Abstracts

Rigorous Analysis of the Step Discontinuity in a Planar Dielectric Waveguide

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Planar dielectric waveguides play an important role in electrooptics and in the submillimeter regions. In many laser configurations and integrated optical components, grooves are etched in the planar surface or overlays are deposited on it. The step is an idealization of such discontinuity. In this paper, the problem of an arbitrary large step under multimode excitation is solved by means of a rigorous variational approach. A rapidly converging expression for the scattering matrix of the step is derived, which is analogous to the one previously derived for transverse discontinuities in closed waveguides. Two choices as to the basis functions are compared: one is constituted by optimally scaled Laguerre functions and the other by the surface waves of both slabs complemented by Laguerre functions. Both the electric field and the magnetic field formulations of the problem have been investigated for the TE case. Numerical results are presented for the scattering matrix of the step under monomode and multimode excitation as well as for its radiation pattern. The accuracy and limitations of existing small step approximations are discussed. The technique is applicable to other transverse discontinuities in open structures.

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