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BOOK REVIEWS

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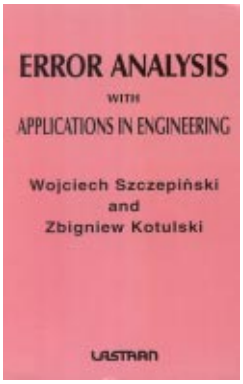
I. FOUNDATIONS & BASIC METHODS

1R1. Error Analysis with Applications in Engineering. - W Szczepinski and Z Kotulski *(Inst of Fund Tech Res, Polish Acad of Sci, Warsaw, Poland).* Lastran Corp, Honeoye NY. 2000. 235 pp. ISBN 1-893000-02-8. $57.00.

Reviewed by M Bonnet (Lab de Mec des Solides, Ecole Polytechnique, Route de Saclay, Palaiseau Cedex, F-91128, France).

This book comprises seven chapters, an appendix, a bibliographical section (98 references), and an index. Exercises are provided at the end of each chapter. The stated goal of the book is to address, in a simple manner, branches of error analysis finding direct applications in engineering practice.

The book can be roughly be divided into three parts. The first (Chs 1-3) presents fundamentals of error calculus. Included in this material is a survey of classical concepts from elementary probability theory (including continuous random variables) and statistics. This very classical material is presented in a rather pleasant and easy-to-read manner, but occupies a substantial fraction of the book (more than one-third). Chapters



4 and 5 are concerned with error analysis for two-dimensional functions of random-variables. Finally, Chapters 6 and 7 are concerned with error analysis for three-dimensional functions of random variables. Chapters 4 to 7 rely strongly on linearization with respect to random parameters (either via Taylor expansion or using linear regression) and on using Gaussian distributions. The exposition is somewhat repetitious, with the same concepts presented twice (for 2D and then 3D) instead of stating once and for all the necessary concepts for n-dimensional situations.

The authors obviously have low-dimensional problems in mind. First of all, many of the examples are essentially geometrical in nature (eg, manipulators), and hence of either 2D or 3D. Besides, some of the methods presented are either impractical (determination of tolerance polygons by direct inspection) or infeasible (Mohr circles for the covariance matrix) in higher dimensions. On the other hand, methods better adapted to higher dimensions are not treated.

Another source of complexity is left out, namely the possibility that the n-dimensional functions of random parameters be defined implicitly through the solution of initial-, boundary-, or initial-boundary value problems. Similarly, no link is made to reliability analysis techniques.

Generally speaking, the computing side of error analysis is not considered. For instance, linear programing could have been invoked in connection with the determination of tolerance polygons. No mention is made either about using numerical algorithms for performing linear regressions or eigenvalue/eigenvector analyses of covariance matrices. The usefulness of computing techniques for error analysis in engineering problems of some complexity is not discussed.

This book is written in a generally clear and readable style which avoids any unnecessary complication. A substantial proportion of this relatively short book is spent on reviewing well-established concepts. The treatment of the subject lacks depth, especially regarding the absence of discussion in connection with complex modeling situations and computer-oriented treatments.

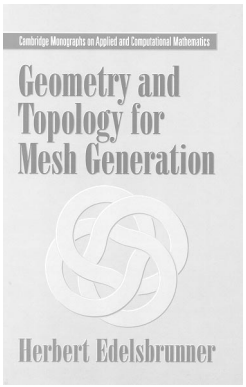
The presentation (clarity of typesetting, language,) is overall of good quality, despite some low-quality graphics and a few minor errors here and there which suggest that the publisher did not do a thorough final proofreading of the manuscript.

In conclusion, this reviewer expects *Error Analysis with Applications in Engineering* to be useful mostly to students and beginners in the subject area, given that the basics are presented in a relatively simple and friendly fashion. As such, it may be purchased by university libraries, although a substantial fraction of the material presented therein is already well covered in probability and statistics textbooks and monographs. On the other hand, scientists and engineers wanting to perform error analysis on complex engineering problems will probably find that the book under review falls a bit short of their objectives.

1R2. Geometry and Topology for Mesh Generation. Cambridge Monographs on Applied and Computational Mathematics. - H Edelsbrunner *(Dept of Comput Sci, Duke Univ, Durham NC).* Cambridge UP, Cambridge, UK. 2001. 177 pp. ISBN 0-521-79309-2. $44.95.

Reviewed by DJ Benson (Dept of Appl Mech and Eng Sci, UCSD, 9500 Gilman, La Jolla CA 92093-0411).

This textbook is a slim 177 pages that focuses on automatic triangular and tetrahedral mesh generation. Although one might expect from the title that it would cover a broader range of topics, eg, hexahedral meshes and blending functions, the preface clearly states the author's intentions.



The book is broken into seven chapters, with the first six chapters representing two weeks of lecture each. The sections within the chapter each represent one 75-minute lecture. The book starts with a discussion of Vornoi and Delaunay triangulations, moves on to algorithms for constructing them, and then discusses algorithms for surface simplification and eliminating/transforming elements with poor aspect ratios. The final chapter discusses unresolved problems, a nice feature that gives those new to the field a perspective on current research. The subject and author indices are thorough.

The book is clearly written with plenty of figures to illustrate its concepts. Each chapter ends with a bibliography and exercises. The bibliography also contains the author's comments on the different references, a feature rarely found in books and which this reviewer found to be very helpful. Some of the algorithms are expressed in a pseudo-

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code format with some features particular to C. Those unfamiliar with C should be able to figure out expressions like ''*n- -*'' based on their context.

While the target audience is upper division seniors and graduate students, *Geometry and Topology for Mesh Generation,* should also appeal to those who want to automatically generate triangular and tetrahedral meshes and are looking for more than a cookbook of algorithms. Those seeking a how-to book for commercial mesh generators should look elsewhere. Individuals seeking information on generating logically regular mesh blocks for computational fluid dynamics would be better off with Joe Thompson's classic book, *Handbook of Grid Generation.*

1R3. Introductory Finite Element Method. Mechanical Engineering Series. - CS Desai *(Dept of Civil Eng and Eng Mech, Univ of Arizona, Tucson AZ)* and T Kundu *(Univ of Arizona, Tucson AZ).* CRC Press LLC, Boca Raton FL. 2001. 496 pp. ISBN 0-8493-0243-9. $89.95.

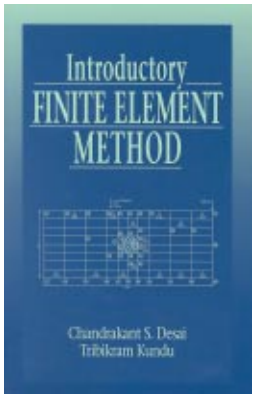
Reviewed by Xiaoyan Lei (Dept of Civil Eng, E China Jiaotong Univ, Nanchang, 330013, China).

This is an excellent addition to the available textbooks on finite element method. The book is intended mainly for undergraduate and beginning graduate students. It distinguishes itself in comparison to other textbooks in its description and organization. Its approach is sufficiently elementary so that it can be introduced with the background of essentially undergraduate subjects. In addition, the treatment is broad enough so that the reader or the teacher interested in various topics such as stress-deformation analysis, fluid and heat flow, potential flow, time-dependent problems, diffusion, torsion, and wave propagation can use and teach from it. The mathematical formulations and fundamental concepts illustrated with simple examples and summaries or comments and plenty of exercises presented at the end of each chapter are other merits of the book.

In what follows, a brief description of the contents of the book is given (14 chapters and three Appendices).

Chapter 1 presents a philosophical discussion of the finite element method. Chapter 2 gives a description of the eight basic steps and fundamental principles of variational calculus. Chapters 3 to 5 cover one-dimensional problems in stress deformation analysis and steady and time dependent flow of heat and fluids.

Chapter 6 deals with the finite element codes that can solve different types of problems. The codes presented are thoroughly documented and detailed so that they can be used and understood without difficulty. Chapter 7 introduces the idea of higher order approximation for the problem of beam bending and beam column. One-dimensional problems in mass transport and wave propagation are covered in Chapters 8 and 9, respectively.



Chapter 10 presents the basic finite element formulation for two- and three-dimensional problems. Different types of two-dimensional problems are discussed in Chapters 11 to 14. The chapters on torsion (Ch 11) and other field problems (Ch 12) havebeen chosen because they involve only one degree of freedom at a point. Chapters 13 and 14 cover two-dimensional stress deformation problems involving two and higher degrees of freedom at a point.

Appendix 1 gives descriptions, solutions, and comparisons for a problem by using a number of methods: closed form, Galerkin, collocation, sub domain least squares, Ritz, finite difference, and finite element. Appendix 2 introduces the commonly-used direct and iterative procedures for the solution of algebraic simultaneous equations. Appendix 3 presents details of a number of computer codes relevant to various topics in the text.

Introductory Finite Element Method is a very useful book for undergraduate students and teachers that deal with the finite element method. It is well produced, the printing is generally clear, and the diagrams are well done. The book is highly recommended for undergraduate students and teachers in universities.

