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Research Techniques in Nondestructive Testing contains five papers with a substantial applied mechanics content. The remaining three papers deal with radiographic imaging, and electromagnetic detection and characterization of defects.

The papers in this volume generally start with a discussion of the fundamentals of an approach, they then take stock of current knowledge and indicate promising areas of future research. Two of the papers display weaknesses that are typical for fast-moving fields, where considerable development can take place between preparation of a manuscript and its publication in a formal volume. Thus, the chapter entitled "A Review of Large-Angle, Low-Frequency Ultrasonic Scatter Analysis" by D. S. Dean is inadequate in its discussion of recent results and in its summary of the current literature. Much of the relevant literature has been developed during the last five years, although the applied mechanics literature actually already contained many papers bearing on the subject. The paper "Caustics and Inversion of Ultrasonic Scattering Data" by Doyle, Latimer, and Adler has another problem. It is a scholarly, detailed, and rather complete presentation. It deals, however, with an idea that briefly seemed attractive, but that has subsequently not been established as a practical method of defect characterization.

The three other papers with applied mechanics content are "Probabilistic Failure Prediction and Accept/Reject Criteria" by J. M. Richardson and K. W. Fertig, "Theoretical and Practical Aspects of the Thermal Nondestructive Testing of Bonded Structures" by V. P. Vavilov and R. Taylor, and "Laser Generation of Ultrasound in Metals" by C. B. Scruby, R. J. Dewhurst, D. A. Hutchins, and S. B. Palmer. These chapters can be recommended as detailed and thorough discussions of important topics in QNDE. The paper by Scruby et al. is of particular interest in that it shows the importance of basic results of thermoelasticity and elastodynamics to laser generation of ultrasound in metals through a treatment that encompasses historical background, principles of ultrasound generation by a laser, experimental results, and applications of laser-generated ultrasound.

An Introduction to Macromolecules. Second Edition. By Leo Mandelkern. Springer-Verlag, New York, 1983. 161 Pages. Price $16.95.

REVIEWED BY J. H. WEINER[3]

In spite of their ever-increasing importance in modern technology, polymeric materials still tend to be slighted in many engineering curricula. This small paperback could serve as supplementary reading for an undergraduate course in materials science and would provide a good qualitative introduction to the field. The topics treated include the chemical structure and methods of preparation of various types of polymers, the behavior of single long-chain molecules with emphasis on their many possible conformations, thermomechanical relations for rubbers and glasses, structure of crystalline and semicrystalline polymers and fibers, and a description of macromolecules of biological importance.

The exposition is clear, lively, and interesting throughout. In addition to its undergraduate audience, it would provide a quick and pleasant overview of the field for a researcher in applied mechanics before he turns to more advanced treatments in such books as those by Treloar or Ward.

For someone with a background in mechanics, one of the unusual and fascinating features of the subject is that entropy, rather than energy changes play a key role in the atomistic basis of rubber elasticity. This giant step forward in understanding, due to Meyer, Karrer, Mark, and others, took place over 50 years ago and by now the idea has acquired the air of reasonableness that comes with familiarity. Nevertheless, the concept remains a slippery one to grasp and to make concrete. It is hard to avoid anthropomorphic statements such as the author's "This restoring force [on extended polymer chains] is a reflection of the strong desire of the chains to return to their original statistical conformation." The formulation of a purely mechanistic interpretation on the atomic level for this force, comparable to the kinetic theory for the pressure exerted by a gas on the walls of its container, remains an interesting challenge.

Probabilistic Methods in the Theory of Structures. By Isaac Elishakoff. Wiley, New York, 1983. 489 Pages. Price $44.95.

REVIEWED BY J. T. P. YAO[4]

There are 11 chapters and five appendices in this book, which is intended to be a first-course text on probabilistic structural mechanics and a treatise of random vibration and buckling. Chapter 1 is a four-page brief introduction to the subject matter with some 90 general references. It would be desirable if the author could provide guidance on which one of these many references a beginning student should read first to gain additional insight into this important and timely topic. In any event, such a cusory listing of many references may be bewildering for first-courst students and unnecessary for those who are interested in advanced topics.

