book. Chap. 6 on "Lateral Buckling of Beams" has been thoroughly revised. Chap. 7 on "Buckling of Rings, Curved Bars, and Arches" differs only slightly from Chap. 4 of the first edition. Chaps. 8 and 10, treating the bending of thin plates and shells, are essentially the same as the old Chaps. 6 and 8. In Chap. 9 on "Buckling of Thin Plates" more cases are discussed than in the first edition, and Chap. 11 on "Buckling of Shells" has been similarly expanded. Throughout the book, references to recent literature have been added.

Thermodynamics

Thermodynamics. By G. N. Lewis and M. Randall. Revised by K. S. Pitzer and L. Brewer. McGraw-Hill Book Company, Inc., New York, N. Y., 1961. Cloth, 6 × 9 in., xii and 723 pp. $12.50.

REVIEWED BY J. KESTIN[5]

THIS is a modernized version of the well-known, classical treatise on thermodynamics written for physical chemists. The revision fully preserves the individuality of the original, its easy style and understanding of the physical phenomena it sets out to study.

In spite of the fact that the first, original edition was published nearly forty years ago (in 1923), it is much more readable and useful than many of the more contemporary efforts which have recently appeared in such large numbers.

Plasma Physics

Plasmas and Controlled Fusion. By D. J. Rose and M. Clark, Jr. John Wiley & Sons, Inc., New York, N. Y., 1961. Cloth 6 × 9 in., xiv and 493 pp. $10.75.

REVIEWED BY HANS MOTZ[6]

THIS is by far the most complete book on the subject that has appeared as yet. A remarkable amount of information is compressed into 493 pp. The treatment is very largely based on the macroscopic hydromagnetic equations which are derived *ab initio* after a brief and effective introduction to the basic physics of gas discharges. For the sake of completeness, even the formulation of Maxwell's equation for moving media and the derivation of the electromagnetic stress tensor are included. This certainly makes the book an excellent text for a graduate course. No wonder that some aspects of relevant plasma physics—relaxation effects, conductivity, viscosity, etc.—could not be treated adequately. The authors are aware of this and chose to write a readable book rather than a book that answers the basic question: Is controlled fusion possible? The first problem which has to be solved is that of confinement. The next problem is to confine the plasma for a sufficiently long period. The obstacles are numerous. First, there are the plasma instabilities. They are mathematically analyzed and the difficult work of Rosenbluth, Suydam, Newcomb, and others is presented clearly. However, the authors have not made clear what time intervals are required for useful power output and what the quantitative limitations due to instabilities are. It may well be that the decisive question of feasibility hinges on the validity of the idealizations inherent in this kind of analysis. The next problem which has to be faced is the balance between useful power output and radiation loss. Again, the theory of radiation loss is explained very well with the use of up-to-date material. The conclusion is reached that D-T reactions may give useful output but D-D reaction cannot. The open questions of surface radiation and inadequacy of the plasma model are indicated. The question of how to heat a plasma to the necessary temperatures is not treated systematically, and the problem is far from solved, but if all these problems could be solved there would still be many others, connected with practical realizations. Many of these are discussed in the book, even the construction of superconducting solenoids for generating the magnetic confining fields, tritium breeding in lithium, etc. The principal candidates for success, stellarators, mirror devices, pinchlike devices, are discussed in detail. Altogether the book incorporates the latest knowledge and ideas on this important subject. The sceptical reader wonders whether the present status of plasma dynamics may perhaps be compared with that of fluid dynamics before there was any knowledge of boundary-layer effects.

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Gear Teeth

Introduction to the Kinematic Geometry of Gear Teeth. By Allan H. Candee. Chilton Co., Philadelphia, Pa., 1960. Cloth, 6½ × 9½ in., ix and 204 pp. $12.50.