1N4. Green's Functions with Applications. - DG Duffy *(NASA Goddard Space Flight Center, Greenbelt MD).* Chapman and Hall/CRC, Boca Raton FL. 2001. 472 pp. ISBN 1-58488-110- 0. $89.00.

This work systematically presents the various methods of deriving Green's functions. It leads readers through the process of developing these useful functions for ordinary and partial differential equations. In addition to exploring the classical problems involving the wave, heat, and Helmholtz equations, the book includes special sections on leaky modes, water waves, and absolute/convective instability.

The author gives special attention to the numerical evaluation of Green's functions. By illustrating many of the functions in the text and problem sets, he helps readers develop an intuition about the behavior of Green's function in certain problems. He also considers the questions of the computational efficiency and possible methods for accelerating the process.

The book offers: detailed, step-by-step methods for finding and computing Green's functions; historical development of Green's functions and a review of the relevant background material; numerous examples and problems from acoustics, applied mechanics, antennas, and the stability of fluids and plasmas; and an emphasis on the numerical evaluation of Green's function.

Constitutive Modelling of Geomaterials. - Edited by B Cambou *(Laboratoire de Tribologie et Dynamique des Syst, Ecole Centrale de Lyon, 36 Ave Guy de Collongue, Ecully Cedex, 69131, France)* and C Di Prisco *(Politecnico di Milano, Piazza Leonardo da Vinci 32, Milan, 20133, Italy).* Hermes Sci Publ, Paris. 2000. 233 pp. Softcover. ISBN 1-903398-06-1. $74.95. (Under review)

Handbook of Continuum Mechanics: General Concepts, Thermoelasticity. - J Salencon *(Lab de Mec des Solides, Ecole Polytechnique, Palaiseau Cedex, 91128, France).* Springer-Verlag, Berlin. 2001. 803 pp. ISBN 3-540-41443-6. $159.00. (Under review)

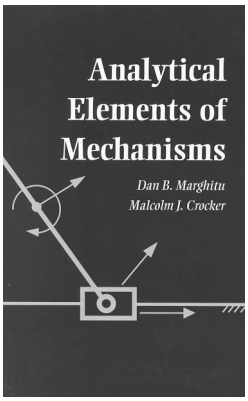
Mechanical Behavior of Engineering Materials, Volume 1: Static and Quasi-Static Loading. - YM Haddad *(Dept of Mech Eng, Univ of Ottawa, Ottawa, ON, Canada).* Kluwer Acad Publ, Dordrecht, Netherlands. 2000. 426 pp. ISBN 0-7923-6355-8. $210.00. (Under review)

II. DYNAMICS & VIBRATION

1R5. Analytical Elements of Mechanisms. - DB Marghitu and MJ Crocker *(Dept of Mech Eng, Auburn Univ, Auburn AL).* Cambridge UP, Cambridge, UK. 2001. 276 pp. ISBN 0-521-62383-9. $59.95.

Reviewed by AF Bertolini (Dept of Aerospace Eng, RMIT Univ, GPO Box 2476V, Melbourne, Vic, Australia).

This is not a book for the faint-hearted non-mathematically oriented among us. Marghitu and Crocker have produced a monograph that explores deeply the mathematics underpinning the theory of mechanisms. From one perspective, it is a *tour-de-force* of mathematical derivation for the properties and motions of mechanisms. From the educational perspective, it lacks the structure and design to make itself a worthwhile educational textbook.



The book is aimed at the senior and graduate student level. Its purpose was so ''readers can become familiar with the solution of kinematics and dynamics problems of mechanisms, methods of solution, and their software implementation. Readers can also study and compare the available methods of analysis from a unified viewpoint.'' This book does fulfill on this inten-

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tion, although perhaps not as well as the authors had hoped. The unifying theory of the contour equation method links most of the book together and does indicate a more simple and cohesive approach compared to that of deriving the position vectors with respect to time to obtain the velocities and accelerations. The derivations shown are clear and do allow the reader to follow the process step by step so as to allow familiarity.

The book begins with an introductory chapter that essentially introduces the basic concepts and definitions of the terms used in the mechanisms area. The reader is then introduced in subsequent chapters to the development and derivations of position, velocity, and acceleration equations. As a counterpoint to this classical approach, the authors develop the contour equation method as a general algebraic approach. This is followed by chapters covering the use of the contour equation method for dynamic force analysis, mechanisms with gears, open kinematic chains, and kinematic chains with continuous flexible links. The book completes with an excellent collection of problems for the reader to solve, and a selection of programs for *Mathematica* in the Appendices.

While the structure of the contents is clear and logical, this reviewer was disappointed with the lack of introductions and conclusions. This made it difficult to gain a perspective of why one would perform all the derivations and an understanding of the links between each chapter. The diagrams were excellent, although the reader sometimes has to search several pages to find out what was being referred to in the text. The index was adequate with only one small error. The bibliography provided covers the area well, however, the referencing used was poor. The authors should use the numbering they gave the references in the bibliography throughout the book.

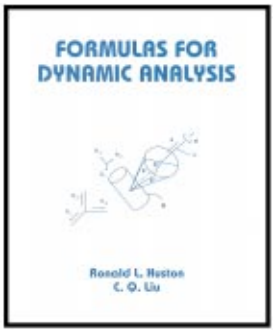
It is an expectation of this reviewer that published textbooks actually attempt to enable the reader to learn easily what is offered. While this book does provide the reader with all the necessary knowledge to familiarize oneself with the theory underlying mechanisms, it was a struggle. This reviewer suggests that Marghitu and Crocker's textbook can be strengthened in a number of ways. If the authors examine the latest edition of the *Engineering Mechanics* textbook by Hibbeler (2001) that they referenced, they would discover how Hibbeler integrates real life examples into his explanations and sample problems, thus making it easier for a reader to grasp the reasoning for the mathematical derivations and the topics covered. The provision of a glossary would not go astray as would a diskette containing all the *Mathematica* programs shown. This reviewer would like to issue a warning to all authors and publishers. There is an ever-increasing body of research on engineering education that is showing the necessity of providing textbooks, learning materials, and activities that truly enable the reader to learn. The era of delivering solely knowledge-based textbooks has past.

Despite the concerns that this reviewer has expressed, *Analytical Elements of Mechanisms* does provide an excellent reference book for graduate students and researchers in the area of mechanisms.

1R6. Formulas for Dynamic Analysis. - RL Huston *(Dept of Mech, Indust, and Nucl Eng, Univ of Cincinnati, 598 Rhodes Hall, Cincinnati OH 45221-0072)* and CQ Liu *(DiamlerChrysler, Auburn Hills MI).* Marcel Dekker, New York. 2001. 624 pp. ISBN 0-8247-9564-4. $175.00.

Reviewed by J Angeles (Dept of Mech Eng and Center for Intelligent Machines, McGill Univ, 817 Sherbrooke St W, Montreal, PQ, H3A 2K6, Canada).

A collection of formulas for rigid-body dynamics without context would be meaningless, to say the least. Fortunately, the book under review goes beyond compiling such a collection. This book, in fact, provides a comprehensive view of the subject, starting from the very basics. While such a book would normally cater to a specialized readership with an engineering or science background, the authors include definitions as fundamental as those of time, distance, particle, etc, which one would normally assume are well known to this readership.



The material in Chapter 1 thus appears somehow out of place for such a book; the untold reader, moreover, may be puzzled by some flawed definitions, like that of *particle*, which the authors base on the concept of *body*, not defined in this chapter but not until two chapters later, and only as pertaining to *rigid* body. The *particle* the authors intend to define, as understood in engineering circles, is a mechanical entity not necessarily *small*, for what is at stake here is the inability of this entity to change its attitude, and so, a *particle* can be the car of a train if the analyst is interested in studying only its vertical vibrations under pure translation. In fact, the authors admit this notion in Chapter 3—the reader has to go two chapters ahead to have an explanation of a definition that is first given in Chapter 1.

Chapter 2 is about elementary vector algebra and vector calculus, while Chapter 3 introduces the kinematics of particles. Here, the authors introduce the concept of rigid body, although the study of this entity is relegated to Chapter 6. It is unclear to this reviewer why the basic concept of angular velocity, proper of rigid bodies, is introduced in Chapter 3, although the authors come back to this concept in Chapter 6, without connecting the two discussions. Chapters 4 and 5 are devoted, respectively, to the kinetics and the dynamics of particles. Kinetics, as is recalled here, refers to the independent study of active and inertia forces, dynamics being the study of the interaction of these two kinds of forces. The downside of devoting one chapter to each of these two items is that the reader has to wait until Chapter 6, which the authors chose to call *Kinematics of Bodies*, to come across the subject that really matters to engineers, namely, rigid bodies. Furthermore, the authors claim in the opening paragraph of Chapter 6 that the chapter ''focuses'' on rigid bodies. The fact of the matter is that the authors do not treat other than rigid bodies in this chapter and in the balance of the book.

