Abstracts

A General High-Order Finite-Element Waveguide Analysis Program

P. Silvester. "A General High-Order Finite-Element Waveguide Analysis Program." 1969 Transactions on Microwave Theory and Techniques 17.4 (Apr. 1969 [T-MTT]): 204-210.

A very general computer program for determining sets of propagating modes and cutoff frequencies of arbitrarily shaped waveguides is described. The program uses a new method of analysis based on approximate extremization of a functional whose Euler equation is the scalar Helmholtz equation, subject to homogeneous boundary conditions. Subdividing the guide cross section into triangular regions and assuming the solution to be representable by a polynomial in each region, the variational problem is approximated by a matrix eigenvalue problem, which is solved by Householder tridiagonalization and Sturm sequences. For reasonably simple convex polygonal guide shapes, the dominant eigenfrequencies are obtained to 5-6 significant figures; for nonconvex or complicated shapes, the accuracy may fall to 3 significant figures. Use of the program is illustrated by calculating the propagating modes of a class of degenerate mode guides of current interest, for which experimental data are available. Numerical studies of convergence rate and discretization error are also described. It is believed that the new program produces waveguide analyses of higher accuracy than any general program previously available.

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