Abstracts

Perturbation Analysis of Electromagnetic Eigenmodes in Toroidal Waveguides

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The propagation of electromagnetic waves in a loss-free inhomogeneous hollow conducting waveguide with circular cross section and uniform plane curvature of the longitudinal axis is considered. The explicit solution of Maxwell's equations cannot be given in toroidal waveguides. For small curvature the field equations can, however, be solved by means of an analytical approximation method. In this approximation the curvature of the axis of the waveguide is considered as a disturbance of the straight circular cylinder, and the perturbed torus field is expanded in eigenfunctions of the unperturbed problem. Using the Rayleigh-Schrodinger perturbation theory eigenvalues and eigenfunctions containing first-order correction terms are derived for the full spectrum of all modes including the degenerate ones. Complicated series expansions are obtained, which are represented in closed form by means of the residue theorem.

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