Rigid bodies, on the other hand, can be regarded either as aggregates of material points (particles) or as continua of matter; in either case, this material entity is constrained to move in such a way that the distance between any pair of its points (the continuum occupies a region of space, and hence, it also involves points) is preserved. The authors chose the traditional first approach, which is not flawless. In this approach, the reader has to believe that a summation of discrete terms can lead to an integral over a continuum. In the second approach, on the other hand, the formulation of dynamics is straightforward, for a whole body of knowledge is available, namely, that pertaining to continuum mechanics. In this context, Newton's second law and Euler's equation of balance of moments become natural derivations of Euler's laws of conservation of momentum and of angular momentum, respectively, which are valid for any continuum, whether fluid or solid and, if the latter, whether deformable or rigid.

A special feature of the book is the extensive discussion on how to derive rotation matrices for different triplets of elementary rotations about the coordinate axes. Here, the authors include what they call *configuration graphs*, a mnemonic means of producing those matrices by using simple rules. This reviewer is not quite convinced of the usefulness of this extensive discussion. Along these lines, the authors go so far as to include a subsection with the heading ''Computation Algorithms.'' The problem is that in this half-page subsection, no single algorithm is spotted. Then, the discussion on *motion classification* has some problems: *translation* and *rectilinear translation* are discussed, along with *plane motion* and *general plane motion*. However, the authors overlooked a rational analysis of displacements in terms of group theory, as available in the archival literature [1],

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and in English in this reviewer's monograph [2]. In the same chapter, the terminology on screw motion is flawed. Indeed, in the most general case of rigid-body motion, no single point of the body remains fixed with respect to an observer (a coordinate frame essentially), whatever this observer may be. However, a set of points of the body can always be found whose points have a velocity, relative to that observer, of minimum Euclidean norm, all points lying on a line, which is termed the instant screw axis of the motion, all the points on this line having identical velocities. The authors wrongfully speak for this general motion of the existence of a *center of rotation*.

One plus of the book is the authors' departure from the usual practice of resorting to what is known as *quasi-coordinates* to account for putative variables from which non-derivative quantities like the angular velocity is believed to derive upon time-differentiation. Here, as in the whole book, the authors faithfully follow Kane's approach, who is a pioneer in this regard, and independent of quasi-coordinates and other esoteric quantities like *pseudo-derivatives*, notorious for plaguing the literature on the subject. Kane's approach is, in fact, extremely enlightening in treating nonholonomic systems. In Chapter 10, addressing this subject, the authors follow literally an earlier paper (Passerello and Huston) [3], in which the authors introduced the nonholonomic constraints into the Lagrange equations of the system under analysis, with the purpose of reducing the number of governing equations to a set of independent second-order ordinary differential equations (ODE), free of constraint forces. In doing this, the authors faced the problem of solving for a number of unknown generalized velocities from a smaller number of linear algebraic equations. The way the authors got around this *quandary* was by adding identities in the same set of generalized velocities, thereby rendering their linear system determined, ie, with as many equations as unknowns, and nonsingular. In the process, the authors rendered their derivations unnecessarily cumbersome. Indeed, as Ostrovskaya and Angeles [4] demonstrated in 1998, there is actually no need to solve any system of equations in this analysis. It is a pity that the authors did not conduct a literature survey—the number of bibliography items that appeared in the last 10 years that are cited in this book is a mere 11. Eight of those are, in fact, either undergraduate textbooks or monographs; only three are archival publications and, of these, two are the first author's own work. Chapter 7 includes additional formulas of rigid-body kinematics, while Ch 8 discusses the inertia properties of rigid bodies in great detail. Chapters 9 and 10 are devoted to rigid-body kinetics and dynamics, respectively. Chapter 11, in turn, includes various classroom-type of mechanical systems whose mathematical models are derived using the various formulations discussed in the book: d'Alembert's Principle; Kane's equations; and Lagrange's equations. The last three chapters cover mechanical systems composed of multiple rigid bodies. On a side note, the typesetting could have been much better. Usual practice calls for italics in literals occurring in mathematical relations; the authors used the same roman fonts of the text. The outcome is that the reading becomes rather heavy. It does not help that the authors used a word processor with rather limited typesetting capabilities, and the publisher printed their document without typesetting it.

This book does not contain a collection of end-of-chapter problems, for which reason its use as a textbook is rather limited, but perhaps it was never the intention of the authors to produce a textbook. As a reference document, *Formulas for Dynamic Analysis* is recommended to the practicing engineer and to the mature graduate student.

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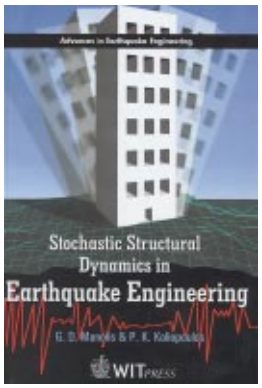
4. Ostrovskaya S and Angeles J (1998), Nonholonomic systems revisited within the framework of analytical mechanics, *Applied Mechanics Reviews*, **51**(7) 415-433.

1R7. Stochastic Structural Dynamics in Earthquake Engineering. Advances in Earthquake Engineering, Vol 8. - GD Manolis *(Aristotle Univ, Thessaloniki, Greece)* and PK Koliopoulos *(Tech Inst, Serres, Greece)*. WIT Press, Southampton, UK. 2000. 271 pp. Diskette included. ISBN 1-85312- 851-1. $225.00.

Reviewed by YA Rossikhin (Dept of Theor Mech, Voronezh State Univ of Architec and Civil Eng, ul Kirova 3-75, Voronezh, 394018, Russia).

This book is the fine textbook for civil engineering students, since it comprises the basics of random vibrations and stochastic mechanics which are adapted to the needs of the civil engineer practicing seismic design of structures.

The book includes nine chapters followed by two appendices, a list of references, and an index. The first chapter is an introduction reviewing manifestation of stochasticity in engineering systems and classification of problems. The second chapter presents the fundamental concepts of probability theory and the statistical analysis of random variables and stochastic processes. These concepts, coupled with the principles of structural dynamics, which are described in Appendix A for students' convenience, form the necessary mathematical background for the remaining chapters. Single- and multiple-dof systems response to random input in the linear approximation are presented in Chapters 3 and 4, respectively. The most widely used techniques for stochastic analysis of dynamic systems when nonlinear mechanisms are involved in either the excitation process or the mechanical properties of the oscillating system are discussed in Chapter 5 by the example of sdof oscillators. Chapters 6 and 7 are devoted to the problem of seismic wave propagation and its influence on structures. Chapter 8 presents numerical methods commonly used in stochastic structural dynamics (FEM and BEM). The last chapter is an introduction to very interesting and practically important field of risk analysis of structures operating in a seismic environment.



It must be noted that if vibrations are covered rather broadly, then the waves are not investigated in detail. The authors restricted themselves by analyzing the simplest case, namely, SH waves propagating along an elastic half-space, and in so doing randomness in the medium is manifested through the wave number. But it is well known that SH waves cropping out at the free surface are unstable (see works by Viktorov, Gulyaev, Bleustein, Rossikhin, etc). This means that the presence of weak stochastic heterogeneity or slight stochastic anisotropy immediately results in the transformation of the SH wave into a surface wave, ie, its amplitude begins to attenuate with depth. Since real soils involve both weak anisotropy and slight heterogeneity, then the pure SH wave coming onto the free surface cannot be obtained. The authors have not even mentioned surface waves in this book, which play an important role in the analysis of the soil-structure interaction under seismic excitation.

Stochastic Structural Dynamics in Earthquake Engineering has features intended to support its use as an advanced undergraduate text. The book is well written, with good quality figures and tables to illustrate the subject. A list of references essentially

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involves textbooks and monographs in the field rather than original papers, which can be attractive for students, but not for researchers. The authors provide a reasonable subject index. There are many numerical examples used to illustrate material in Chapters 2 through 9 and in Appendix A. Problems appear at the end of all chapters with the answers provided in Appendix B. The computer programs that are referred to in conjunction with the various exercises in the book are available on an attached diskette. However, the book's high price is a significant deterrent to classroom use, especially since other texts on the topic are available. Consequently, this reviewer only recommends purchase by libraries and individuals with an interest in earthquake engineering.

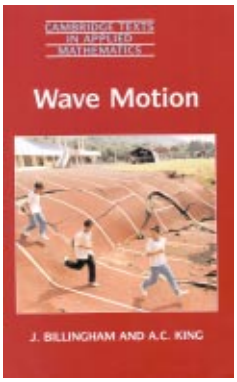
1R8. Wave Motion. Cambridge Texts in Applied Mechanics. - J Billingham and A King *(Univ of Birmingham, UK).* Cambridge UP, Cambridge, UK. 2000. 468 pp. Softcover. ISBN 0-521- 63450-4. (Hardcover ISBN 0-521-63257-9 $110). $37.95.

Reviewed by Shi Tsan Wu (Dept of Mech and Aerospace Eng, Univ of Alabama, Sparkman Dr, Huntsville AL 35899).

Wave motions are most common phenomena which we encounter in daily life. For example, when someone signs or plays a musical instrument, the standing waves in their vocal cords and piano strings produce a pressure change as sound waves which is audible. On the other hand, the existence of waves can be seen in the universe in the electromagnetic waves that cover a spectrum from low frequency radio waves, through visible light to x-ray and gamma rays. This text is designed for use by advanced undergraduates in applied mathematics with potential to be used for physics and engineering students. The authors also state that this is not a book about numerical methods for wave propagation.

