Abstracts

A Modified Finite-Element Method for Dielectric Waveguides Using an Asymptotically Correct Approximation on Infinite Elements

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A modified finite-element method for the propagation analysis of such dielectric waveguides as optical fibers and integrated optical waveguides is presented. Possible applications include nondissipative structures of arbitrary anisotropic media with, in some cases, inhomogeneous exterior regions. The method is based on the frill vectorial finite-element formulation, which is known to be without spurious solutions. With this formulation all appropriate boundary and interelement conditions on both tangential and normal components are a priori satisfied. For the unbounded, exterior region a novel type of asymptotically correct approximation on infinite elements is proposed that simultaneously, for each mode and frequency, locally adapts the rate of radial decay to the transversal wavenumbers. The linearity of the original finite-element method has been retained by using beta/k/sub 0/ as a parameter, which results in a sparse generalized eigenvalue problem. Numerical examples including both optical fibers and integrated optical waveguides, isotropic as well as anisotropic, have been analyzed to confirm the validity of the method. The observed correspondence with analytical solutions has been found to be excellent. For some examples a special near-field wavenumber has been added to preserve a high accuracy close to cutoff.

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