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ANALYSIS MODEL FOR THE MICROSTRIP SLOT ANTENNA.

A. Van de Capelle (°),D. Amandt,J. Hermans.
K.U.Leuven, Dept. of Electrical Engineering, Div. M.I.L.
B-3030 Heverlee, Belgium.

Introduction.

Several types of microstrip slot antennas has been studied, ref. 1,2.These configurations have the disadvantage to need a feedline for each radiating slot.

In this paper we present an analysis model for a radiating slot excited by a non terminated microstripline, fig. 1.

Analysis Model.

The model is an extension of the well-known method for the analysis of the radiation by a slot in a waveguide, ref. 3.

We consider the structure of fig. 1.Assuming a slot at resonance,it can be shown that the slot acts as a series resistance R (fig.2),so that the power radiated by the slot is equal to the power dissipated in R.By application of the Lorentz reciprocity theorem the resistance can be written as a function of the field in the slot,the magnetic field along the microstripline and the radiation conductance.

The magnetic field along the microstripline is determined with the method of Denlinger,ref.4.The calculation of the value of the resistance R requires a normalisation of the magnetic field,which is possible with the Parseval theorem.

For the field distribution in the radiating slot several hypotheses has been examinated.For each proposed field distribution the radiation pattern,the directivity and the radiation conductance are derived with the aperture theory.Comparing these theoretical results with experiments the most significant hypothesis has been selected.

Results.

The experiments are carried out with microstrip slot antennas realised with conventional photo-etching techniques on PTFE-substrates with a thickness of 0.79 mm and a relative permittivity of 2.25.The characteristic impedance of the feedline is 50 ohm.

(°) A. Van de Capelle is a qualified researcher of the National Foundation of Scientific Research of Belgium.

A radiating slot, resonant at 9.75 GHz, with dimensions 30 mm length and 9.6 mm width will be analysed here in detail.

The magnetic field along the microstripline at the resonance frequency is presented in fig.3. The field distribution in the radiating slot is a |20|-mode, shown in fig.4. In fig.5 we compare the theoretical values of the reflection coëfficient Γ, the equivalent resistance R and the directivity D for the proposed |20|-mode with the measured values, and fig.6 gives a comparison of the calculated radiation pattern for the |20|-mode with the experimental pattern. The agreement between theory and measurements is quite good. In the E-plane there is an oscillation on the radiation pattern because of the finite size of the substrate.

Conclusion.

A new analysis model is presented for the microstrip slot antenna. The model is simple and easy to use for analysing a single as well as an array of radiating slots feed by the same microstripline.

References.

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(3) R. Collin and F. Zucker, "Antenna Theory, Part 1.", pp.602-610, Mc Graw Hill, 1969.

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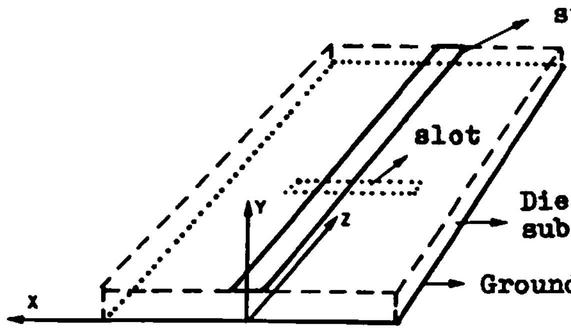


Fig.1 A single slot fed by a microstripline

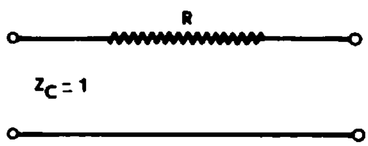


Fig.2 Equivalent circuit

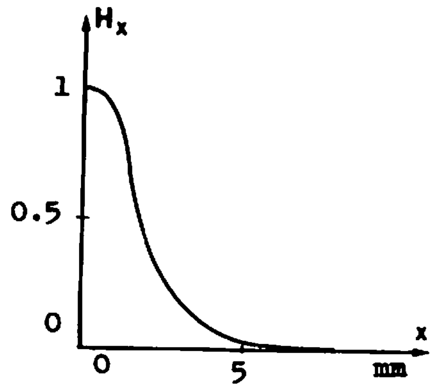


Fig.3 The magnetic field along the microstripline

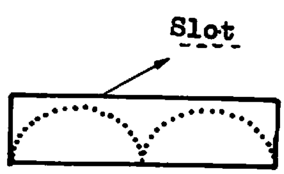
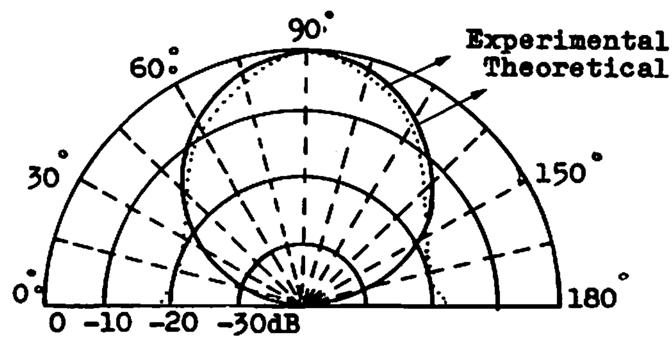


Fig.4 the|20|-mode

RESULTS	r	R	D (DB)
Theoretical	0.24	0.65	6.8
Experimental	0.21	0.53	8.1

Fig.5 Results

H-plane pattern



E-plane pattern

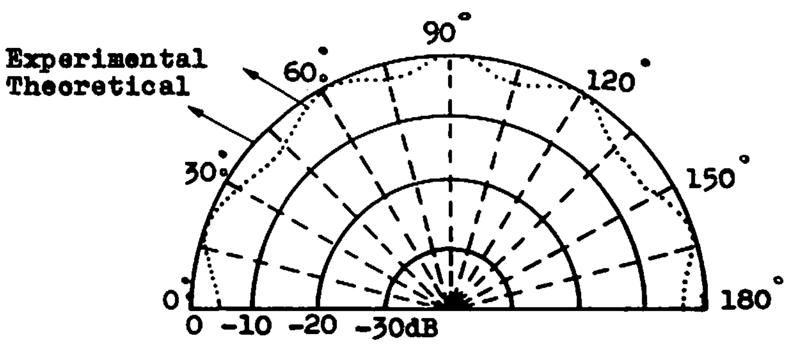


Fig.6 Radiation patterns