Abstracts

Numerical Implementation and Performance of Perfectly Matched Layer Boundary Condition for Waveguide Structures

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This paper presents some numerical implementation issues and the performance of Berenger's perfectly matched layer (PML) boundary condition for modeling wave propagation in waveguide structures by the finite-difference time-domain (FDTD) method, The relation between the thickness and the conductivity profile of the perfectly matched layer is studied and a guideline for the selection of PML parameters is given. It is shown that the standard Yee's time-marching scheme results in virtually the same numerical solution as the exponential time-marching scheme. Numerical tests are provided for parallel-plate and rectangular waveguides and microstrip lines. It is found that PML is very effective in absorbing TEM and quasi-TEM waves, as well as nonTEM waves somewhat above cutoff frequencies, but ineffective in absorbing evanescent waves and nonTEM waves near cutoff frequencies. The reason for the ineffectiveness of PML for absorbing evanescent waves is explained. Comparative study of PML and Higdon's boundary condition shows that high-order Higdon's boundary condition can reach the same performance of 16-cell PML and can be adjusted for absorbing evanescent waves, but PML is in general more robust to implement. Performance of the boundary condition obtained by combining PML and Higdon's boundary condition is evaluated.

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