plane stress, impact loading of plastic structures. Due to the nature of the subject the second part is written at a level considerably more advanced than the first part. It is based on recent research work and should be of great interest to research engineers.

The extensive bibliography and abundant problems add to the value of this book.

Photoelasticity

Praktische Spannungsoptik. By L. Föppl and E. Mönch. Springer Verlag, 1959. Cloth, 6½ × 9½ in., illus., vii and 209 pp. DM 30.

REVIEWED BY GUSTAV MESMER[6]

THE second edition of this book is thoroughly revised and completed. As before, the authors describe their own pertinent research at some length, reporting more briefly on other publications.

Chapter I of Part 1 deals with the instruments (including a new projectory arrangement of lenses and mirrors) and the basic photoelastic facts and measurements. The materials Araldit (made by CIBA, Basel, Switzerland) and VP 1527 (made by Dynamit, Troisdorf, Germany) are recommended and discussed.

Chapter II covers three-dimensional photoelasticity, especially the use of Araldit B in the freezing method.

Chapter III discusses some theoretical and practical aspects of model-similarity, the choice of scale, and the magnitude of errors.

The second part of the book includes short paragraphs concerning mechanical and optical measurements of the sum of the principal stresses, measurement of bending moments in plates, and photoplasticity.

The third part describes some test methods and results of the Munich Photoelastic Laboratory. Some stress problems in gears, foundations, and a plexiglas dome are repeated from the first edition. New tests deal with three-dimensional stresses in helical gears, in the area of a pipe intersection, in a three-dimensional part of the block of a turbine. Interesting two-dimensional examples are a swaybracing wall, gravity stresses in a gelatine model of a dam, and stresses in reinforced concrete.

Summarizing, the reviewer recommends the book to the photoelastic beginner as containing a short, clear, reliable, and rather complete introduction, and to the expert as fairly presenting the present (1959) state of photoelasticity in Germany.

Statistical Physics

Statistical Physics. By Landau and Lifshitz. Addison-Wesley Reading, Mass., and Pergamon Press, New York, N. Y., 1958. Cloth, 6 × 9 in., viii and 484 pp. $12.50.

REVIEWED BY JOHN ROSS[7]

THIS is one of a series of volumes on theoretical physics by Landau and Lifshitz in an English translation. Other volumes available include "Quantum Mechanics," "Fluid Mechanics," and "The Classical Theory of Fields." It has been said, with merit, that these volumes are the most brilliant and authoritative work on theoretical physics since the classical compendium of A. Sommerfeld.

The topics discussed in this volume include not only the standard ones of the Gibbs ensemble distribution, the perfect gas, the real gas and condensation, solids, and solutions, but also excellent vignettes of topics such as quantum fluids and superfluidity, the properties of matter at very high temperatures, fluctuations and their relations to equilibrium as well as transient phenomena, the symmetry of macroscopic bodies, and surfaces. In addition, there are chapters on the thermodynamics of homogeneous and heterogeneous systems. The breadth of applications of statistical mechanics in physics is remarkable and given full display in the book, from the completely ionized gas to the creation of nuclei (in the chapter on surfaces, of course!).

The authors reject the proposition that statistical physics is the least well-founded branch of theoretical physics. They ignore the fact that the formulation of its foundations is disputed and discussed by a large number of physicists, and dismiss the entire issue with the sentence, "We believe that the difficulties are created artificially because the problems are often not stated sufficiently rationally." There is no fooling around here. The critical point is the role of ergodic theory in statistical mechanics. The authors accept the Gibbsian axioms of ensemble theory, and deny the need for solutions of the ergodic problem, at least in physics. (My sentiments are with them until they seek a rationale for the use of ensembles in a thinly disguised ergodic theory.)

Fortunately, the structure and predictions of statistical physics are independent of the arguments surrounding its foundations, and this, the main concern of the book, is given in precise and logical sequence. The depth of understanding by the authors and their ability to convey this on the written page elicit admiration. The highest praise is due the excellent book by Landau and Lifshitz, and it is recommended for its astuteness, insight, and clear presentation.

Heat Transfer

Turbulent Flows and Heat Transfer. Vol. V of High Speed Aerodynamics and Jet Propulsion. Edited by C. C. Lin. Princeton University Press, Princeton, N. J., 1959. Cloth, xvi and 549 pp. $15.

