

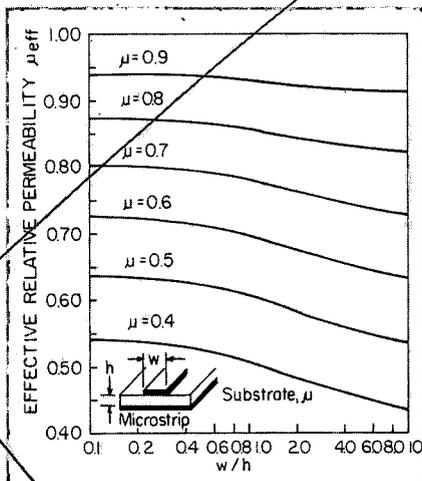
1972

Gloria

Magnetic substrate design made easy

Up until now there were no design graphs for microstrip on ferrite and Garnet substrates. In "Microstrip Propagation on Magnetic Substrates—Part I: Design Theory, and Part II: Experiment," (*IEEE Trans. on MTT*, Vol. 20, No. 5, May, 1972, pp. 304-313), R. A. Pucil and D. J. Masse have eliminated this problem. They present formulas and graphs for the effective relative permeability and the filling factors of magnetic substrates in microstrip.

After a review of the formulas for dielectric substrates, a duality relationship for magnetic substrates is derived based on the duality of k and $1/\mu$ in Maxwell's equations and a TEM approximation for the magnetic case. Wheeler's filling factor analysis is then used to get a magnetic filling factor. It is not necessary to solve for the magnetic field distribution in the microstrip. The figure shows the effective relative permeability of the magnetic substrate microstrip as a function of the system geometry.



Permeability varies with the strip conductor dimensions. It can be shown that μ_{eff} is bracketed by

$$\mu < \mu_{eff} < \left(\frac{2\mu}{1 + \mu} \right)$$

Experimental data verifying the theory is obtained with ring resonators printed on various magnetic substrates. All ferrite losses are accounted for.

Can microwaves hurt?

This question is clearly of interest to the readers of *MicroWaves*. Unfortunately, we really don't know the answer at the lower power levels. In "Human Exposure to Non-ionizing Radiant Energy-Potential Hazards and Safety Standards," (*Proc. IEEE*, Vol. 60, No. 4, April, 1972, pp. 389-421), S. M. Michaelson sheds some light on the

controversy between thermal and non-thermal effects. He reviews all the current theories of tissue-microwave interactions, critical organs, perception and threshold problems and protection guides. He comes out for retention of the 10 mW/cm² standard and reminds us that we lack sufficient data for "rational and informed decisions."

Analyze time-varying linear networks

Time-varying networks appear in the microwave technology in the form of diode modulators, parametric amplifiers, harmonic generators, etc. The circuit designer is often faced with the task of designing one of these linear two-port networks with both time-varying and time-invariant elements. When the elements can be lumped and vary periodically, a form of spectral analysis can be used and a general matrix description of the two-port can be derived which is particularly useful for computer aided design.

In "Spectral Analysis of Periodically Time Varying Linear Networks," (*IEEE Trans. on CT*, Vol. 19, No. 3, May, 1972, pp. 297-299), B. J. Bardakjian and M. Sablatash have derived a matrix approach to the network which has both periodically time-varying and conventional time-invariant elements. With this matrix you can use the well-known ideas of "normal" linear two-port network theory.

The derivation uses operator theory and Fourier Analysis. A simple parametric capacitance is used as an example.

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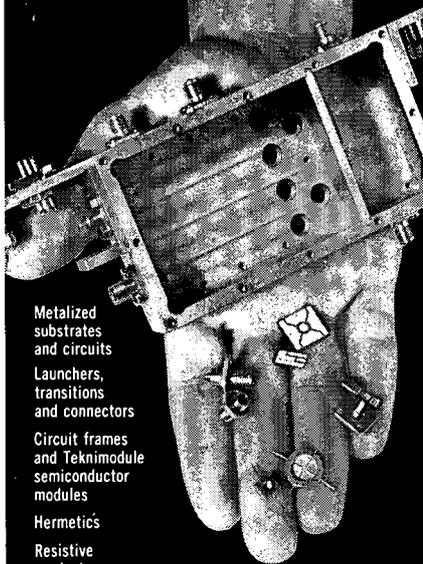
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READER SERVICE NUMBER 23

editorial

In union there is strength

The application of technology to society in this country cannot truly be said to be guided by free market economics. Some of our largest technological institutions receive nearly 90% of their financing from the Government. Government decisions have a heavy bearing on the electrical engineer's salary and working conditions, and even on the geographical locale in which he lives.



The time has come to respond to the growing interdependence between technical progress and social needs. The demands of his work too often preclude the engineer from devoting much time to this topic. A strong organization can help him use his time more efficiently. An IEEE committee chaired by William E. Cory, director of Electronic Systems Research at the Southwest Research Institute in San Antonio, Texas, has now recommended several specific steps which the IEEE could take in this direction. These proposals, discussed in the February '72 issue of *Spectrum*, call for contact between IEEE sections and Government, socially oriented papers in IEEE journals, official participation in public spirited international bodies, and lobbying for tax structures fostering better use of our resources.

The microwave engineer should give careful consideration to the Cory report, and vote in September on the new amendment to the IEEE constitution permitting IEEE entry into nontechnical fields. He might also send his suggestions to Mr. Cory, P.O. Dwr. 28510, San Antonio, Texas 78284.

Roger J. Becker
Associate Editor

We're now ten

This is the tenth anniversary of MicroWaves. Over the years we have dedicated ourselves to helping you, the microwave engineer, to do your job more effectively. Sincere thanks are due you, our readers and our advertisers, who have supported us. We look forward to serving you in the future.

Richard T. Davis
Managing Editor