In this book, the authors have divided their presentation into three parts. Part I contains Chapters 1 through 6 which deal with linear wave theory. All of the analytical techniques of 19th century mathematics concerning linear wave theory are presented. These techniques include separation variables, Fourier series and Fourier transforms which are used to reveal the characteristics of linear waves on stretch string (Ch 2), linear sound waves (Ch 3), linear water waves (Ch 4), linear waves in solids (Ch 5), and electromagnetic waves (Ch 6).

Part II includes Chapters 7 through 9. The nonlinear wave theory with 20th century mathematics are presented. The authors begin in Chapter 7 by examining hyperbolic systems governed by propagation of information on characteristics. The fundamentals of method characteristics are introduced. Examples are used to illustrate the mathematical theory which are traffic flow and nonlinear gas dynamics (shocks). The authors then move on to study nonlinear water waves presented in Chapter 8, which includes the topics of the nonlinear shallow water waves, the effect of nonlinearity on deep water gravity waves (Stokes Expansion), the Korteweg-deVries equation for shallow water waves and nonlinear capillary waves. To conclude this part, the subject of chemical and electrochemical waves are presented in Chapter 9. Specific topics discussed are the law of mass action, molecular diffusion, reaction-diffusion system, auto-catalytic chemical waves with unequal diffusion coefficients, and the transmission of nerve impulses (the Fitzhugh-Nagumo equation).



Part III, the final part of the book, covers more advanced topics which include Chapters 10 through 12. In Chapter 10, the authors present various physical systems that can be modeled using Burger's equation. These include more complicated analyses of the traffic flow and weakly nonlinear compression gasdynamics. The analysis of scattering and diffraction of both scalar and vector waves through apertures and past obstacles are presented in Chapter 11. In the final Chapter (12), the authors describe the use of the inverse scattering transform to solve the Korteweg-deVries (KdV) equation and the nonlinear Schrödinger (NLS) equation. The KdV equations are used to analyze the propagation of long waves on shallow water and the NLS equation governs the propagation of dispersive wavepackets in a nonlinear medium such as pulses of light in optical fibers. The book also includes an appendix for useful mathematical formulas and physical data which are very useful.

In summary, this is a very well written textbook. This reviewer agrees with the authors claim that this is a textbook for advanced undergraduate in applied mathematics. But this reviewer would suggest that the book could also be used as a textbook for first-year graduate students in physics and engineering disciplines as a reference for scientists and engineers who are interested in analytical methods and solutions for wave motions.

1N9. European Conference on Vehicle Noise and Vibration 2000. Held May 2000, London. - Edited by Automobile Div *(Inst of Mech Eng, London, UK).* IMechE, London. Distributed in USA by ASME, New York. 2000. 388 pp. ISBN 1-86058-270-2. $245.00.

All aspects of vehicle design and manufacture must consider the effects of vibration on the components and performance, while also looking at the implications of environmental legislation with regards to exterior noise, such as tyre noise and exhaust systems. This book does so, including papers that recognize not only the importance of specialist skills and expertise, but also the way in which these are combined effectively to produce a high-quality result in an affordable time.

1N10. IUTAM Symposium on Mechanical Waves for Composite Structures Characterization. Held in Chania, Crete, Greece, June 2000. - Edited by DA Sotiropoulos *(Southern Polytechnic State Univ, Marietta GA).* Kluwer Acad Publ, Dordrecht, Netherlands. 2001. 196 pp. ISBN 0- 7923-7164-X. $65.00.

This book is a collection of selected reviewed papers that were presented at the symposium. As the symposium theme was interdisciplinary in nature, topics covered in the book fall within diverse fields such as applied mathematics; applied physics; biomedical, civil, and electrical engineering; fluid and solid mechanics; materials and mechanical engineering; and seismology. The papers cover analytical, computational, numerical, theoretical, and experimental aspects, from state-of-the-art fundamental research to applied research and applications in emerging technologies.

The topics include body waves, elastic waves, guided waves, inhomogeneous waves, rays, surface waves, and ultrasound in composite materials which are fiber-reinforced, laminated, or homogeneous containing bonds, coatings, cracks, defects, or thin films. The material interfaces are either flat or non-planar, and wave motion exists either by itself or superposed on a pre-existing state of stress.

1N11. Materials and Structures for Energy Absorption. From IMECHE Seminar held May 2000, London UK. - Edited by Mat and Mech of Solids Group *(Inst of Mech Eng, London, UK).* IMechE, London. Distributed in USA by ASME, New York. 2000. 64 pp. ISBN 1-86058-321-0. $93.00.

This volume deals with the subject of impact and the energy absorbing capabilities of materials and structures. Contents include papers from the conference on Vehicle crashworthiness in real world conditions; Woven polypropylene structures; Controling structural collapse in off axis impact of rail vehicles by retrospective modification; Design and performance of energy absorbing subfloor structures in aerospace applications; Energy absorption in hybrid composite structures; and Development of autobody sheet materials for crash performance.

1N12. Multi-Body Dynamics: Monitoring and Simulation Techniques—II. - Edited by H Rahnejat, M Ebrahimi, R Whalley *(Dept of Mech and Med Eng, Univ of Bradford, UK).* IMechE, London. Distributed in USA by ASME, New York. 2000. 350 pp. ISBN 1-86058-258-3. $276.00.

This is a collection of papers from the Second International Symposium on the topic. Contents include Contact problems in multi-body dynamics; Multi-body impact with friction; Non-collocated tracking control of a rotating Euler-Bernoulli beam attached to a rigid body; Passenger and carbody interaction in rail vehicle dynamics; Human body modeling techniques for use with dynamics simulations; Dynamic tire testing for vehicle handling studies; Simulations of flexible engine block, crank, and valvetrain effects using DADS; Analysis of knock intensity in spark-ignition engines; Test-bench investigation of CV-joints regarding NVH behavior; Low-frequency torsional vibration of vehicular driveline systems in shuffle; Simulation of driveline

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actuation cables to improve cable design; Modeling and simulation of a vehicle dynamometer using hybrid modeling techniques; and End milling and its effects on the spindle drive mechanism.

1N13. Seventh International Conference on Vibrations in Rotating Machinery. Held September 2000, Univ of Nottingham, UK. - Edited by Tribology Group, and Machine Syst, Computing, and Control Group *(Inst of Mech Eng, London, UK).* IMechE, London. Distributed in USA by ASME, New York. 2000. 758 pp. ISBN 1-86058-273-7. $332.50.

This is a collection of papers from the conference which provides for the reader to be informed of new developments and industrial applications of current technology relevant to the vibration of machines and assemblies.

Topics covered include steam and gas turbines; generators; pumps; compressors; motors; reciprocating engines; miniature assemblies; transmission assemblies and MEMS; braking systems; disk drives; torsional, axial, and lateral vibration analysis; condition monitoring and diagnostics; measurement techniques and systems; active and passive control; balancing; instability; bladed systems; gears, seals, and bearings; tribology and contact mechanics; cracked rotors; and fluid structure interaction.

Advances in the Theory of Shock Waves. Progress in Nonlinear Differential Equations and Their Applications, Vol 47. - Edited by H Freistuhler *(Max Planck Inst for Math in the Sci, Leipzig, 04103, Germany)* and A Szepessy *(Dept of Math, Royal Inst of Tech, Stockholm, 100 44, Sweden).* Birkhauser Boston, Cambridge MA. 2001. 516 pp. ISBN 0-8176-4187-4. $79.95. (Under review)

Encyclopedia of Vibration: Volume 1, 2 and 3. - Edited by SG Braun *(Fac of Mech Eng, Technion-Israel Inst of Tech, Haifa, 32000, Israel),* DJ Ewins *(Dept of Mech Eng, Imperial Col of Sci, Tech and Med, Exhibition Rd, London, SW7 2BX, UK),* SS Rao *(Dept of Mech Eng, Univ of Miami, PO Box 248294, Coral Gables FL 33124-0624, SW7 2BX).* Academic Press, San Diego. 2001. 1595 pp. 3-vol set. ISBN 0-12-227085-1. $925.00. (Under review)

Linear and Nonlinear Rotordynamics: A Modern Treatment with Applications. - T Yamamoto and Y Ishida *(Nagoya Univ, Nagoya, Japan).* Wiley, New York. 2001. 325 pp. ISBN 0-471- 18175-7. $94.95. (Under review)

Linear Elastic Waves. - JC Harris *(Theor and Appl Mech Dept, Univ of Illinois, Urbana IL).* Cambridge UP, New York. 2001. 162 pp. ISBN 0-521-64368-6. $69.95. (Under review)

Mathematical Aspects of Numerical Solution of Hyperbolic Systems. Monographs and Surveys in Pure and Applied Mathematics, Vol 118. - AG Kulikovskii *(Dept of Mech, Steklov Math Inst, Russian Acad of Sci, Moscow, Russia),* NV Pogorelov *(Inst for Problems in Mech, Russian Acad of Sci, Moscow, Russia),* AY Semenov *(General Phys Inst, Russian Acad of Sci, Moscow, Russia).* Chapman and Hall/CRC, Boca Raton FL. 2001. 540 pp. ISBN 0-8493-0608-6. $94.95. (Under review)

