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Introduction to
**ELECTRICAL
MACHINES**

A. R. Daniels

University of Bath

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MACMILLAN

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First published 1976

Reprinted 1978, 1979, 1982, 1985

Published by

Higher and Further Education Division

MACMILLAN PUBLISHERS LTD

Houndmills, Basingstoke, Hampshire RG21 2XS

and London

Companies and representatives

throughout the world

ISBN 978-0-333-19627-4

ISBN 978-1-349-15689-4 (eBook)

DOI 10.1007/978-1-349-15689-4

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Preface

The attention given to the study of the performance of electrical machines has, in recent years, been reduced in many higher-education courses. Developments have taken place which, in the early stages, emphasize the similarities, rather than the differences, between the various machine types. In preparing this text, a basic approach to the formation of operating equations has been made using the concept of a so-called 'general machine' whose operation covers all the well-established different machine types. In this manner, the concepts of synchronous and asynchronous operation and the action of both a.c. and d.c. commutator motors are introduced at the earliest possible stage. Since the action of all electrical machines depends on energy storage in a coupling field, a simplified treatment of electro-mechanical energy conversion has been included.

Once the common principles governing the operation of all forms of electrical machine have been established, each different machine type is dealt with separately in a conventional manner. Modern teaching courses take place at a rapid pace and the salient facts in the basic analysis of each machine type are considered first in each chapter. In this way, more advanced topics in certain chapters can be omitted without disrupting the continuity of the text. The first section of the book (chapters 1–3) considers general principles and also deals with winding arrangements. The performance of the transformer and the various machine types is considered in the next section (chapters 4–8) and the final section (chapter 9) deals with the characteristics and application of the power thyristor when used to control the speed of both d.c. and a.c. motors.

Throughout the text, distinction between phasor and scalar quantities is made by the use of bold type to designate phasors. In the particular case of phasor diagrams which, in any case, always depict phasors, bold type is not used. A simple circuit convention for a source of energy (generator) and for a sink of energy (motor) is used throughout the text. This particular convention is only one of many possible conventions and its only requirement is that it should be correctly and continuously applied.

I would like to thank the Council of the University of Bath for permission to use past examination papers. Any dedication made must be to my past students, all of whom survived after treatment with the material contained in this textbook.