REVIEWED BY H. PORITSKY[7]

THIS book is devoted to the classical kinematic geometry of spur gear teeth. The treatment is elegant, lucid, quite detailed, and graphical whenever possible. Presumably this is the first of several volumes to follow, which will treat more complex gears such as helical gears, worm gearing, bevel gears, and hypoid gears.

Some of the topics covered are: Generation of the conjugate profile as the envelope of the given profile; also by means of segments of normals to the given profile extending to its pitch circle. Methods of manufacturing gear teeth by means of cutters, hobs, shapers, and by "generating" by means of a cutting tool shaped like the conjugate tooth profile. Special properties of involute gear teeth, such as interchangeability irrespective of pitch circle, mating action irrespective of changes in spacing of the axes, etc. Measurement of tooth thickness by means of calipers and by means of pins. "Strength factors" of gears. Profile errors, modification, and variation. Approximations to involutes.

The book forms a valuable addition to gear literature.

Lubrication

Theory of Hydrodynamic Lubrication. By Oscar Pinkus and Beno Sternlicht. McGraw-Hill Book Company, Inc., New York, N. Y., 1961. Cloth, 6 × 9 in., 500 pp., 242 illus. $15.

REVIEWED BY EDWARD SAIBEL[8]

THE subject of hydrodynamic lubrication has advanced considerably over the past decade. Numerous theoretical solutions of varying degrees of approximation have appeared and a great deal of experimental work has been reported. The time is ripe for a book in which this new work is drawn together, expounded, compared, critically examined, and incorporated into that portion of the old which has stood the test of time.

The authors have gone a great way toward this goal. They have kept track of developments in all parts of the world and they have made substantial contributions of their own. Extracts from all of this have been compiled together with basic derivations and classical material to form a substantial text on the subject. The material is exhibited in a systematic manner, the style is pleasant and readable.

The value of the book would have been greatly enhanced, however, by more exercise of critical judgment. Material from many of the sources which is of doubtful value has been used verbatim and given the same prominence as important matter.

Unfortunately, those unacquainted with the field in detail will

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have difficulty in tracking down the original articles due to the Authors' use of "Sources" rather than the customary use of numbered references in the text.

Nevertheless, the book serves a very important purpose in supplying a much needed book on recent developments both theoretical and experimental.

Some idea of the scope of the book may be gleaned from the following, taken from section headings. Basic Differential Equations, Hydrodynamics of Simple Configurations, Incompressible Lubrication, Gas Bearings, Hydrostatic Bearings, Squeeze Film and Dynamic Loading, Instability, Adiabatic Solutions, Elasticity Considerations, Rolling Elements, Inertia and Turbulence Effects, Non-Newtonian Fluids, Experimental Evidence.

The book in addition to being a very useful compendium for the engineer will also serve as an excellent text for a graduate course in the subject.

AGARD

AGARD Dictionary. Edited by G. H. Frenot and A. H. Holloway. Pergamon Press, New York, N. Y., 1961. $10^1/_2 \times 9^1/_2$ in. $20.

REVIEWED BY J. KESTIN[9]

THE present is a new kind of dictionary. It is composed of loose-leaf pages on which aeronautical terms are given in eight languages, the meaning of each being explained with the aid of a brief definition in the respective language. The terms are arranged in a logical, decimal order, and eight alphabetical indexes, one in each language, quickly direct the readers to them. Thus in one moderate volume the reader is provided with an eight-language dictionary as well as with a glossary of terms in each of them. A plan of this kind is well adapted to dictionaries of scientific or technical terms for which a good approximation to a one-to-one correspondence exists in the various languages. It is hoped that the idea of the present dictionary will be applied to many other branches, and that some international body, preferably UNESCO, will undertake the work of writing them. From the point of view of applied mechanics, the range of terms covered in the present dictionary is regretfully very limited.

Heat Transfer

Heat Transfer. By Benjamin Gebhart. McGraw-Hill Book Co., Inc., New York, N. Y., 1961. Cloth, $6 \times 9^1/_2$ in., x and 454 pp. $10.75.

