Abstracts

Scattering by a Cylindrical Post of Complex Permittivity in a Waveguide

E.D. Nielsen. "Scattering by a Cylindrical Post of Complex Permittivity in a Waveguide." 1969 Transactions on Microwave Theory and Techniques 17.3 (Mar. 1969 [T-MTT]): 148-153.

An exact solution of the discontinuity problem of a circular cylindrical post of arbitrary complex permittivity centered in a rectangular waveguide with the axis parallel to the electric field vector of the dominant mode has been set up and numerical results based directly on this solution have been found rising an electronic computer. The method used divides the waveguide up into three different regions by introducing two imaginary plane walls perpendicular to the waveguide walls. In the center region, which contains the cylindrical rod, the electromagnetic field is expanded in cylindrical waves and in the outer regions the field is expanded in waveguide modes. By setting up the boundary conditions at all discontinuity surfaces and performing numerical matching of the fields at the two imaginary walls, a system of linear equatious determining the coefficients of reflection, transmission, and absorption of the field due to the cylindrical rod is found. The structure which is of most interest in the case of a plasma column is a coaxial structure consisting of an inner dielectric cylinder with complex permittivity (the plasma) surrounded by a dielectric sleeve with real, positive permittivity (the glass tube). The theory is therefore developed to apply generally for such structures. From the numerical results, curves have been obtained showing the relationship between the coefficients of reflection and transmission and the (complex) permittivity of the rod material. Such curves maybe used for deducing the microwave properties of a cylindrical rod from measurements of the reflection and transmission coefficient of the rod.

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