Nonlinear Hyperbolic Waves in Multi-Dimensions. Monographs and Surveys in Pure and Applied Mathematics, Vol 121. - P Prasad *(Dept of Math, Indian Inst of Sci, Bangalore, India).* Chapman and Hall/CRC, Boca Raton FL. 2001. 338 pp. ISBN 1-58488-072-4. $89.95. (Under review)

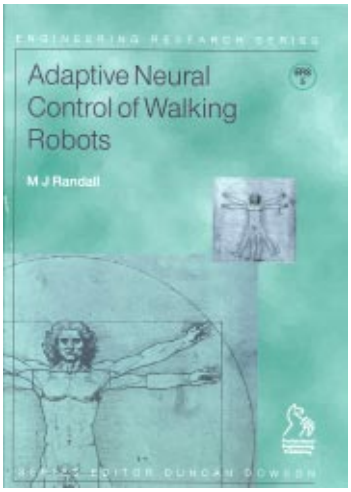
III. AUTOMATIC CONTROL

1R14. Adaptive Neural Control of Walking Robots. Engineering Research Series, Vol 5. - MJ Randall *(Deceased).* Professional Eng Publ, Suffolk, UK. 2001. 332 pp. ISBN 1-86058-294-X. $69.00.

Reviewed by JE Cochran (Dept of Aerospace Eng, Auburn Univ, 211 Aerospace Eng Bldg, Auburn AL 36849-5338).

Scientists and engineers have often used nature as a source of both inspiration and practical solutions in the design of machines. It follows that when an engineer considers the problem of designing a walking machine, it can be expected that he or she will try models of walking animals. As a basis for the design of a walking machine capable of transversing rough terrain, the author of this monograph chose to study the walking processes of hexapod insects. On the basis of observations of these animals and the application of mathematical tools such as neural networks and optimal control, he developed both the theory and a working model of a walking robot that was to some degree successful. The author dedicated much of his unfortunately short life to the work described in this book, and it is a lasting tribute to him and to his professors and co-workers who are responsible for its publication.

This book should be of interest to everyone involved in the design of walking robots, to engineers and scientists interested in the application of neural networks and optimal control to electromechanical systems, and even to professors teaching philosophy of science who have good mathematical backgrounds. The extensive coverage of the literature relating to robots and the use of models of insect motion alone makes this book a valuable resource. It is not a textbook, but could be used in a graduate course as one of several resources.



The author considers many areas ranging from philosophy to applied psychology, to biology, to dynamics, and to insect neurophysiology. Starting with Aristotle, the author provides, in Chapter 1, background on walking robots, gives many uses for such machines, and discusses several operational robots such as the Plustech Forestry Harvester and the Honda bipeds. The author approaches the problem of designing a walking robot by developing, in Chapter 2, a novel generic control hierarchy consisting of ''four layers:'' motivation, body route trajectory generation, kinematic planning, and dynamic execution. In Chapter 3, he considers the emulation of walking strategies of insects that transverse rough terrain to obtain basic principles regarding sensing and control. Walking animals exhibit gaits, ie, repetitive motions of their limbs, which are used for slow and fast motion.

Chapter 4 deals with gaits from the standpoint of biological oscillatory behavior, and the research on stability of interconnected oscillators is reviewed. Various approaches to robot leg trajectory generation are considered in Chapter 5. These include the *top-down* and *bottom-up* approaches to motion generation. In the top-down approach, the motion is observed, and a mathematical model of the motion is used to determine the forces and moments needed to generate it. The *top-down* approach is similar to dynamic inversion used in the control of aerospace flight vehicles. An interesting concept, the *isochrony principle*, which requires that a trajectory segmented by *way points* be generated so that the times between way points are equal, is used to generate velocity and acceleration time histories. The *bottom-up* approach to motion generation is based on the notion that the motion should be such that the time rates of change of the linear and angular accelerations (the *linear and angular jerks*) are minimized. This requires the use of optimal control principles.

In Chapter 6, the author considers the kinematics and dynamics (kinetics?) of hexapods. A closed-form solution for the forward and inverse kinematics of a single leg is derived. A review of the theory of adaptive neural control is presented in Chapter 7. Controllers classified as linear-equivalent and nonlinear equivalent are described, and the former type is chosen. The synthesis of stable adaptive neural controllers for open-chain dynamic systems is addressed using Lyapunov's Second Method. Some experiments are also discussed. Proofs of certain theorems are given in the Annex to this chapter.

Since in walking the hexapod robot produces closed, rather than open chains when two or more of its feet are on the ground, the stability of closed kinematic chains is considered in Chapter 8, and the most important results of the author's work are presented in the form of four theorems. As the author writes in the concluding chapter (Ch 10), ''...the stability proof does not guarantee that the robot will not fall over... However, it does guarantee that if such a failure

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occurs, it would not be as a result of the instability of the neural controllers.''

Preliminary experimental results are presented in Chapter 9. These show the promise of the approach taken by the author. In Chapter 10, he suggests that his work could be extended at both the theoretical and practical levels. Interested graduate students and other researchers will find some challenging ideas there.

As noted above, individual researchers in the area of robotics will find *Adaptive Neural Control of Walking Robots* of interest. It is also recommended as a selection for libraries at institutions where research in this area is conducted.

1N15. Climbing and Walking Robots. Proc of 3rd Int Conf, held Oct 2000, Madrid. - Edited by M Armada and P Gonzalez de Santos *(Inst de Automatica Indust, Consejo Superior de Investigaciones Cientificas, Madrid, Spain).* IMechE, London. Distributed in USA by ASME, New York. 2000. 901 pp. ISBN 1-86058-268-0. $561.00.

Robotic solutions for new challenging fields are presented in this work. Important research and technical development effort must be undertaken so that actual capabilities and performances of robots can be enlarged and improved. One of the major issues to achieve this goal is mobility. Wheeled and tracked platforms have limitations when it comes to moving in unstructured environments, and something more adaptable is required. In these situations, a climbing or a walking robot is now being recognized as an advanced and promising solution.

This collection from the Third International Conference brings together papers from leading and international academic researchers and industrialists working in this area of robotics. All aspects of CLAWAR machines are dealt with, covering topics that span the whole spectrum of technologies needed to produce good robotic designs.

1N16. Optimization Methods and Applications. Applied Optimization, Vol 52. - Edited by Xiao-qi Yang, Kok Lay Teo *(Dept of Appl Math, Hong Kong Polytechnic Univ, Hong Kong, Peoples Rep of China),* L Caccetta *(Sch of Math and Stat, Curtin Univ of Tech, Perth, Australia).* Kluwer Acad Publ, Dordrecht, Netherlands. 2001. 450 pp. ISBN 0-7923-6866-5. $167.00.

This book includes chapters on optimal control, nonlinear programing, global optimization, network optimization, and dynamic systems dealing with theory, computational techniques, and real-world applications. For the application chapters, the topics involved are optimum digital Laguerre network, stochastic optimal control model of solar powered car, personnel task scheduling problem, envelope constrained filter design, and optimal steel casting.

Engineering System Dynamics: A Unified Graph-Centered Approach. Control Engineering Series. - FT Brown *(Dept of Mech Eng, Lehigh Univ, Bethlehem PA).* Marcel Dekker, New York. 2001. 1006 pp. ISBN 0-8247-0616-1. $195.00. (Under review)

Optimal Control: An Introduction. - A Locatelli *(Dept di Elettronica e Informazione, Politecnico di Milano, Piazza L da Vinci 32, Milano, 20133, Italy).* Birkhauser Verlag AG, Basel, Switzerland. 2001. 294 pp. ISBN 3-7643-6408-4. (Under review)

Systems Dynamics and Mechanical Vibrations: An Introduction. - D Findeisen *(Dept 11 Mech Eng and Prod Tech, Inst of Machine Des, Tech Univ, Strasse des 17 Juni 135, Berlin, 10623, Germany).* Springer-Verlag, Berlin. 2000. 383 pp. ISBN 3-540-67144-7. $99.00. (Under review)

IV. MECHANICS OF SOLIDS

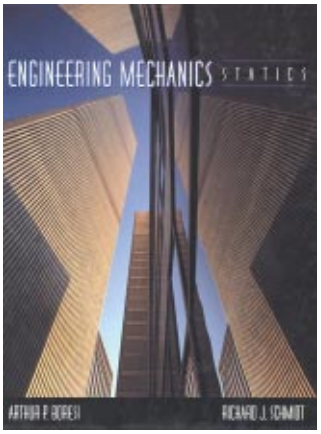
1R17. Engineering Mechanics: Statics. - AP Boresi and RJ Schmidt *(Dept of Civil and Architec Eng, Univ of Wyoming, PO Box 3295, Laramie WY 82071-3295).* Brooks/Cole, Pacific Grove CA. 2001. 683 pp. ISBN 0-534-95152-X. $104.95.

