Abstracts

Numerical Simulation of the Power Density Distribution Generated in a Multimode Cavity by Using the Method of Lines Technique to Solve Directly for the Electric Field

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In this paper, a new numerical method is presented in order illustrate how the Method of Lines technique can be used to obtain the power density distribution in a dielectric material by solving directly for the electric field in three-dimensional space. A detailed analysis of the treatment of the boundary conditions at the interfaces that exist between air and the material, as well as at absorbing boundary and input planes, are also given in this paper. The method is tested and verified on some simple waveguide examples for which analytic solutions are available. The technique is subsequently applied to the more complicated cavity problem and the solutions for the power density distribution are compared directly with those obtained in previous research using the finite-difference time-domain (FDTD) method. The results of all tests conducted in this research indicate that the Method of Lines technique is a robust numerical tool which can be used to readily handle the hyperbolic nature of the Maxwell equations. Finally, in order to demonstrate the versatility of the developed model, the power density distribution generated inside a dielectric material loaded in a cavity that has multiple input waveguides is presented. The chosen examples exhibit the complicated electromagnetic phenomena which arise inside the cavity and provides some idea of the effect of multiple waveguide input on the power density distribution.

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