Abstracts

Full-Wave Analysis of Lossy Quasi-Planar Transmission Line Incorporating the Metal Modes

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We present a novel and accurate full-wave mode-matching approach to analyze the dispersion characteristics of millimeter-wave and microwave transmission lines with finite conductivity, metallization thickness, and holding grooves. The approach is quite general but only the results for a unilateral finline are presented. The accuracy of the solution depends primarily on the correct and complete description of eigenfunction expansions in each of the uniform (stratified) or nonuniform layer regions. The latter consists of metallized strips of finite conductivity, which in turn produce the so-called metal modes (eigenmodes). The metal mode exists in the metallized region with high conductivity for the most part and decays sharply in the air region. Without incorporating the metal modes, the convergence studies will fail and the accuracy of the field theory solution deteriorates. Since the accuracy of the present approach is established, the composite effects of the finite conductivity and metallization thickness can be studied rigorously. A numerical limiting case analysis shows that the mode conversion between the dominant finline mode and the dielectric-slab-loaded waveguide mode may happen through the reduction of the metallization thickness. The theoretical results for the dispersion parameters of the dominant mode propagation constant and the characteristic impedance are reported. The effects of the conductor losses using various metallizing materials are also presented.

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