Reviewed by G Rega (Dept di Ing Stutturale e Geotecnica, Univ di Roma La Sapienza, Via Antonio Gramsci 53, Roma, I-00197, Italy).

The present book deals with most of the classical topics of statics commonly addressed in introductory texts of engineering mechanics. The material is organized in 12 chapters. After a review of basic concepts of mechanics (Ch 1), the book introduces the concepts of force and other vector quantities in Chapter 2. Equilibrium of a particle is addressed in Chapter 3, mostly based on geometrical reasonings. Equilibrium of a rigid-body in a two-dimensional and a three-dimensional framework is addressed in Chapters 4 and 5, respectively, by introducing vector algebra tools when they are needed, and by progressively generalizing concepts and principles of statics. Much of the rest of the book is devoted to application of the principles in the analysis of structural and mechanical systems. Chapter 6 deals with trusses, while Chapter 7 considers simple structures (frames and cables) and basic devices used in machines and simple mechanisms. Distributed forces and the concept of centroid of a body are addressed in Chapter 8, whereas fluid statics and friction are presented in Chapters 9 and 10, respectively. The last two chapters are devoted to the analysis of beams and shafts and, respectively, to an introduction to work principles as an alternative method for solving statics problems. Short appendices provide basic reference materials of algebra, geometry, and inertia.

The book adds to several existing texts in engineering mechanics. So, one might wonder: What's new with respect to the existing ones? The answer would be: a worthing-explicitly stated perspective of effectively teaching and consciously learning mechanics.

As a matter of fact, the authors' intention in writing the book, and the related objectives, are given in explanatory addresses to the instructor and the student: ''....to provide a thorough, rigorous presentation of mechanics, augmented with proven learning techniques..., ...to present the topics thoroughly and directly, allowing fundamental principles to emerge through applications to real-world problem..., ...to integrate learning principles and teaching techniques'' that instead of focusing ''exclusively on technical principles,'' as common to texts in engineering mechanics, can provide the students with ''effective study habits while they learn mechanics.''



The authors identify the instructor's task as that of cultivating ''students' interest, while educating them in the fundamentals and broad applications of mechanics.'' As a first way to accomplish this task, they choose to smoothly introduce concepts and principles of mechanics as motivated by the need to solve real-world problems. Accordingly, they emphasize concepts, derivations, and interpretations of the general principles by presenting the simplest and most elementary derivations that are consistent with the demand of rigor. At the same time, they apply concepts and derivations in a lot of example problems taken from everyday engineering practice. A huge number of basic technical systems from engineering mechanics is addressed throughout the book, by either directly solving them or proposing them to the students as homework problems. The book is also illustrated with many nice photographs and drawings.

As a second way to accomplish the task, the authors propose a structured approach to reading and learning along the lines of a formal procedure—the so-called SQ3R study-reading method—that has proven effective in improving textbook reading comprehension. It actually consists of allowing the student to develop a global view of the course material one chapter at a time, to deal with manageable pieces of the overall material, and to finally review it as a coherent whole. Practical tools are suggested for accomplishing these goals: to sequentially *survey, question, read, recite,* and *review* the contents of each chapter. This should allow the student to progressively move from a general idea of what is discussed in the chapter, to identifying what he/her should learn from its reading, to actually reading the chapter and reciting its major ideas, up to consistently reviewing all of its material. According to this framework, the authors also furnish a number of learning aids within each chapter: a look forward, survey questions, key terms, key concepts, learning objectives of each section, checkpoints, chapter highlights, homework problems, review questions, computer problems,

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and design problems. The final objective is helping the student to develop effective study habits by adding structure and discipline to his/her routine. A twofold criterion seems actually to underlie the authors' effort: globally improving the student's problem-solving abilities, while highlighting that conceptual understanding of mechanics is as important as problem solving.

The authors dwell upon the advantages obtainable in attacking new problems through a systematic application of the proposed strategy. Actually, this (present) European reviewer, who used to emphasize concept of mechanics through a systematic approach and to deduce applications from general principles/situations, is tempted to feel this formal reading-and-learning methodology is a bit naive. He would even wonder whether such a diversified amount of learning aids would actually result in scattering the reader's study habits rather than critically structuring them. But these are likely awkward doubts which do not adequately account for the American educational system towards which, it's worth noting, the European system is now moving, too. In contrast, it is worth emphasing the effort made by the authors to deal with mechanics in such a way to develop in the student a critical attitude of mind while clearly linking mechanics to problems from the real world. Of course, the practical experience will show whether the proposed methodology actually helps to improve the students' comprehension of mechanics.

Anyway, it must be stressed that we are dealing with a new valuable textbook to be strongly recommended to teachers of undergraduate courses in civil, architectural, and mechanical engineering.

1R18. Fracture Mechanics of Piezoelectric Materials. - Qing-Hua Qin *(Dept of Mech and Mechatronic Eng, Univ of Sydney, Sydney, Australia)*. WIT Press, Southamptom, UK. 2001. 282 pp. ISBN 1-85312-856-2. $149.00.

Reviewed by C Zhang (Dept of Civil Eng, Hochschule Zittau/Goerlitz, Univ of Applied Sciences, Theodor-Koerner-Allee 16, Zittau, D-02763, Germany).

Piezoelectric materials have wide engineering applications in smart structures and devices such as transducers, sensors, and actuators. Since piezoelectric materials are usually very brittle, their fracture behavior is very important to the mechanical integrity and reliability of these materials in engineering applications. Though many diverse research works have been carried out in recent years, a comprehensive and unified treatment on fracture mechanics of piezoelectric materials is still lacking. This book is perhaps the first extensive and detailed monograph on the subject, and it contains many recent research results, including the author's.

The book contains seven chapters entitled: Linear theory of piezoelectricity; Basic solution approaches for crack problems of piezoelectric materials; Cracks in piezoelectric materials; Cracks in thermoelectroelastic solids; Fracture criteria for piezoelectric materials; Analyzing crack problems by the boundary element method; and Experiments. Each chapter contains an introduction and a reference list to the subject under investigation. Thus, each chapter is self-contained and can be considered more or less independently of other chapters.

In Chapter 1, the basic governing equations and the commonly-used terminology of linear piezoelectricity are briefly summarized for later use. Three different electric boundary conditions are reviewed and discussed, namely, the permeable, the partially permeable (by air or vacuum), and the impermeable boundary conditions. Then, the fundamental relations for two-dimensional problems are given. Two solution methods are explained subsequently: the Stroh formalism and the Lekhnitskii formalism.

Chapter 2 deals with some basic solution methods for crack analysis in piezoelectric materials. The corresponding boundary value problems are formulated and the asymptotic crack-tip solutions for the mechanical and electric fields are given. As crack-tip characterizing parameters, the stress and the electric displacement (SED) intensity factors, the extended path-independent J-integral, and the energy release rate are presented. Five solution methods are briefly discussed. In particular, they are: the Green's function method, the Fourier transform technique, the potential function method, the finite element method (FEM), and the boundary element method (BEM).

Several crack problems in piezoelectric materials are treated in Chapter 3. They include the semi-infinite crack, the finite Griffith crack, the elliptical hole, the interface crack, crack dislocation interactions, macro and micro crack interactions, crack kinking, crack deflection in bimaterials, and the elliptical crack. The piezoelectric solids investigated are either infinite, semi-infinite (half-plane), or a strip of infinite length but finite width. Most of these problems are dealing with two-dimensional in-plane or anti-plane cracks. Special attention is given to derive the asymptotic crack-tip field and to obtain relations between the SED intensity factors, the energy release rate, and the applied mechanical and electric loading. Different solution techniques, such as the extended Lekhnitskii formalism, the conformal mapping technique, the Green's function method, the Fourier transform method, and the singular integral equation method, have been applied for this purpose. Several numerical results are also presented, and they are obtained mainly by using the singular integral equation method. In addition, criteria for crack kinking and propagation are also discussed.

Crack problems in thermoelectroelastic materials are analyzed in Chapter 4. In contrast to piezoelectric crack problems investigated in Chapter 3, thermal effects are taken into account in addition to mechanical and electric coupling. After an introduction and a summary of the basic theories of thermopiezoelectricity, the Fourier transform method, the Green's function method, and the conforming mapping technique are used to obtain the temperature and the electroelastic fields. Various crack problems are analyzed in this chapter, and they include crack-tip singularity, cracks in infinite, semi-infinite and bimaterial solids, multiple crack problems, macro and micro crack interactions, the penny-shaped crack, the interaction between a hole and a crack, and the interaction between an inclusion and cracks. For some crack problems mentioned above, numerical results obtained by a singular integral equation method are presented and compared with the finite element (FE) results.

In Chapter 5, fracture criteria for piezoelectric materials are presented. In particular, the fracture criteria using the stress intensity factors, the total energy release rate, the mechanical strain release rate, and the local energy release rate are explained. Advantages and drawbacks of these fracture criteria are discussed. As remarked by the author, further research works are required to verify which of these fracture criteria is suitable to describe the fracture behavior of piezoelectric materials properly.

