Calculation of eigenmodes in a nonperiodic corrugated waveguide

A theoretical technique for determining the dispersion relation, the electromagnetic field components, and the quality factor of a dielectric-loaded nonperiodic corrugated waveguide is presented for the case of azimuthally symmetric TM waves. The Floquet theorem is used to express the field distribution in the vacuum region, while an eigenfunction expansion is employed in each dielectric region, with the appropriate boundary conditions applied at the interfaces, leading to an infinite system of equations. This system is solved numerically by truncation, while the convergence of the solution is examined with the number of spatial harmonics. Based on this formulation, a numerical code, called FISHBONE-TM, is developed and its results are compared with those obtained with an established code (CASCADE) based on the scattering-matrix method.

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