CIRCUIT THEORY OF ELECTRON DEVICES

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PREFACE

THIS BOOK HAS BEEN WRITTEN PRIMARILY FOR COLLEGE AND UNIVERSITY students. Most of the material included in the book has been used during the past ten years in note form by students enrolled in the electrical engineering and engineering physics curricula at The Ohio State University. Course prerequisites have included mathematics through differential and integral calculus, one year of physics at the sophomore level, and one year of work in circuit theory including some treatment of differential equations, transients, and Fourier series. The material is sufficient for a two-semester course and has been used at The Ohio State University during the last quarter of the third year and the first quarter of the fourth year of the electrical engineering curriculum.

The fundamental emphasis of this book is devoted to the circuit theory and not to the physics of electron devices. It is believed that analysis for the beginning student of electron devices should be limited *at first* to the circuit properties of the device, properties that can be determined by measurements at available terminals. Analysis of more difficult internal complexities may be deferred until circuit experience, confidence, and additional maturity have been developed by the student. The usual background of mathematics, physics, and electric circuit theory available to the third- or fourth-year engineering student serves quite well as preparation for the initial linear circuit theory of electron devices, but is inadequate for a thorough appreciation of an analysis carried to the level of electron dynamics and electron emission theory. These ideas based upon experience in years of teaching have led to the arrangement of this book. Some electron and ion physics is, of course, necessary, but this material has been integrated in the circuit theory where needed and is usually sufficient to satisfy the natural curiosity of the thorough student. At The Ohio State University, the material of this book is followed by course material devoted primarily to the physics of electron devices including field theory, electron dynamics, kinetic theory of gases, noise phenomena, and electron emission theory. By the time this more difficult material is presented the student has made con-

siderable progress in his understanding of the electron device as a circuit component and is prepared to appreciate an analysis of the internal complexities of the device.

The vacuum tube and the transistor as operated in the linear region of their characteristics have been treated in this book as four-terminal networks using the generalized admittance or impedance parameters of four-pole theory. This method was suggested to me by Mr. J. A. Morton of the Bell Telephone Laboratories. Much of the philosophy of presentation of the material of this book and some of the material as well have resulted from conferences and correspondence with Mr. Morton. It is a pleasure to acknowledge my indebtedness to him.

I am sincerely grateful to my colleagues at The Ohio State University for their many constructive criticisms and suggestions, and to students whose questions have often led to an improvement in presentation. Professor E. E. Dreese, chairman of the department of electrical engineering, has consistently encouraged the completion of the book and has offered valuable suggestions for its improvement. I am indebted to Professor W. G. Dow of the University of Michigan for introducing me to the field of electronics and for his continued interest in and appraisal of this book. All of the typing and processing of notes and manuscript involved in the preparation of this book has been done by Genevieve E. Bohrman whose skillful assistance has been invaluable and is gratefully acknowledged. It also seems appropriate to acknowledge my debt of gratitude to my wife, Nevada, for her encouragement and for her patient acceptance of the encroachment of manuscript preparation upon free time.

E. MILTON BOONE

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