A boundary element method for crack analysis of thermoelectroelastic materials is presented in Chapter 6. Singular boundary integral equations are applied to determine the temperature discontinuity, the crack opening displacements (displacement discontinuity), and the potential discontinuity. To solve the singular boundary integral equations numerically, a numerical solution procedure is presented. A technique based on the least-square method is adopted to obtain the SED intensity factors numerically. Numerical examples are given to show the efficiency and the accuracy of the BEM developed by the author.

Finally, experimental techniques are briefly described in Chapter 7. Three experimental techniques to determine the fracture toughness of piezoelectric materials are explained: the indentation fracture test, the double torsion test, and the mode I

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and the mixed mode fracture test. Some experimental results from literature are reported and they are compared with those obtained by the FEM.

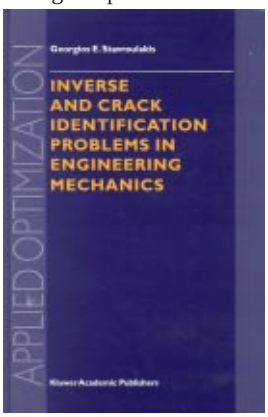
The book deals primarily with linear and static crack problems in transversely isotropic piezoelectric materials such as piezoelectric ceramics. Crack-tip nonlinearities such as dielectric break-down, polarization switching, local de-poling and domain reversal, and dynamic crack problems are not investigated. A few typographical errors in the book are found by the reviewer. Some shorted notations are not explained in the proper place, and some of the figures could be better presented and organized. The book is otherwise well written and contains figures of high quality. It is a specialized monograph on fracture mechanics of piezoelectric materials. *Fracture Mechanics of Piezoelectric Materials* is strongly recommended for purchase by scientific libraries. It is also highly recommendable to graduate students, professional researchers, and engineers from applied mechanics, material sciences, applied mathematics, and physics, who are working on and interested in this research subject.

1R19. Inverse and Crack Identification Problems in Engineering Mechanics. Applied Optimization Series, Vol 46. - GE Stavroulakis *(Dept of Civil Eng, Inst of Appl Mech, Tech Univ Carolo Wilhelmina, Braunschweig, Germany).* Kluwer Acad Publ, Dordrecht, Netherlands. 2001. 223 pp. ISBN 0-7923-6690-5. $122.00.

Reviewed by G Maier (Dept of Struct Eng, Tech Univ Politecnico, Piaza Leonardo Da Vinci 32, Milan, 20133, Italy).

Inverse problems undoubtedly represent, nowadays, a broad area of applied mechanics; an area which is growing in all its three subdomains, namely parameter identification, optimum design and structural control. The first one, especially, which is dealt with in this book, exhibits a variety of basic concepts and a multiplicity of approaches. An interdisciplinary character arises in it from the confluence of experimental methodologies with recent developments in mathematics (such as regularization of ill-posedness and nonconvex constrained minimization) and in computational mechanics (such as sensitivity analysis). In many applications, deterministic approaches have to be replaced by stochastic ones, in view of important roles played by noisy experimental data and modeling uncertainties. Batch exploitations of experimental data to simply minimize a discrepancy norm between measured and corrupted quantities may be satisfactory in many practical situations. Other situations suggest sequential techniques like in Kalman filter, which consists of a sequence of stochastic estimations along a flow of noisy measurements starting from an expert's *a priori* estimates. From an engineering point of view, a sharp distinction operatively and otherwise exists between material parameter identification based on laboratory testing and diagnostic identification of damages in structures on the basis of *in situ* monitoring.

In the inhomogeneous field of inverse mechanical problems, this volume basically focuses on structural parameter identification problems in statical and dynamical regimes endowed with the following peculiarities: unilateral contacts and cracks as primary sources of nonlinearities; consequent central role of complementarily problems or variational inequalities; and (in view of the nonlinearity confinement to lesser dimensionality loci) frequent recourse to boundary element methods for field modeling in space.



The purpose pursued by the author in this book (which was originated by his ''Habilitation'' thesis), clearly, is not to provide a textbook nor a broad conspectus of the subject. In fact, after a brief introduction on the conceptual framework of the topics to be expounded, three chapters are devoted to the *theoretical and computational tools* of later use, namely: linear and nonlinear complementarity problems; convex and nonconvex quadratic and nonlinear programing; mathematical programing ''under equilibrium constraints'' (MPEC); space discretization by boundary elements; evolutionary and *soft* computing techniques, such as genetic algorithms and neural networks.

The *tools* presented in the first half of the book, are put to work in the second half for the numerical solution of identification problems concerning flaws and cracks, in statics, steady-state dynamics, and transient dynamics (Chs 5, 6, and 7, respectively).

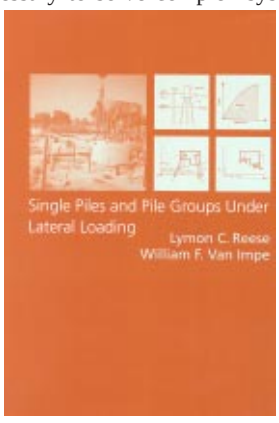
The pertinent literature is abundantly cited in reference lists at the end of each chapter. The style is clear and terse. The presentation is properly illustrated by meaningful (though mostly academic) examples and by numerous good figures.

In this reviewer's opinion, this up-to-date monograph by Georgios Stavroulakis substantially supplements the quantitatively still limited (but qualitatively excellent) set of general treatises, such as those by Bui and Tarantola. Its readership will hopefully include not only researchers and doctoral students interested in inverse mechanical problems, but also libraries of universities and companies. In fact, though deliberately restricted in coverage and purposes, *Inverse and Crack Identification Problem in Engineering Mechanics* presents systematically, with a reasonable balance between theoretical and computational aspects, very recent developments in its subject, and it illustrates concepts and methods which are partly novel and partly are now being transferred from mathematics to mechanics and from mechanics to engineering.

1R20. Single Piles and Pile Groups Under Lateral Loading. - LC Reese *(Dept of Civil Eng, Univ of Texas, Austin TX)* and WF Van Impe *(Lab for Soil Mech, Ghent Univ, Ghent, Belgium).* Balkema Publ, Rotterdam, Netherlands. 2000. 463 pp. Softcover. ISBN 90-5809-348-9. $45.00. (Hardbound ISBN 90-5809-340-9 $85).

Reviewed by RD Holtz (Dept of Civil Eng, Univ of Washington, PO Box 352700, Seattle WA 98195- 2700).

Many structures commonly founded on piles or groups of piles are required to resist lateral loads, both static and cyclic, in addition to the usual axial loads. Examples include bridges, power transmission structures, overhead signs, offshore platforms, quays, dolphins, and high-rise buildings subjected to wind and seismic loads. Design methods based on limiting equilibrium are quite adequate for estimating maximum or ultimate axial pile loads, but these methods are unable to accurately predict foundation deformations due to anticipated lateral loads. Instead, a method of analysis is required that considers the interaction of the soil and the pile. The field of soil-structure interaction has progressed rapidly in recent years, largely due to developments in digital computers and numerical methods that are necessary to solve complex systems of



nonlinear equations. Specifically, the analysis of laterally loaded pile foundations has developed because of the interest of the offshore oil industry, together with a number of well-documented, full-scale instrumented pile load tests.

This is an important book on a complicated subject that until now has not been dealt with particularly well in, for example, most textbooks on foundation engineering. Thus, this book is a welcome addition to

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the technical literature on foundation engineering. Its comprehensive treatment nicely complements the 1980 text by Poulos and Davis.

Both authors are well qualified. Professor Lymon Reese is one of the leading experts on deep foundations in the US. His co-author, Prof William Van Impe of Belguim, is a distinguished foundation engineer. Thus, their book represents the best combination of US and European research and design practice.

The introductory chapter discusses various design techniques as a way of introducing the *p-y* concept, which is the basis of the rest of the book. Chapter 2 presents the derivation of the beam-column equations and describes solution methods for the *p-y* method. A detailed example is also included. Various expressions for *p-y* curves for soils and weak rock under both static and cyclic loading are presented in Chapter 3, while Chapter 4 discusses some of the pertinent material and geometric characteristics of piles.

Chapters 5 and 6 are the heart of the book. Both present detailed analyses methods for virtually all practical problems of laterally loaded foundations. Chapter 5 describes the analysis of pile groups subjected to inclined and eccentric loads, while Chapter 6 presents the analysis of single piles and groups subjected to active and passive loading. The formats of these two chapters are different. Five has the format of a state-of-the-art review, while six is more in textbook style with numerous examples and solutions.

A number of case studies in which the results of full-scale field tests of instrumented piles at well-documented sites are described in Chapter 7. In Chapter 8, detailed procedures for conducting successful tests on full-size piles are given.

Factors of safety including load and resistance factor design and a bit about probabilistic methods are discussed in Chapter 9. Finally, Chapter 10 presents a brief treatment of two additional design topics such as validation of computations and other topics not discussed previously.

There are ten useful appendices covering topics such as the Broms method, alternative solution methods, comments on the Eurocode, and factor of safety. The book also contains a CD-ROM with student versions of LPILE and GROUP, well known design programs developed by Reese and his students.

