Abstracts

An Efficient Finite-Element Formulation without Spurious Modes for Anisotropic Waveguides

I. Bardi and O. Biro. "An Efficient Finite-Element Formulation without Spurious Modes for Anisotropic Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1133-1139.

A numerically efficient finite-element formulation is presented for the analysis of lossless, inhomogeneously loaded, anisotropic waveguides of arbitrary shape. The electromagnetic field is described either by the three components of a magnetic vector potential and an electric scalar potential or by the three components of an electric vector potential and a magnetic scalar potential. The uniqueness of the potentials is ensured by the incorporation of the Coulomb gauge and by proper boundary conditions. Owing to the implementation of the solenoidality condition for the vector potential even in the case of zero wavenumber, no spurious modes appear. Variational expressions suited to the finite-element method are formulated in terms of the potentials. Standard finite-element techniques are employed for the numerical solution, leading to a generalized eigenvalue problem with symmetric, sparse matrices. This is solved by means of the bisection method with the sparsity of the matrices fully utilized. Dielectric- and ferrite-loaded waveguides with closed and open boundaries and including both isotropic and anisotropic materials are presented as examples.

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