Abstracts

An Efficient Finite Element Formulation to Analyze Waveguides with Lossy Inhomogeneous Bi-Anisotropic Materials

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In this paper a finite element formulation in terms of the magnetic field is presented for the analysis of waveguides with bianisotropic media. Such a formulation can deal with lossy inhomogeneous materials characterized by simultaneous permittivity, permeability, and cross-coupling (as in optical activity) arbitrary full tensors. The analysis takes into account arbitrary cross sections, and results in spurious-mode suppression, complex-mode computation, and the possibility of alternatively specifying the frequency or the complex propagation constant as an input parameter. In this way, many novel classes of waveguides with promising applications, such as chirowaveguides and chiroferrite-waveguides, can be analyzed. The formulation leads to a quadratic sparse eigenvalue problem which is transformed into a sparse generalized eigenvalue problem. This eigensystem is solved by the subspace method, the sparsity of the matrices being fully utilized. The proposed method has been validated by analyzing waveguides with biisotropic and bianisotropic materials. The agreement with previously published data is found to be excellent.

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