SESSION 5: COMPONENT APPLICATIONS OF FIELD THEORY

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Field theory is continually being applied to useful component-oriented structures. The use of planar transmission line technology and miniaturized packaging demands an ever-increasing need for field solutions to produce scattering parameters, coupling coefficients, impedance parameters, radiation, etc. at the component-transmission line interface. This session on "Component Applications of Field Theory" treats a wide variety of components associated with five different types of transmission media (dielectric image guide, non-radiative dielectric waveguide, dielectric planar waveguide, microstrip, and rectangular waveguide). The material is directly applicable to making filters, antennas, bias circuits, and guiding structures for millimeter waves and integrated optics.

The first paper, authored by P. Guillon and F. Farzaneh, presents a study of the coupling between a dielectric image guide and the $TE_{0\gamma\delta}$ cylindrical dielectric resonator mode. A lumped equivalent circuit of the component is given and the coupling coefficient is evaluated.

A paper by Sanchez and Oliner shows that a recently introduced variant of H guide, a non-radiative dielectric waveguide, can be made leaky by foreshortening the length of one of the sides. The resulting leaky wave structure lends itself well as a novel antenna for millimeter wavelengths. An almost rigorous microwave network analysis is presented of the leakage constant of the structure, and the results are shown to compare very well with measurements.

Shigesawa and Tsuji will present a paper dealing with the dielectric step junction discontinuity, which is a basic constituent of many guiding structures for millimeter waves and integrated optics. Analyses of scattering by such step discontinuities have shown slow convergence rates, particularly for oblique incidence and for open waveguides. This paper presents a new technique involving an edge condition that permits much faster convergence rates, thereby resulting in a much improved and practical procedure for calculating the reflected, transmitted, and radiated power from the step.

Giannini, Sorrentino, and Vrba will present a planar circuit analysis of microstrip radial line stubs, which serve as low impedance (10 - 20 ohms) stubs for low-pass filters, bias filter elements, mixers, etc. Effective dimensions and permittivities for the magnetic wall model are first derived for each of the TM resonant modes of the structure. Then the input impedance is expressed in terms of the stub's wavenumber, the eigenvalue of the TM_{on} mode, and the coupling coefficient between the TM_{on} mode of the microstrip feed line and the TM_{on} mode excited in the stub. The computed input reactance is shown to be in good agreement with experiment.

The final paper of this session is authored by Shih, who has derived a variational formula for the reflection coefficient of inductive strips in rectangular waveguide. Unlike some previous methods dealing with this component, a carefully chosen estimate of the current distribution function on the strip provides accurate results for a wide strip without using complex matrix manipulations. These inductive strips in waveguide have been successfully used for high-Q bandpass filters at microwave and millimeter wave frequencies.

0149-645X/84/0000-0187 $01.00 © 1984 IEEE