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Enhanced Feeding Structure of Microstrip Antenna

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SUMMARY In this paper, A waveguide-fed slot-coupled microstrip antenna is proposed as enhanced feeding structure of microstrip antenna and an analysis is presented. The presence of dielectric substrate between a strip and a slot is explicitly taken into account in this analysis. The evaluation of the antenna characteristics is carried out using the method of moments and the spectral domain approach in terms of the electric current distribution on the strip and the magnetic current distribution on the slot.

key words: *microstrip antenna, waveguide feeding, slot coupling, method of moments*

1. Introduction

Microstrip antennas have been widely used in a broad spectrum of applications, due to their inherent advantages like low volume and ease of production. On the contrary, they have disadvantages of having high feeding loss and handling only low power because of dielectric substrates. Waveguide slot antennas have merits of low loss and are also commonly used as the basic elements of the planar array antennas, especially at need of high power [1], [2]. In this paper, we propose and analyze a new feeding structure of microstrip antenna. It is a combination of a microstrip and a waveguide-fed slot [1], leading to better performance. This proposed structure has dielectric slab for enhancing antenna characteristics with a strip on it.

Some article has reported that a strip on a slot behaves like a second radiating element so that the antenna characteristics are enhanced [3]. However, it used an ideal current source and dipole on the infinite conducting screen without substrates instead of the real radiating structure like a waveguide-fed slot and a strip on the dielectric. Also a strip-dipole-loaded waveguide slot antenna having similar structure has been proposed for making circularly-polarized wave [4]. However, it did not consider the effect of the dielectric slab on the antenna performance.

The structure presented here has a dielectric substrate between the strip and the waveguide-fed slot, which is taken into account in this paper. For this purpose, spectral domain Green's functions which describe the presence of dielectric are used [5], [6]. Also, we use Stevenson's Green's function inside the waveguide to give the field on the slot [2]. In consequence, simulation results show the antenna characteristics in the more realistic case.

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2. Procedure of Analysis

The structure to be analyzed is illustrated in Fig. 1 which shows a broad wall slot of size $2ls$ by ws, offset x_0 from side wall, with a strip of size $2ld$ by wd above the slot. As depicted in Fig. 1, the rectangular waveguide of size a by b is filled with air and the thickness of dielectric substrate is d. The broad wall with the slot is assumed to be a infinite conducting plane and its thickness to be negligible, for it is possible to use the ground plane of microstrip structure as a top broad wall with slot aperture.

In order to obtain coupled equations, we find the magnetic field on the slot aperture as a function of the magnetic surface current M which is equivalent to the tangential electric field on the aperture and the electric surface current J on the strip using appropriate Green's functions. On the strip, we also express the electric field as a function of M and J. Stevenson's Green's function is used inside the waveguide and

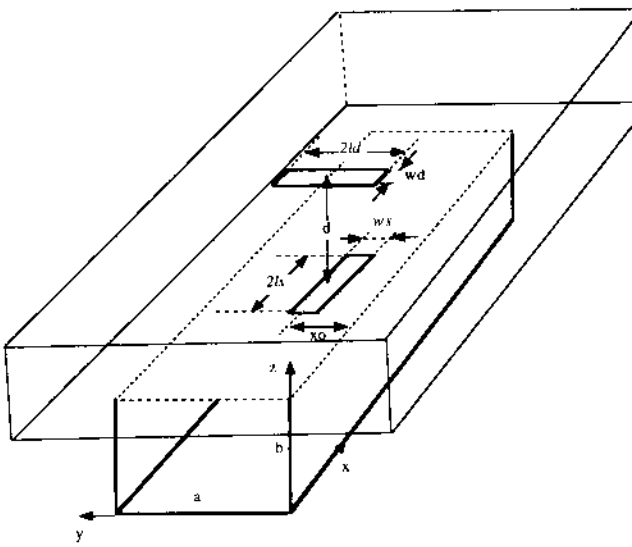

Fig. 1 Structure of waveguide-fed slot-coupled microstrip antenna.