MATHEMATICS FOR CIRCUITS

INTRODUCTORY MONOGRAPHS IN MATHEMATICS

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MACMILLAN EDUCATION

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MACMILLAN AND COMPANY LIMITED
St Martin's Street London WC 2
also Bombay Calcutta Madras Melbourne

THE MACMILLAN COMPANY OF CANADA LIMITED
Toronto

ST MARTIN'S PRESS INC
New York

ISBN 978-0-333-00961-1 ISBN 978-1-349-00072-2 (eBook)
DOI 10.1007/978-1-349-00072-2

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PREFACE

A member of the Royal Society once wrote

‘ . . . besides the great delight and pleasure there is in these mathematical and philosophical enquiries there is also much real benefit to be learned, particularly for such gentlemen as employ their estates in those chargeable adventures of draining mines, coal-pits etc. . . . ’

This is enough to make any mathematician throw up his hands in horror; but it is a hard fact that the elegant language of mathematics has become the medium through which the scientist and engineer express their problem in a quantitative fashion. Mining engineering may have been uppermost in the mind of our seventeenth century philosopher but the sentiments expressed apply to every branch of applied science.

Electrical engineering is one branch in which the subject matter may be broadly divided under two main headings: the study of field theory, and the study of circuit theory. Each facet requires a sound knowledge of mathematical principles: each requires the same basic approach. First, an appraisal of the nature of the problem, second, a knowledge of the physical laws relating to the particular study in hand, third, the setting out in mathematical form of the relationships which describe the mode of behaviour of the system, and finally, the extraction of an intelligent solution.

It is in respect of this final point that the broad training in engineering is of such vital importance. In the analysis of a circuit problem, for example, it may very well be that two or more solutions will be found in calculating the value of a particular component: it may equally well be that the use of one of the possible values will result in the circuit becoming a charred mass on being put into service. In other words, at least one function of the engineer is to accept the advice offered by the mathematical solution and reject that which is quite irrelevant.

In the following text there is an introduction to the ways in which certain well-known mathematical processes may be applied to circuit theory. An attempt is made to show how simultaneous equations, differential and integral calculus, certain forms of differential equation and complex numbers all find application in a study of networks.

There is an indication that mechanical systems may have the same form of response as certain networks simply because the equations which describe their respective modes of behaviour are identical.

There can be no great depth of study in such a short introductory text; many volumes have already been written and will continue to be written about the response of networks to certain forms of disturbance. This is simply a brief indication of the kind of tools which are necessary to any student of engineering before a deep and detailed study of the subject can be attempted.

I should like to express my gratitude to Mr. A. J. Moakes and Mr. E. H. Williams for the extremely helpful and constructive suggestions which they have made, and to Miss E. Dewdney for preparing the final draft.

1963

W. J. C.