

MULTIPOLE THEORY ANALYSIS OF CUTOFF WAVENUMBERS OF WAVEGUIDES PARTIALLY FILLED WITH DIELECTRIC

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ABSTRACT: *A new approach, the multipole theory (MT) method, is presented for the computation of cutoff wavenumbers of waveguides partially filled with dielectric. The MT formulation of the eigenvalue problem of an inhomogeneous waveguide is derived. Representative computational examples, including dielectric-rod-loaded rectangular and double-ridged waveguides, are given to validate the theory, and to demonstrate the degree of its efficiency. © 2000 John Wiley & Sons, Inc. Microwave Opt Technol Lett 25: 397–400, 2000.*

Key words: *multipole theory; waveguide partially filled with dielectric; cutoff wavenumber*

1. INTRODUCTION

A waveguide loaded with dielectric finds many applications in microwave engineering, so the computation of the cutoff wavenumbers of TE and TM modes in waveguides partially filled with dielectric has been of great interest to many investigators. Over the past decades, laborious work has been performed on them, an remarkable achievements have been made [1–8].

Recently, we have developed a new approach, the multipole theory (MT) method based on the generalized series expansion, for calculating two-dimensional (2-D) Helmholtz equation problems, and the MT method has been applied to the computation of the cutoff wavenumbers of homogeneous waveguides [9, 10]. In this paper, the MT method is applied to the computation of the cutoff wavenumbers of inhomogeneous waveguides that are partially filled with dielectric. The MT formulation of the eigenvalue problem of inhomogeneous waveguides is derived. Several examples are given to validate the theory and to demonstrate the degree of its efficiency.