A nonuniform FDTD technique for efficient analysis of propagation characteristics of optical-fiber waveguides

In this paper, we present a highly efficient one-dimensional cylindrical nonuniform finite-difference time-domain (1-D CNUFDTD) method, which utilizes the unsplit anisotropic perfectly matched layer (APML) for mesh truncation along the radial direction to analyze axisymmetric optical-fiber waveguides. As a first step, we validate the proposed FDTD algorithm by analyzing a uniform dielectric waveguide of circular cross section and show that the results are in excellent agreement with the conventional mode theory solutions. Next, we apply the algorithm to analyze propagation characteristics of a number of commonly used optical-fiber waveguides, i.e., step-index multimode, graded-index multimode, and single-mode step-index configurations.

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