THEORY OF THERMIONIC VACUUM TUBE CIRCUITS

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PREFACE

The purpose of this treatment of thermionic vacuum tube circuits is to develop conventions and methods which may be used in treating electrical networks and systems containing trielectrode devices. The topics and the circuits which might be discussed in a treatise on triode circuits are almost endless in number, and this book does not aim to cover them all. While most of the fundamental topics are covered, the main aim of the book is to impart to the reader a knowledge of fundamental theory and a familiarity with methods of attacking problems so that he can investigate systems and circuit arrangements other than those discussed in the book. It naturally follows then that the circuits and topics which are treated are those which best illustrate and fix in the mind of the reader the methods and conventions used in arriving at the performance of triode circuits.

The plan is to take the characteristic curves of the triode as a starting point and to develop the methods by which it is possible to predict from these curves the performance of the device in an electrical network. The book introduces four fundamental triode constants to treat those situations in which operation takes place over portions of the characteristic curves which are essentially straight lines. Two of these four constants were originally introduced into the discussion of triode circuit equations by Prof. Edward Bennett of the University of Wisconsin. One of these constants, the controlled grid conductance, is the ratio of the change in grid current to the change in plate voltage when the grid voltage is maintained constant. This ratio is relatively small and in many cases equal to zero for modern vacuum tubes which have a high vacuum. In an investigation, however, carried on in 1917 by Professor Bennett at the University of Wisconsin on the properties of open-air amplifiers, using the corona formation as a source of ions, this ratio was a relatively important one and it is therefore introduced for the sake of completeness of treatment.

The author follows the system of nomenclature for constants adopted by Professor Bennett. In this system of nomenclature the ratio of the change in plate current to the resulting change in grid voltage when the plate voltage remains constant is called the controlled conductance of the plate by the grid, or briefly the controlled plate conductance. It is common practice elsewhere to call this constant the mutual conductance. This name is rejected because this quantity is in no accepted sense of the word a mutual one. If it were, it should equal the controlled grid conductance defined above. We have enough misnamed quantities in electrical engineering theory now without deliberately adding another to the list.

The third chapter introduces the idea of describing certain triode circuit phenomena as resistance neutralization. This idea is then used as a unifying thread to tie together the material presented in Chaps. II, IV, V, VI, and VIII. This method of presentation is a powerful aid in the establishing of a unity of viewpoint for the treatment of diverse phenomena.

I wish to express my indebtedness to Prof. Edward Bennett for the helpful suggestions which he has given during the writing of this book and also to Glenn Koehler for the experimental data which he furnished in connection with the calculations of the performance of amplifier circuits.

LEO JAMES PETERS.

MADISON, WISCONSIN,
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