Abstracts

An Accurate Finite-Difference Method for Higher Order Waveguide Modes

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The study of new waveguide shapes requires an accurate knowledge of their higher order modes for bandwidth consideration, waveguide discontinuity analysis, and multimode launching and propagation studies. The finite-difference method solved by successive overrelaxation is a very accurate and general technique for dominant mode solution. The method makes minimum demand on computer store, the number of storage locations required being equal to the order of the matrix defining the system of linear equations used. Convergence criteria require that this matrix be positive semidefinite. For modes higher than the dominant, the method fails to converge as this condition is violated. Solution is obtained by redefining the problem such that the matrix is positive semidefinite for all modes. An algorithm is described which produces one row at a time of the new matrix, as required for successive overrelaxation, and thus reserves almost all computer store for the eigenvector. The eigenvector elements give field potentials at discrete points in the guide cross section. Iteration for higher order modes is successfully applied with all the computational benefits realized by previous finite-difference schemes for the dominant mode. Examples studied are the rectangular, circular, asymmetric ridge, and lunar guides. Results for higher order cutoff wave numbers are usually accurate to within 0.1 percent.

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