systems, i.e., systems subjected to one independent loading parameter. Postbuckling behavior is analyzed and the corresponding influences of imperfections are examined. A chapter on simultaneous buckling is also included. Although this first part of the book is self-contained and is itself interesting reading, its primary purpose is to serve as an introduction to Part 2, which is devoted to multiple-parameter systems. It is this second part of the book which contains new and stimulating material. Here, the stability behavior of structures subjected to more than one independent loading parameter is explored. This subject matter is not included in other recent books on elastic stability (e.g., Thompson and Hunt) and thus makes Huseyin's monograph an excellent complement to these texts.

In Part 2, a systematic stability analysis based on the "multiple-parameter perturbation technique" is presented and applied to structures under combined loading. It is also shown how a multiple-parameter analysis may be useful even for systems subjected to only one independent loading parameter. Some fundamental theorems are developed, for example, concerning the convexity of the stability boundary, and shown to have important practical applications in the estimation of bounds to this boundary.

This book will be a useful reference for persons interested in elastic stability theory. However, its extremely specialized content limits its suitability as a textbook for a graduate course on structural stability.

Formulas for Stress and Strain. By R. J. Roark and W. C. Young. McGraw-Hill. vi + 625 pp. Cost $19.50.

REVIEWED BY R. PLUNKETT[5]

Most readers of this journal have probably used previous editions of this very handy compilation. The coverage remains encyclopaedic and the presentation lucid. The formulas are now presented in such a way as to make them more useful for computer calculations than was the case in previous editions. One major change is the use of singularity functions and the addition of a large number of discontinuous deformation cases for beams and plates which are useful for matrix-stiffness analysis of complex structures.

The chapter headings are almost identical to those of previous editions but the contents have been greatly revised. They are almost self-explanatory:

1 Definitions, 14 pp.
2 Behavior of Bodies Under Stress, 25 pp. (Hooke's law, plasticity, failure criteria).
3 Principles and Analytical Methods, 8 pp.
4 Experimental Methods, 9 pp.
5 Properties of a Plane Area, 12 pp.
6 Tension, Compression, Shear, and Combined Stress, 16 pp.
7 Beams; Flexure of Straight Bars, 120 pp.
8 Curved Beams, 77 pp.
9 Torsion, 38 pp. (mainly Saint Venant but some helical).
10 Flat Plates, 90 pp. (mainly circular plates).
11 Columns and other Compression Members, 31 pp.
12 Shells of Revolution, 58 pp.
13 Bodies Under Direct Bearing and Shear Stress, 18 pp. (contact, rivets, and pins).
14 Elastic Stability (reasonable coverage of idealized cases), 33 pp.
15 Dynamic and Temperature Stress, 25 pp. (a short compilation of impact, centrifugal stress cases, natural frequencies, very elementary temperature stresses).

The formulas for stresses and deflections of beams and plates as a function of position cover more cases and are necessarily more complicated, which has doubled the number of pages in the corresponding chapters.

The way in which one presents material of this sort, the coverage, the order, and the grouping are largely a matter of taste and there is little point in commenting on the details of such presentation. The compendium itself is useful, is carefully done, and is accurate in every case I have sampled. There is no need to make a long list of the really good features of this outstanding handbook; the large number of illustrative examples should help the novice.

In order to validate my reviewer's licence, I feel impelled to mention a couple of minor points which annoy me, some of them carried over from previous editions. The definitions and symbols would be more useful if they agreed with ANSI standards. The first six short chapters are so superficial as to be misleading. In particular, the references for chapters three and four are few and, in many cases, obsolete. For example, it is doubtful if anyone would use the membrane, hydrodynamic or electrical analogies for Poisson's equation when numerical methods using digital computers are routine. Most of the formulas for flat plates give explicit references to the original sources so that the assumptions, constraints, and methods may be checked; the same should have been done for all cases.

Enough, my franchise is safe, I need do no more nit-picking. This is a reasonably priced book that belongs on the shelf or desk of every engineer who does stress analysis of real machines or structures. The new edition continues the fine tradition started by the late R. J. Roark and our profession owes a vote of thanks to his hardworking and able successor.

