Abstracts

Guided Waves in Inhomogeneous Focusing Media Part I: Formulation, Solution for Quadratic Inhomogeneity

C.N. Kurtz and W. Streifer. "Guided Waves in Inhomogeneous Focusing Media Part I: Formulation, Solution for Quadratic Inhomogeneity." 1969 Transactions on Microwave Theory and Techniques 17.1 (Jan. 1969 [T-MTT]): 11-15.

This work is a theoretical study of waves in a circular-cylindrical radially inhomogeneous guiding medium. A vector theory based upon Maxwell's equatious is used to derive linear homogeneous fourth-order equations satisfied by the longitudinal electric and magnetic field components for a medium in which the permittivity decreases monotonically from the propagation axis. The percentage change of permittivity from the guide axis to some radius a is assumed small. For modes with propagation constants approximately equal to the wave number at guide center, all field components are shown to satisfy second-order differential equations. In particular, all transverse field components are proportional to a single scalar function. In a Iossless system with no containing boundary, a new class of polynomial-Gaussian solutions describes the longitudinal fields for the case of a quadratically decreasing permittivity, while the transverse fields are Gaussian-Laguerre. Mode patterns, propagation constants, and orthogonality relations are given. It is shown analytically that the modes tend to TE or TM as the mode order increases. Moreover, the transverse fields become dominant at large wave numbers, and the fields become tightly bound to the guide axis as the wave number and/or inhomogeneity increases. Studies of more general permittivity variations and wall effects will be reported shortly.

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