Scattering at a Junction of Two Waveguides with Different Surface Impedances

We consider junction of two cylindrical waveguides and derive the scattering matrix when a single mode is incident in one of the two waveguides. We are interested primarily in the case of two corrugated waveguides with different longitudinal impedances, but the analysis applies also to waveguides with nonzero transverse impedances. It is shown that, under certain general conditions the infinite set of equations specifying the junction scattering coefficients can be solved exactly by the residue-calculus method. Very simple expressions are then obtained between the scattering coefficients and the propagation constants γ_n and y_i of the modes in the two waveguides. These expressions, obtained previously only in special cases, are direct consequences of certain simple relations derived here for the coupling coefficients between the modes of the two waveguides. In those cases in which the scattering coefficients cannot be determined exactly, we determine them approximately by a perturbation analysis.

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