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Accession number:20120814789933

Title:Rigorous analysis of the parallel plate waveguide: From the transverse electromagnetic mode to the surface plasmon polariton

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Source title:Radio Science

Abbreviated source title:Radio Sci

Volume:47

Issue:1

Issue date:2012

Publication year:2012

Article number:RSON02

Language:English

ISSN:00486604

CODEN:RASCAD

Document type:Journal article (JA)

Publisher:American Geophysical Union, 2000 Florida Avenue NW, Washington, DC 20009, United States

Abstract:This paper presents an analysis of the parallel plate waveguide, based on a hybrid mode formulation. The nonideal metallic conductors of the waveguide are treated as a media characterized by an equivalent permittivity. The frequencies of interest in the presented analysis are at the terahertz band (from 300 GHz to 30 THz), and appropriate models are used for the correct characterization of metallic conductors at these frequencies. The behavior of the electromagnetic field of the fundamental mode is studied in a wide frequency range. At low frequencies (microwave regime) the fundamental mode is the well-known transverse electromagnetic (TEM) mode; as frequency increases, the electromagnetic field changes significantly and a surface wave or surface plasmon polariton (SPP) behavior is observed at the highest frequencies of the terahertz band. This paper shows a unified formulation that explains this transformation in the electromagnetic field behavior. Copyright 2012 by the American Geophysical Union.

Number of references:22

Main heading:Surface plasmon resonance

Controlled terms:Electromagnetic fields - Electromagnetic wave polarization - Surface waves - Waveguides

Uncontrolled terms:Appropriate models - Fundamental modes - Hybrid mode - Low frequency - Metallic conductor - Microwave regime - Nonideal - Parallel plate waveguide - Rigorous analysis - Surface plasmon polaritons - Terahertz band - Transverse electromagnetic mode - Wide

frequency range

Classification code:701 Electricity and Magnetism - 711 Electromagnetic Waves - 714.3
Waveguides

DOI:10.1029/2011RS004838

Database:Compendex

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