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Accession number:20115114624351

Title:Field propagation in circular hollow waveguides with non-ideal metallic conductors from microwaves to terahertz frequencies

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Source title: IEEE Transactions on Microwave Theory and Techniques

Abbreviated source title: IEEE Trans. Microwave Theory Tech.

Volume:59

Issue:12 PART 1

Issue date:December 2011

Publication year:2011

Pages:3013-3022

Article number:6065772

Language:English

ISSN:00189480

CODEN:IETMAB

Document type: Journal article (JA)

Publisher:Institute of Electrical and Electronics Engineers Inc., 445 Hoes Lane / P.O. Box 1331, Piscataway, NJ 08855-1331, United States

Abstract:A general and rigorous formulation is proposed for the analysis of hollow metallic waveguides from the gigahertz to the terahertz band. The analysis is based on a hybrid mode formulation and the Drude model for the dielectric permittivity of metallic conductors. The obtained results for the circular waveguide are compared with the classical microwave approach (surface impedance approximation or Leontovich condition). The validity range of the surface impedance approximation in both the propagation constant and the electromagnetic field pattern is studied. As a consequence, a direct relation between the error in the propagation constant and the electromagnetic field configuration is shown. Moreover, this formulation shows the evolution in the field pattern: from TE/TM modes at microwaves to the so-called Surface Plasmon Polariton at terahertz frequencies.

Number of references:42