Abstracts

A Numerically Efficient Finite-Element Formulation for the General Waveguide Problem without Spurious Modes

J.A.M. Svedin. "A Numerically Efficient Finite-Element Formulation for the General Waveguide Problem without Spurious Modes." 1989 Transactions on Microwave Theory and Techniques 37.11 (Nov. 1989 [T-MTT]): 1708-1715.

A numerically efficient finite-element procedure showing no spurious modes is presented for the analysis of propagation characteristics in arbitrarily shaped metal waveguides loaded with linear materials of arbitrary complex tensor permittivity and permeability. The method is straightforwardly derived from the first-order Maxwell curl equations and comprises both the transversal and longitudinal components of the electric and magnetic fields. Hence, all necessary boundary conditions on the tangential field components are a priori satisfied by the trial functions. With this formulation an absence of spurious modes has been found. Furthermore, by also imposing the additional boundary conditions on the normal components of the magnetic induction and electric displacement fields, the dimension of the resulting matrix equation may be significantly reduced. In this formulation both the propagation constant and the frequency may be treated as an eigenvalue of the resulting sparse generalized eigenvalue problem. For the fundamental modes, both the convergence order and the accuracy of the presented method are found to be significantly higher than those of comparable methods when applied to some numerical examples.

❑ Return to main document.