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Hybrid Planar - 3D Waveguiding Technologies

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ACADEMIC EDITOR

Marcos D. Fernandez
University of Castilla-La Mancha,
Spain

CO-EDITORS

José A. Ballesteros
University of Castilla-La Mancha,
Spain

Hector Esteban
Universitat Politècnica de València,
Spain

Ángel Belenguer
University of Castilla-La Mancha,
Spain

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Traditionally, high-performance communication systems were based on rectangular waveguides (RWGs) to guide high-frequency signals. Newer, efficient RWG-like systems are now available with the added value of low cost, low volume and low weight, together with compactness and ease of manufacture. These systems are based on substrate-integrated waveguides (SIWs), empty SIW (ESIW) and their multiple va...

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Chapter

Novel Filtering Applications in Substrate-Integrated Waveguide Technology

Angela Coves and Maurizio Bozzi

Abstract

The SIW technology combines complete shielding and fairly low losses with simple and cost-effective manufacturing, thus representing the ideal platform for the development of the next generation of wireless systems, including the band-pass filters among them. In this chapter, a number of novel SIW filter configurations will be presented to improve the filter performance, reduce losses, and minimize the filter footprint. To this end, different topologies of band-pass filters in SIW technology will be described based on stepped-impedance configurations (with high and low dielectric constant sections) making use of the impedance inverter model, extending this concept to half-mode SIW structures, with the aim to reduce the size of the filters.

Keywords: filters, substrate-integrated waveguide (SIW), effective permittivity

1. Introduction

Substrate-integrated waveguides (SIWs) are planar structures that emulate a dielectric-filled rectangular waveguide (RWG) in a single circuit board, in which the lateral metallic walls are replaced with a periodic array of metallic vias (see **Figure 1**) [1, 2]. Thus, SIWs are good candidates to be used as building blocks for the implementation of microwave waveguide filters with different topologies, benefiting from the advantages of such technology (mainly low cost and easy integration), combined with the well-known advantages of conventional rectangular waveguides (complete shielding and high-power-handling capability).

In the following sections, we begin analyzing the main properties of ordinary SIWs with the homogeneous substrate, and those whose substrate is periodically loaded with either cylindrical air holes or with metallic cylinders, thus achieving a reduced/higher effective permittivity, respectively. After that, different topologies of band-pass filters in SIW technology are briefly described, starting from classical iris-type SIW filters and moving to more novel topologies, consisting of step impedance filters based on high and low dielectric constant sections, extending this concept to half-mode SIW structures, with the aim to reduce the size of the filters, showing in all cases good performances in terms of insertion and return losses in their passbands, along with deep and wide rejection bands.

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