Except for Sections 2.1, 2.8, and 4.18, Chapters 2, 3, 4, and 6 cover topics that are found in most standard textbooks of probability theory. In Section 2.1, the experimental study of cylindrical shells are described in some detail. In Section 2.8, a brief introduction is made to the reliability analysis of statically determinate trusses. In Section 4.18, the application of probabilistic methods to obtain optimal dike height in the Netherlands is presented as a practical example.

In Chapter 5, the author starts with a tensile member with a random force following an uniform distribution. This example is used to illustrate various terms such as reliability, unreliability (failure probability), worst and "short-of-the-worst" cases in design. This bar example is modified to have (*a*) a deterministic load and random strength, and (*b*) a given tensile force and allowable stress and random cross-sectional area. Next, a beam under a random distributed force is treated to be followed by a study of static and dynamic imperfection of a three-hinge, rigid-rod system with a nonlinear spring. The case of axial impact of a bar with random initial imperfection is then discussed. As an engineering teacher, the reviewer likes the use of simple examples for the illustration of concepts and methods. In this case, however, these "concrete examples" (p. 104) appear to be nonhomogeneous and inconsistent in terms of the degree of simplicity and difficulty. It may be desirable to mark those sections (e.g., Sections 5.5–5.7) for advanced students only realizing the fact that the first course on structural reliability is taught to undergraduate students in some universities.

Chapter 7 covers the classical theory of structural reliability. The author chooses to use a table for error function rather than a table for standardized normal distribution when normal and lognormal distributions are evaluated. The reviewer wishes that this chapter can be expanded to include the treatment of system reliability which was introduced very briefly in Sections 2.7 and 2.8.

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Chapter 8 gives an introduction to random processes with a good list of recommended references. In Chapter 9, topics covered include random vibration of linear multidegree-of-freedom systems and modal cross correlations.

In Chapter 10, the concept and methods of random fields are introduced. Other topics include axisymmetric random vibration of a cylindrical shell under ring loading, boundary-layer turbulence, and flutter and random vibration of beams (mostly from the author's own work). A brief introduction to Monte Carlo methods is given in Chapter 11 concluding with the author's work on buckling of a bar supported on a nonlinear foundation.

As a college teacher who is interested in structural reliability, the reviewer wishes to compliment the author for the completion of a difficult task in preparing this book on a subject matter, which is still developing on many fronts. Although the author stated in his preface that the book is intended for students in aeronautical engineering, mechanical engineering, and theoretical and applied mechanics, most topics as covered are very much of interest to civil engineers, many of whom including the late Professor A. M. Freudenthal made significant contributions to the development of this important and timely subject matter. Several constructive suggestions are made herein for consideration by the author and readers of this interesting book.

Numerical Solutions of Partial Differential Equations. Edited by J. Noye. North-Holland, The Netherlands, 1982. 648 Pages. Price $93.00.

REVIEWED BY M. HOLT[5]

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This conference is one of a series successfully organized by Dr. Noye in different regions of Australia at two year intervals. As on previous occasions, the main direction of the conference was emphasized by four invited survey papers covering the principal aspects of numerical analysis currently being applied to physical problems in Australia. The lead-off survey by John Noye on finite difference methods is extremely thorough and could be used as the text for a graduate course on the subject. The second invited lecture, by Clive Fletcher, uses Burgers' equation as a model for illustrating Fletcher's recent contributions on finite difference, Galerkin, spectral, and finite element methods and is written with his usual clarity. The survey is a curtain raiser for Fletcher's recently completed text on Galerkin methods. In the third survey, Josef Tomas explains the fundamentals of finite element methods to engineers, avoiding the obscurity to be found in many mathematical presentations of the subject. The fourth invited lecture, by L. J. Wardle, explains the boundary element method, a technique for reducing mainly elliptic boundary value problems to those of solving integral equations. The remaining long, invited lectures by Ken Mann and Leonard Colgan deal with the special problems associated with the handling of large sparse matrices. The invited contributions take up over half the volume. Sixteen regular papers were presented, 10 of which concerned applications to engineering problems while the remainder dealt with computational techniques themselves. The applied problems included tidal flows, stratified flow, surface waves, diffusion, and reacting flows. With one exception, all the authors are Australian and the Proceedings demonstrate the advanced level attained in computational physics by Australian research workers and their familiarity with the latest developments in the subject made in other leading countries.

The volume is easy to read and is strongly recommended to all those who wish to become familiar with the latest advances in the rapidly growing field of Computational Physics.

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