Abstracts

Mode conversion and design consideration of integrated nonradiative dielectric (NRD) components and discontinuities

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In this paper, a class of nonradiative dielectric (NRD)-guide discontinuities is studied toward the establishment of design rules of NRD-guide circuits and components for millimeter-wave applications. A mode-matching technique with a multimodal transverse resonance condition is formulated to derive a generalized scattering matrix that allows accounting for effects of higher order modes and intermode coupling. Transmission properties of an NRD structure featuring a multilayered dielectric in cross section are presented. Mode conversion and power transfer among principal NRD-guide modes are, in particular, characterized for design consideration of NRD-guide components and circuits. New sets of easy-to-use design curves are introduced, thereby allowing practitioners to choose appropriate dielectric materials and NRD-guide topologies. Equivalent-circuit models are extracted from the generalized S-matrix for some basic and practically useful discontinuities involved in the design of almost every NRD-guide component, which include open ends, junctions, steps, and gaps. Calculated results of the selected structures are found to be in a good agreement with measurements. Dispersion diagrams of periodic NRD structures are also given in this paper.

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