

# **PRINCIPLES OF MICROWAVE CIRCUITS**

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# PRINCIPLES OF MICROWAVE CIRCUITS

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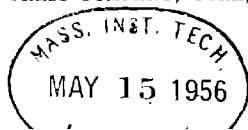
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# *PRINCIPLES OF MICROWAVE CIRCUITS*

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FEB 20 1964



## *Foreword*

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THE tremendous research and development effort that went into the development of radar and related techniques during World War II resulted not only in hundreds of radar sets for military (and some for possible peacetime) use but also in a great body of information and new techniques in the electronics and high-frequency fields. Because this basic material may be of great value to science and engineering, it seemed most important to publish it as soon as security permitted.

The Radiation Laboratory of MIT, which operated under the supervision of the National Defense Research Committee, undertook the great task of preparing these volumes. The work described herein, however, is the collective result of work done at many laboratories, Army, Navy, university, and industrial, both in this country and in England, Canada, and other Dominions.

The Radiation Laboratory, once its proposals were approved and finances provided by the Office of Scientific Research and Development, chose Louis N. Ridenour as Editor-in-Chief to lead and direct the entire project. An editorial staff was then selected of those best qualified for this type of task. Finally the authors for the various volumes or chapters or sections were chosen from among those experts who were intimately familiar with the various fields, and who were able and willing to write the summaries of them. This entire staff agreed to remain at work at MIT for six months or more after the work of the Radiation Laboratory was complete. These volumes stand as a monument to this group.

These volumes serve as a memorial to the unnamed hundreds and thousands of other scientists, engineers, and others who actually carried on the research, development, and engineering work the results of which are herein described. There were so many involved in this work and they worked so closely together even though often in widely separated laboratories that it is impossible to name or even to know those who contributed to a particular idea or development. Only certain ones who wrote reports or articles have even been mentioned. But to all those who contributed in any way to this great cooperative development enterprise, both in this country and in England, these volumes are dedicated.

L. A. DuBRIDGE.





## Preface

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IN THE engineering application of low-frequency currents, an important step forward was the development of the impedance concept and its utilization through the theory of linear networks. It was almost inevitable that this concept would be generalized and become useful in the application of microwaves. This volume is devoted to an exposition of the impedance concept and to the equivalent circuits of microwave devices. It is the intention to emphasize the underlying principles of these equivalent circuits and the results that may be obtained by their use. Specific devices are not discussed except as illustrations of the general methods under consideration. These devices and the details of the design procedure are treated in other volumes of this series. The solutions of the boundary-value problems which give the susceptances of microwave-circuit elements are likewise omitted. The results of such calculations that have been performed up to the present time are compiled in Vol. 10, the *Waveguide Handbook*, and these results are used freely. Although the work of the Radiation Laboratory at MIT was the development of military radar equipment, the principles discussed in this volume can be applied to microwave equipment of all kinds.

THE AUTHORS

NEW HAVEN, CONN.,  
February, 1947.



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