Three-Dimensional Crack Problems. By M. K. Kassir and G. C. Sih. *Noordhoff International Publishing, Leyden.* 1975. Cost $55.73. About 400 Pages.

REVIEWED BY J. R. RICE[6]

This book is the second in a Noordhoff series on the *Mechanics of Fracture* edited by Sih. The authors treat linear elastic three-dimensional crack problems and limit themselves, for the most part, to those static problems that are amenable to exact solution. These include variously loaded internal and external cracks in infinite solids with elliptical and, especially, circular crack fronts, cracks on dissimilar material interfaces and in nonhomogeneous bodies, cracks in anisotropic bodies, and cracks in bodies with finite boundaries (solved usually to some order of approximation in terms of proximity of the boundary).

There is a remarkably large store of results in the area, enough to fill over 400 rather tightly written pages in the present summary, and the great majority of literature references that the authors cite, while traceable to earlier work by Sneddon (1946) and Green and Sneddon (1950), have appeared within the last decade. Indeed, Kassir and Sih have been major contributors to this literature.

Although the barest outline of the methods used for developing solutions are given in most cases, the book should be viewed more as a "handbook" or "catalog" of known solutions than as a study on methods of elastic crack analysis. The presentation is not without a few misprints and a few formulas, checked by the reviewer for consistency with known limiting cases, seem to be wrong (specifically, those for concentrated forces near external circular cracks as given in the Appendix of Chapter 2). Thus the reader may well be advised to rederive important results and to check the references given, but this is sensible in the use of any such book, and should not be construed as detracting from the excellent job that Kassir and Sih have done.

Those interested in mathematical solutions for practical surface flaw geometries, e.g., for part-through surface cracks in plates or shells, for corner cracks from rivet holes, etc., will be somewhat disappointed.

---

[5] Professor, University of Minnesota, Minneapolis, Minn.

[6] Professor, Division of Engineering, Brown University, Providence, R. I.

The authors make no attempt to summarize the results available in this area through approximate solutions of various kinds to the 3-D field equations. Nor do they present, for readers prepared to utilize modern computer techniques, finite element, boundary integral, and other numerical techniques for obtaining such solutions.

Finally, it seems to the reviewer that there is little added to this book by an "Introductory Chapter" of approximately 40 pages, authored by Sih, on the "strain-energy-density factor" theory of crack growth and its extension to 3-D problems. First, the chapter seems extraneous in the sense that nothing else in the book touches on theories of crack growth. But this theory, while presented with evident enthusiasm, seems to derive from no self-consistent or physically plausible description of the crack growth process. Instead, failure is assumed to occur when a *local minimum* value of the energy density, at some given radius from the crack tip, reaches a critical value. Why the energy density, and especially, a local minimum of it, should be chosen is unclear enough. But the function does indeed have a *local* minimum, in general, and it seems disconcerting to take as critical a value of the energy density for which both greater and lesser values occur at other points at the same given radius from the crack tip.

Originally, the energy density concept seems to have been introduced at least in part because the problem of obtaining the Griffith-Irwin energy release rate for incipient nonplanar crack extension seemed intractable. But now that problem seems to have been correctly solved by Hussain and coworkers. In any event, for many "brittle" constructional materials, the nonelastic zone prevailing near a crack tip at fracture is such that no detailed interpretation, in Sih's sense or any other, should be given to the elastic crack-tip stress field, other than that of providing "outer field" characterizing parameters (i.e., the 3 stress-intensity factors) on which empirical failure criteria can be based.

To summarize, this is a generally outstanding book by two major contributors to three-dimensional elastic crack analysis. Its context is somewhat limited by comparison to engineering requirements, but it is thorough within its context and, despite the unfortunate Introductory Chapter, it fills an important need and can be recommended strongly to students and practitioners of fracture mechanics.

Holographic Nondestructive Testing. Edited by Robert K. Erf. Academic Press, New York. 1974. Cost $25.20. 462 Pages.

