

Preface

This book is the second volume in the Principles of Electrical Engineering series described in the Foreword, and extends into another field the circuit theory begun in the first volume. Computation of magnetic-circuit performance, principles associated with the concepts of interlinked electric and magnetic circuits, and their application to the analysis of transformers are the essential subject matter.

Like the other volumes in this series, this book is intended for a first basic course. Emphasis, hence, again is placed on fundamental principles important to students of electrical engineering regardless of what their special fields ultimately may be; both power and communication problems are considered. Rigor of thought and analysis rather than extensiveness of scope is likewise the intended feature of this book.

The treatment assumes that the reader has knowledge of electric-circuit theory as given in the first volume of the series or in other textbooks on a similar level. Mathematics through differential equations is freely used; not, however, as a substitute for the explanation of physical phenomena but rather as a means of describing quantitatively their consequences. Parallel to the mathematical analysis, explanations are given in terms of physical interpretations.

The text is divided into two parts. Part I, "Magnetic Circuits," starts with a discussion of the current theory of ferromagnetism, derives the magnetic-circuit concept, and continues with development of the fundamental principles for computation of the behavior of magnetic circuits. A chapter is devoted to discussion of iron-core reactors by means of model theory — a method of analysis of great power whenever nonlinear phenomena are involved. A brief summary of thermal-circuit problems is also included. Part II, "Transformers," begins with a short discussion pointing out that the theories from which the characteristics of all electric apparatus can be computed are developed through the combination of the fundamental concepts of the electric, dielectric, magnetic, thermal, and mechanical circuits contained in them, and that costs and other practical matters are of paramount importance in their influence on the development of electric apparatus. Part II then continues with a study of the applications of these general principles to transformers. The theory of transformers is developed both from the resolution of their magnetic fields into leakage and resultant mutual components and from the classical

theory of coupled circuits, the interrelations between the two methods of analysis being emphasized.

Although the text is by no means exhaustive in any one field, nor is it intended to be a design book, an attempt has been made to discuss a variety of representative practical problems in both the heavy-current power and the light-current control, measurement, and communication applications of magnetic materials and transformers. As in the other volumes of the series, more material than is usually covered in a first course is presented, to provide for additional study by particularly apt or advanced students, and to increase the usefulness of the text as a reference book.

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