Abstracts

Ray Optics-A Novel Approach to Scattering by Discontinuities in a Waveguide

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Waveguide discontinuities are analyzed conventionally by techniques utilizing the induced field in the vicinity of the discontinuity for calculation of the distant reflected and transmitted field in the various modes. Evaluation of the induced field constitutes the major difficulty in the problem. By an alternative and novel approach explored in this paper, scattering by a discontinuity in a waveguide is deduced from a knowledge of its far zone (asymptotic) scattering properties in free space. In contrast to "small obstacle" techniques wherein similar concepts are utilized for isolated scatterers whose size is small compared to the free-space wavelength, the present procedure accommodates also large discontinuities such as strips, apertures, bifurcations, changes in cross section, etc. The description of various scattering processes is carried out naturally in terms of ray optics which provides at each stage of the calculation an interpretation of the associated physical mechanism. The procedure is illustrated for apertures, strips, and bifurcations in a parallel plane waveguide for which comparisons with exact solutions can be made. It is found that while the ray-optical technique is best suited to the high-frequency (multimode) regime far from modal cutoffs, it is capable of providing remarkable accuracy even in the range of propagation of only the dominant mode.

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