REVIEWED BY J. KESTIN[8]

THIS IS vol. 5 of the twelve volumes of the "Princeton Series" which now needs no special introduction to the readers of this Journal. As its title lays down, it deals with:

A Transition from Laminar to Turbulent Flow (H. L. Dryden)
B Turbulent Flow (G. B. Schubauer and C. M. Tchen)
C Statistical Theories of Turbulence (C. C. Lin)
D Conduction of Heat (M. Yachter and E. Mayer)
E Convective Heat Transfer and Friction in Flow of Liquids (R. G. Deissler and R. H. Sabersky)
F Convective Heat Transfer in Gases (E. R. van Driest)
G Cooling by Protective Fluid Films (S. W. Yuan)
H Physical Basis of Thermal Radiation (S. S. Penner)
I Engineering Calculations of Radiant Heat Exchange (H. C. Hottel)

Most reviewers of the series have agreed that, with the number of busy and highly competent contributors, it was not possible to attempt to weld the sections in a particular volume into an organic treatise. In many of the previous volumes it lead to excessive repetition as well as to serious omissions. The present volume is a happy exception in the first respect. It is much more unified than the others and does not suffer from being repetitive. It is not, however, comprehensive and does not give an exhaustive treatment under each heading.

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The existence of turbulent flows was discovered nearly one hundred years ago by O. Reynolds, and yet it is still impossible to indicate a unified theory of transition. The first article by H. L. Dryden pinpoints the reasons for it with great lucidity and in minute detail. In particular, the essentially three-dimensional character of transition and the relation of transition to boundary-layer instability are discussed in simple and clear terms. His conclusions carry with them the weight of authority and one cannot but agree when he states: "... the principal outlines are reasonably clear and the apparently rival ideas are not contradictory but complimentary," and: "Progress in the development of a satisfactory conceptual picture and theory is dependent on progress in the study of nonstationary solutions of the Navier-Stokes equations."

The second section gives a thoughtful description of fully developed turbulent motions, the aim being to "... understand the reason for their behavior, not only to formulate laws for practical use, but to satisfy our desire to know and to be able to explain...". Wherever possible, the presentation is carried out in terms of compressible flows, but often the authors are compelled to revert to the more conventional, incompressible presentation, because many of the fundamental concepts have not yet become satisfactorily transposed to embrace compressible fluids. The contribution includes a well-written section on Reynolds' analogy, a thoughtful discussion of the various empirical laws of wall and wake friction, and an excellent bibliography. It is very complete and informative and constitutes an admirable presentation of the subject. It may be inadequate as a handy reference for practical engineers, but this would be impossible to achieve even in the space alloted to the whole volume.

The reviewer must refrain from making any comments on Section C. On the one hand, the mathematical equipment required is beyond the grasp of average engineers, and on the other, it is difficult to see which contributions from the statistical theories of turbulence can be turned into practical use (in the widest sense of the meaning of the word).

Section D does not attempt to give a general theory of conduction, and readers who expect it might be disappointed, because "the problems discussed ... have been selected on the basis of their immediate applicability to heat flow in combustion chambers and nozzles, in skins of high speed aircraft, turbine blades, etc. Emphasis is placed on simple...model problems...". If the reader bears this in mind, he will find much to interest him, but the reviewer is surprised that not a single chapter is devoted to dimensional analysis and that the presentation is couched in almost exclusively analytic terms.

Section E is rather disappointing and far too short for its scope; it ends with a discussion of nucleate boiling. Problems of forced convection in gases, i.e., compressible fluids, have been concentrated in Section F. Their treatment is not comprehensive but the most important results for laminar and turbulent compressible boundary layers have been included. The subject is developed analytically with careful comparisons with experimental measurements discussed at every step. Chapter 2 is devoted to engineering applications (aerodynamic heating, heat transfer in rocket motors) and to a very brief discussion of dissociation effects. Problems of transpiration cooling are discussed in Section G.

The very short Section H gives a brief summary of the laws of radiation as derived from Planck's distribution law and then concentrates on theoretical calculations of gas emissivities presented in the form of a qualitative outline. Section I concentrates on the conventional and most practical methods of calculating the exchange of heat by radiation. This section too, is very short.

The volume, as a whole, is very useful and worth having. The reviewer regrets that the phrase "space does not permit" occurs far too frequently for a 12-volume work running well into 8000 pages.