direction implicit (ADI) technique that has been used in formulating an unconditionally stable two-dimensional FDTD is applied. Unlike the conventional ADI algorithms, however, the alternation is performed in respect to mixed coordinates rather than to each respective coordinate direction, Consequently, only two alternations in solution marching are required in the 3-D formulations. Theoretical proof of the unconditional stability is shown and numerical results are presented to demonstrate the effectiveness and efficiency of the method. It is found that the number of iterations with the proposed FDTD can be at least four times less than that with the conventional FDTD at the same level of accuracy.

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