REVIEWED BY E. M. SPARROW[10]

THIS new book continues the trend toward more advanced subject matter that has been seen in many recently published beginning and intermediate texts on heat transfer. Topics such as conduction solutions by the separation of variables-Fourier series method and similarity boundary-layer solutions, which formerly might have been reserved for graduate-level presentation, are included. However, the book still gives adequate coverage to the simpler type of fundamentals which are needed in a beginning course in heat transfer.

The conduction portion deals with analytical and numerical solutions of basic one and two-dimensional situations. Additional treatment of conduction problems with convective boundary conditions is given in a later chapter on combined modes, which includes such topics as fins and composite walls.

The radiation portion begins with a discussion of such fundamental matters as black bodies, Kirchhoff's law, diffuse surfaces, angle factors, and so forth. For the calculation of radiant interchange between surfaces, Professor Gebhart presents an approach originated by himself. Radiation from absorbing-emitting gases is not considered at length.

The section on convection opens with a strong chapter on fluid flow which includes the derivation of the Navier-Stokes and the boundary-layer equations and also presents boundary-layer similarity solutions. The momentum integral approach is also shown. Turbulent flow processes and the corresponding semi-empirical methods (e.g., mixing length) of analysis are described.

The chapter on forced convection is the longest in the book and treats laminar and turbulent flows under internal and external conditions. There are strong sections on laminar boundary-layer heat transfer including viscous dissipation and variable properties. Empirical heat-transfer correlations are given for flow over single cylinders and through tube banks. Correlations for turbulent tube flow are also presented.

The next chapters are respectively concerned with natural convection, boiling, and condensation. Similarity-type boundary-layer solutions are described for laminar natural convection on a vertical plate, and a parallel analysis is also shown for laminar film condensation. Analytical treatment of combined forced and free convection in a laminar boundary layer is described at some length. The chapter on boiling, in large part descriptive, contains several experimental correlations. In the other chapters, empirical correlations are also given to supplement theory.

The last chapters deal with combined modes (mostly conduction and convection), heat-exchanger design, and analogy methods. Tables of various thermophysical properties are given in the Appendix.

It is felt that the book might well serve as text for undergraduates with a good mathematical background.

Axial Flow Fans

Axial Flow Fans. By R. A. Wallis. Academic Press, New York and London, 1961. viii and 366 pp., 22 tables, 163 figs., 7 pictures. $10.

REVIEWED BY M. J. SCHILHANSL[11]

THE subtitle "Design and Practice" reveals the specific goal of this monograph of low-pressure fans.

The first chapters are devoted to fundamentals of mechanics of incompressible flow, boundary layer, airfoil data, diffusers, and ducts. Fan design methods are discussed in the following chapters and one of them is developed in much detail, apparently the one the author considers to be the best. A few chapters on fan noise and on fan testing are added.

The reader gets sometimes the feeling of reading a cookbook of fan design as some recommendations on how to do it are made without explanation. Some views are objectionable. Here, a few of them are listed.

The treatment of boundary problems is strictly two-dimensional in spite of the fact that fluid particles in the boundary layer of the rotor blades experience centrifugal forces perpendicular to the surface at which the boundary layer is investigated. This fact is barely mentioned on page 80 as one of the complexities of the flow at the rotor blades.

The definition of the efficiency of a diffuser is based on the mean velocities at the diffuser entrance and exit; this is not a correct definition.

The reviewer disagrees also with the statement on page 120 that "methods of calculating interference factors such as the ratio of the actual lift of the blade to the lift it would exert in the absence of the other blades have *failed in general* to produce consistent results." This statement should read: Such methods permit the comparison of *inviscid* flow past cascades of airfoils and around isolated airfoils. It is also possible to calculate the boundary-layer growth in *viscous* flow around isolated airfoils and past cascades for accelerated flow as well as for decelerated flow. The

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