APPLICABLE MATHEMATICS

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A COURSE FOR SCIENTISTS AND ENGINEERS

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PREFACE

This book is primarily intended to serve the mathematical needs of students following introductory courses in engineering and the physical sciences, up to graduate level. The initial standard of knowledge assumed is that of 'A' level or O.N.C. mathematics, and the book is designed to provide an introduction to those branches of pure mathematics which have widespread applications in industry and research.

The typical student for whom this book is intended is likely to look upon mathematics mainly as a means to an end. We feel that it is nevertheless unfortunate if, as happens all too often, his mathematical armoury consists merely of a collection of unrelated techniques which he uses under appropriate (and possibly under inappropriate) circumstances. We have tried to avoid this situation by providing a background of mathematical analysis which will serve to unify the subject matter and to provide the reader with sufficient mathematical insight for his successful application of the methods described. This analytical material is contained in chapters 2, 3, 4 and 5 and, since the treatment it receives is rather more thorough than is customary in books for non-specialists, readers will undoubtedly find these chapters more difficult than the remainder of the book. However, a detailed knowledge of the entire content of the four analytical chapters is not a pre-requisite for reading those which follow; in particular, certain sections marked with an asterisk may be omitted on a first reading since their prime relevance is to more advanced topics. The analytical part of the book is also designed to provide a useful source of reference for students going on to post-graduate studies and applications involving more advanced mathematics. The remaining chapters cover number systems, polynomials and their applications, linear algebra, ordinary differential equations and vector algebra. These non-analytical chapters need not be read in numerical order; they all draw on material from the analytical section, but are otherwise largely self-contained.

Computers play an essential rôle in the solution of contemporary practical problems, and we have endeavoured to avoid the usual artificial division between numerical methods and the rest of mathematics by introducing related analytical and numerical techniques side by side. Notes and references are given at the end of chapters, pointing the way to more advanced studies along the same lines and indicating some possible applications. Many exercises are included, some routine, others developing the theory a stage further. For the most part, specific physical examples have been omitted, because students studying different disciplines do not all find the same physical examples relevant. Further, we feel that examples

of this nature are best provided in the context of a student's specialist studies, since their physical aspects can sometimes distract attention from the underlying mathematics.

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