

### Friction and Lubrication

By Dr. F. P. Bowden and D. Tabor. (Methuen's Monographs on Physical Subjects.) Pp. x+150+7 plates. (London: Methuen and Co., Ltd.; New York: John Wiley and Sons, Inc., 1956.) 10s. 6d. net.

**A** KNOWLEDGE of the effects of friction and lubrication is of great importance in the modern technological world and there has been a real need to have to hand a concise yet authoritative book so that the modern concepts of these subjects may be utilized and applied with confidence when considering practical problems. This need has been admirably filled by this monograph. The authors are to be congratulated on producing such a readable little book, and I would encourage anyone interested in frictional and associated phenomena to delve into its pages, and, if necessary, to use it as an introduction to the standard work by the same authors: "The Friction and Lubrication of Solids" (Oxford University Press, 1951).

After giving a historical introduction and reviewing the methods of measuring friction, the authors discuss the nature of solid surfaces and the true area of contact between them; they lead on to considerations of adhesion, the mechanism of friction using clean and contaminated metallic surfaces, the operation of polishing and rolling friction. Friction in non-metallic materials (including the development of the fast running ski) leads on to the subject of solid lubricants and to lubrication in general. After explaining the basic concepts of fluid lubrication, attention is directed to the theory and practice of boundary lubrication and to the work being done on extreme pressure lubrication.

Criticisms are few, but one does ask what parameter is represented by the abscissa in Fig. 5, and one would wish to see the index both accurate and enlarged—for example, the first mention of 'P.T.F.E.' is on p. 59 and not p. 57 and one must read p. 59 in order to discover that further consideration is given to this material on p. 66. DAVID TRAIN

### Ion Exchange Technology

Edited by F. C. Nachod and Jack Schubert. Pp. x+660. (New York: Academic Press, Inc.; London: Academic Books, Ltd., 1956.) 15 dollars.

**T**HE widespread use of ion-exchange processes on the industrial scale has resulted in a need for an authoritative text-book on the technology of the subject. "Ion Exchange Technology" is intended to meet this need and to serve both as a reference book and text-book for technologists and engineers. The fundamental aspects of ion-exchange are considered in the first part of the book, which includes chapters on the general properties of ion-exchange resins, equipment and process design, mass transfer and equilibria, deionization, electrochemical operations, ion-exclusion, economics and the prediction of fixed-bed performance.

In the second part of the book the applications of ion-exchange are described in chapters on water treatment, catalysis, metal recovery, the separation of rare earths, processing radioisotopes, the treatment of radioactive wastes, sugar refining, the purification of organic chemicals and on pharmaceutical and biological processes. The authors of the individual chapters are all experts in their respective fields and each chapter is useful and authoritative. Many of

the chapters contain information which is not readily accessible or which has only recently been published. Short accounts of some important topics recur in several chapters. While this may be justified in the case of topics such as costs and stability, some unnecessary duplication could perhaps have been avoided and more detailed accounts of the mixed-bed process and the development of continuous ion-exchange processes included. Only a few minor errors have been noted and the general arrangement of the book is excellent.

The editors are to be congratulated on their initiative in arranging for the publication of this work, which is a valuable addition to the literature on ion-exchange. It should do much to stimulate still greater interest in the application of ion-exchange resins and ion-exchange processes.

D. K. HALE

### The Theory of Functions of Real Variables

By Prof. Lawrence M. Graves. Second edition. (International Series in Pure and Applied Mathematics.) Pp. xii+375. (London: McGraw-Hill Publishing Company, 1956.) 56s. 6d.

**T**HE first edition of this book appeared in 1946. It was noteworthy for a very careful discussion of the concept of a real variable, for precise and detailed analysis of the ideas of continuity and differentiability, and for its account of the Riemann, Lebesgue and Stieltjes integrals; the development of the Lebesgue integral was on lines suggested by F. Riesz, and a comparison may now be made with Riesz's own account in his book (written with Nagy) on "Functional Analysis". The expert may have found Graves's book a little lacking in outlook value, but the novice might be grateful for careful explanations and neat illustrations of difficult points. In the new edition, the main part of the book is substantially unchanged, but there are two new chapters, one on the theory of sets and transfinite numbers, the other a concise introduction to the notion of a metric space. Here again, explanations are lucid and precise, some exercises designed chiefly to enable the reader to test his assimilation of the text are supplied, and difficult points are illustrated with well-chosen examples. Thus, for example, three forms of Zermelo's axiom and three forms of Zorn's lemma are supplied, and the logical equivalences are worked out in full. References for further reading occur at the end of each chapter, and should do something to correct the one defect in an otherwise sound and valuable book, that it does not show sufficient resolution in breaking through into new ground; but the bases for further advance are thoroughly laid.

T. A. A. BROADBENT

### Vibration Analysis Tables

By R. E. D. Bishop and Prof. D. C. Johnson. Pp. viii+59. (Cambridge: At the University Press, 1956.) 10s. 6d. net.

**T**HE word 'receptance' has been adopted to stand for the amplitude of the motion at a chosen point of a dynamical system elicited by a simple-harmonic force of unit amplitude applied at the same or some other point. Thus a receptance is, in effect, a flexibility measured under the conditions of simple-harmonic motion; the name 'mechanical admittance' was formerly applied but abandoned because the analogy with electrical admittance is incomplete.