In a book having so wide a coverage there is a serious risk that the treatment of some topics may be so sketchy or superficial as to be almost valueless. The risk can be minimized by very careful selection of material, meticulous attention to its presentation and care to direct the reader's attention, wherever necessary, to its limitations. Prof. Chard has satisfied these criteria to a remarkable degree. The presentation is clear and precise at those levels of difficulty at which this is practicable; but in those instances in which the logic of the step cannot be demonstrated this is stated. References at the end of each chapter direct the reader to more detailed and advanced treatments of the various branches of the subject. The standard of mathematics utilized comes well within the compass of an undergraduate course in electrical engineering.

This book should be of real service to undergraduate electrical engineers, not on account of its presenting topics in a particularly novel way, nor because it offers material not otherwise readily available, but because it selects and treats in one volume the range of phenomena which are of the greatest significance in the behaviour of a power system.

In a foreword written by Mr. J. L. Egginton, chief transmission engineer of the Central Electricity Generating Board, it is pointed out that a comprehensive introduction to power system problems, such as this, has a real value also to practising engineers who are not specialists but who require, for purpose of reference, a sound, general treatment.

The book is well printed and produced, the clarity of the diagrams and the mathematical portions of the text being particularly good. JAMES GREIG

GYROSCOPIC PHENOMENA

Gyrodynamics and Its Engineering Applications

By Prof. Ronald N. Arnold and Prof. Leonard Maunder. Pp. x+484. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1961.) 100*s*. net.

FOR many years gyroscopes have been used in stabilizers and compasses for ships and aircraft and, although some interesting alternatives are being investigated, there appears to be no prospect of gyroscopes being displaced by other devices during the next decade. In recent years there have been spectacular improvements in constructional techniques which have led to the practical attainment of systems of great precision; inertial navigation, which is dependent on gyroscopes having drift-rates of a few minutes of arc per hour is now in use in ships, aircraft, missiles and land-vehicles.

Elementary theory which can be used to explain simple gyroscopic phenomena is insufficient for an adequate understanding of the problems that arise with these more precise systems, and this book will be of great value to those who wish to study the subject fully. The treatment is mathematical, and the authors expound the view that the majority of readers will profit more from this approach than from physical reasoning alone. There is a great deal of truth in this; however, the book does not neglect practical applications or the physical interpretation of the analytical results. The reader is required to be able to handle linear differential equations.

The book is based on lectures given in the Post Graduate School of Applied Dynamics in the University of Edinburgh, and in the early chapters there is an air of a class 'brushing up its dynamics'. It is somewhat surprising to find in a book which will, in general, be read by graduate engineers an exposition of Newton's laws of motion or an introduction to vectors, but it is by no means merely a collection of lecture notes. The first six chapters deal with classical dynamics and much of this matter will be familiar to the reader. Nevertheless they are easy to read, and may be found useful for reference.

The remaining ten chapters, which form the bulk of the book, are concerned with gyroscopic phenomena and systems utilizing gyroscopes. Much of this is new or has not been collectively published and, in addition to being of considerable value to the engineer concerned with design and development of these systems, it will be of general interest to a wider circle of readers. The Coriolis acceleration and its effects are treated clearly and fully and there is a comprehensive analysis of the behaviour of several gyroscopic configurations. The ship's gyrocompass is discussed in some detail (nearly 40 pages are devoted to it), and as a natural follow-on from gyroscopic vibration absorbers the early Schlick and Sperry ship's gyrostabilizers are briefly analysed and compared. These devices are, of course, of no practical interest to-day, and it must be assumed that the authors included them solely because of their analytical interest. There is a brief (rather too brief) chapter on gyroscopic effects in aircraft, but no reference to autostabilizers or autopilots (in which the gyroscope plays an important part).

Inertial navigation is treated at considerable length. There is intensive activity within many countries in this subject for military application and the outcome of much of the work is not freely available, but the basic principles and problems are clearly set down in this book, and the reader who has mastered it will be well equipped for further work in this field.

The book's value to the student is enhanced by the inclusion of a set of problems relating to each chapter. W. O. BROUGHTON

DERIVATION OF ASYMPTOTIC EXPANSIONS

Asymptotic Approximations

By Prof. Harold Jeffreys. Pp. 144. (Oxford: Clarendon Press; London: Oxford University Press, 1962.) 30*s*. net.

THIS is an introductory tract on asymptotic approximations in which special emphasis is placed on uniformity of approximation over regions in the complex plane. A brief chapter covering Poincaré's definition, multiplication, division, integration and differentiation of asymptotic series is followed by the central core of the work, a closely related group of four chapters dealing successively with the derivation of asymptotic expansions for a function expressed as a definite integral (mainly by steepest descents), the derivation of asymptotic expansions of Stokes and Green types for a function satisfying a given linear differential equation of the second order, application to Bessel functions, and applications to confluent hypergeometric and parabolic cylinder functions. The remainder of the text consists of short chapters on Mathieu functions, estimation of the remainder in an asymptotic expansion, and wave problems in three dimensions.