REVIEWED BY R. J. SANFORD[7]

The title of this book should be interpreted in the very broadest sense. Although presented within the context of nondestructive testing, many of the techniques described can be applied to a wide range of engineering measurements. The editor has assembled an impressive array of authors (most of them original contributors in the development of applied holographic methods) to cover a wide range of topics including vibration analysis, surface contouring, strain measurement, and defect detection.

The book can be divided into three major sections. The first section composed of the first four chapters provide an introduction to holography, primarily aimed at the novice reader. Chapter 2 presents a nonmathematical description of the principle of holography and some of the practical aspects of making a hologram. This chapter is well suited for the undergraduate and advanced technician. The concluding chapter of this section, Chapter 4, on interferometric holography is the weakest chapter in the book. This is unfortunate since most of the techniques discussed in the remainder of the book are based on interference phenomena obtained through holography, and a thorough mathematical treatment would have done much to unify the book. There is no discussion of the vital topics of fringe formation and localization. The second section of the book consists of a collection of articles on the applications of various optical holographic methods to engineering measurement. Each article is well written and provides a balance between the theory and the practical aspects of the method presented. Particularly noteworthy is the article on vibration analysis by Karl A. Stetson, a major force in this field. Chapter 8, divided into 12 parts, provides a broad range of specific examples. The third section on nonoptical holographic methods adds little to the book and would better have been replaced with articles on holography of refractive index fields (of interest to the fluid mechanicist) and polarization holography (i.e., photoelastic holography).

On balance the 14 contributors have done a good job in presenting a practical text on the applications of holography to engineering measurement with special emphasis on the NDT applications. It is well illustrated and referenced for further study. A strong point of the book is the attention to experimental details which will aid the reader in duplicating the results. The book finds its best audience in the nonexperienced reader interested in learning about the current (up to about 1972) applications of holography for engineering measurements and should be included in every major library collection.

Optical Holography. By R. J. Collier, C. B. Burckhardt, and L. H. Lin. Academic Press, New York. May 1971. Cost. $27. 605 Pages.

REVIEWED BY R. J. SANFORD[8]

At the outset it should be stated that this book is not a mechanics oriented text. It is clearly a book in optics designed for the reader who wants a thorough understanding of the principles of optical holography; however, the authors assume very little background in optics from the reader and proceed to develop the topic starting from first principles. The authors stated goal is to develop the theory of the holographic method beginning with only basic mathematical and optical concepts. To this end the authors achieve their goal to the highest degree and it is this factor which gives the book its outstanding qualities. The reader should be warned that the book is not designed for casual reading; however, a broad understanding of holography can be obtained by skimming over the mathematics and concentrating on the interpretation of the mathematical results.

With the exception of the chapter on holographic recording materials the book offers very little in the way of practical advice on making a hologram. The line drawings tend to be more theoretical than practical. Similarly, the topic of most interest to the experimentalist, holographic interferometry, is discussed in only one chapter comprising less than six percent of the volume. The topic of polarization holography is not mentioned at all. For these topics the reader must seek out other sources.

The book is intended for the serious holographer who wants to gain a detailed understanding of the fundamentals of holography and for this audience it is a valuable reference work. The jacket claims that "it may well become the classic monograph on this subject" and the reviewer agrees.

Elastostatics and Kinetics of Anisotropic and Heterogeneous Shell-Type Structures. By Liviu Librescu. Noordhoff International Pub., P.O. Box 26 Leyden, The Netherlands. Published, 1975. Cost $78.50. 580 Pages.

REVIEWED BY J. G. SIMMONDS[9]

The aim of this book is twofold: to present nonlinear, dynamic theories of heterogeneous, anisotropic, multilayered, heat-conducting shell structures and to simplify and reduce these theories—often by

[7] Naval Research Laboratory, Washington, D.C.

[8] Naval Research Laboratory, Washington, D.C.

[9] Professor, University of Virginia, Department of Applied Mathematics and Computer Science, Charlottesville, Va.