The list of references is extensive and up-to-date, with many from the late 1990s; a few mentioned in the text are inadvertently missing from that list. The book is generally well illustrated. Notation, always a source of some confusion in geotechnical writing, is discussed when used in the text, but a separate list of symbols would have been helpful at times. There are a few minor typographical errors.

This reviewer is impressed by the number of worked examples included along with detailed procedures for obtaining soil and pile properties and for carrying out design calculations. This feature will be very useful to practicing foundation engineers and students alike.

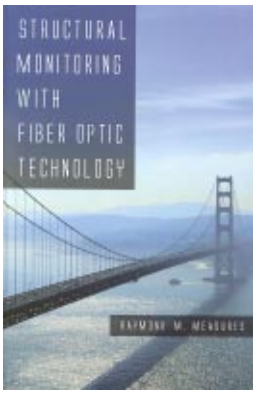
Single Piles and Pile Groups under Lateral Loading is strongly recommended for foundation engineers dealing with laterally loaded pile foundations. Both engineers and graduate students will be pleased with its modest cost in paperback.

1R21. Structural Monitoring with Fiber Optic Technology. - RM Measures *(Inst for Aerospace Studies, Univ of Toronto, Downsview, Toronto, Canada)*. Academic Press, San Diego. 2001. 716 pp. ISBN 0-12-487430-4. $175.00.

Reviewed by S Abrate (Col of Eng, Southern Illinois Univ, Mailcode 6603, Carbondale IL 62901-6603).

This is book deals with use of fiber optics for structural monitoring. As explained in the first chapter, the subject of the book should be seen in the larger context of smart structures, which are defined as possessing a structurally-integrated sensing system. Sensors are used to monitor the state and response of the structure. Fiber optic technology has been developed recently; it has some definite advantages over older more established technologies and is generally not familiar to practicing engineers. This book addresses a need for a comprehensive reference on this subject.

The author is well known for his original contributions to the field and several comprehensive reviews of the literature. Seventy-five articles for which Prof Measures is the author or one of the co-authors are listed in an extensive list of references containing 693 entries. The large number of references mentioned indicates that extensive research is being conducted in this area and that the book presents detailed and comprehensive coverage. This field of study has developed relatively recently. This is reflected in the fact that 600 of the references listed were published in the 1990s, and 86 of them appeared in the 1980s.



Chapter 2 provides examples of applications of fiber optics for integrated structural monitoring in several industries. Chapters 3-7 deal with the various pieces of hardware: light sources, detectors, optical fibers, and sensors. Each time, the basic principle of operation is described and applications are presented. Chapters 8-12 cover implementation issues such as installation and materials integration, and multiplexed and distributed sensing.

For this book, the objectives stated in the preface are: to introduce fiber optic structural sensing to those interested in learning what is possible with this new technology; to serve as a primer for understanding the basics of the technology; and to provide an insight into its capability. Those objectives have been met very successfully while avoiding some common problems with this type of book. While a large number of references are cited, the book does not read like a literature survey. A large number of applications are mentioned, but each one is selected to illustrate a particular point, is described in enough detail, and is woven into the narrative so that the reader does not get the feeling of going through a list of examples. Many equations and theoretical developments are provided, but the book does not feel like a textbook on optics or applied mathematics. Many pieces of hardware are mentioned, but the book does not resemble a manufacturer's catalogue. All of this means that the author managed to strike a good balance between the different elements needed to cover the subject in a comprehensive fashion.

The author does not explicitly define the intended audience for this book. It is written as a reference for those interested in structural monitoring with fiber optic technology. The book is focused on engineering applications as opposed to more fundamental science and, therefore, will appeal to engineers in a wide range of industries: civil engineers for monitoring bridges, aerospace engineers for monitoring the health of composite structures, and also engineers dealing with many other applications. The book is easily accessible for engineers and managers who simply need to know what this technology is, how it works, and what can be done with it. In that case, some of the more mathematical aspects of the book can be skipped over. The book can also be used for more in-depth study for those planning to use the technology and become specialists. A third audience consists of graduate students and researchers because this book presents the current state of the art for this technology. A basic background in strength of materials, experimental stress analysis, and composite materials would be helpful to appreciate the contents of the book.

The book is very well produced with many illustrations and is easy to read. A few typographical errors have been noticed, but they do not cause undue distractions. The writing style is such that the book is easy to read, the interest of the reader is always kept up, and the significance of each development is always made clear. *Structural Monitoring with Fiber Optic Technology* makes a unique contribution by being

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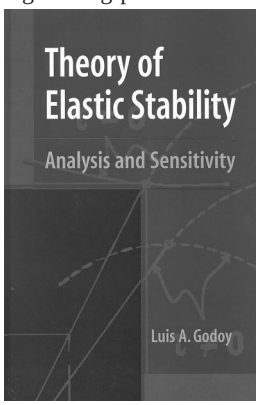
the first to describe a new area in a comprehensive manner while being accessible to many. It is highly recommended for engineering libraries and for individuals interested in learning about this new technology.

1R22. Theory of Elastic Stability: Analysis and Sensitivity. - LA Godoy *(Dept of Eng, Univ of Puerto Rico, Mayaguez, Puerto Rico).* Taylor & Francis, Philadelphia. 2000. 434 pp. ISBN 1-56032-857-6. $95.00.

Reviewed by Long-Yuan Li (Dept of Civil Eng, Aston Univ, Aston Triangle, Birmingham, B4 7ET, UK).

This book is primarily written for professionals and graduate students in civil, mechanical, and aeronautical engineering. The book gives a unified presentation of the field of stability, provides a basic understanding of the fundamentals of the elastic stability of structures, and applies these fundamentals to solve, analytically, a spectrum of engineering problems.



The emphasis of the book is placed on the formulation of engineering problems rather than on the proof of the fundamental principles. The formulation presented is based on the total potential energy of the discrete system from which analyses of equilibrium, stability, postcritical states, design sensitivity, and imperfection sensitivity are conducted. The second feature of the book is the use of perturbation techniques as part of the formulation and also of the analyses. This reduces the effort necessary to understand the solution of nonlinear systems.

Following a brief introduction of the subject in Chapter 1, Chapter 2 reviews basic concepts of the theory of nonlinear elasticity and main equations of elasticity under nonlinear kinematic assumptions. The formulation is written in terms of the total potential energy of structural components using generalized coordinates. Chapter 3 provides an introduction of the techniques of perturbation which serves as a tool in the analyses presented in later chapters.

Chapter 4 presents the concept of stability of equilibrium states. In addition to that, the question of stability of a path is also addressed. Critical states are presented in Chapter 5. Again, the conditions for the presence of a critical state are formulated in terms of the energy function. Chapter 5 also contains examples of simple structural components for which the critical states are computed.

The limit point and bifurcation point, the two types of the critical point, are discussed in Chapters 6 and 7, respectively. Conditions for both limit point and bifurcation point are presented. Examples are also provided in these two chapters.

Chapter 8 presents the equilibrium of systems with imperfections. Equilibrium and stability of systems with imperfections are discussed. Nonlinear analyses of limit point and bifurcation systems are provided. Chapter 9 deals with the influence of nonlinear material behavior on buckling states. Systems with both stable and unstable postbuckling behavior are discussed. Examples are provided.

Imperfection sensitivity of critical points is discussed in Chapter 10, which includes the sensitivity of limit points to imperfections and imperfection sensitivity in symmetric and asymmetric bifurcation systems.

Chapter 11 deals with sensitivity of bifurcation points to changes in design parameters, which includes sensitivity to geometrical imperfections and sensitivity to changes in design parameters that are relevant in optimization, stochastic analysis, etc. The sensitivity of postcritical behavior with respect to changes in design parameters is discussed in Chapter 12.

Chapter 13 provides the W-formulation for bifurcation states in which the postcritical path is written in terms of sliding coordinates, and equations to obtain the asymptotic coefficients are derived. The analysis using sliding coordinates is entirely similar to that presented in Chapter 7, but the resulting equations are simpler.

Mode interaction and corresponding sensitivity to imperfections of problems with mode interactions are discussed in Chapters 14 and 15, respectively. Examples are provided which include a thin-walled I composite column under axial load, in which the modes are set to coincide by design.

In summary, *Theory of Elastic Stability: Analysis and Sensitivity* presents the material in an instructive manner, suitable for self-study. It emphasizes analytical treatment of the subject, which is essential for handling modern numerical methods as well as assessing and creating software packages. The author provides generous explanations, systematic derivations, and detailed discussions, supplemented by a variety of problems and solved examples. The book has good quality figures and a good subject index. It is a good textbook for graduate engineering students and equally useful as a reference for researchers and thus should be in all engineering libraries.

1N23. Designing High-Performance Stiffened Structures. From IMECHE Seminar held June 1999, London. - Edited by Aerospace Indust Div *(Inst of Mech Eng, London, UK).* IMechE, London. Distributed in USA by ASME, New York. 2000. 85 pp. ISBN 1-86058-308-3. $98.00.

This is a proceedings of an ImechE seminar which brings together leading structural and materials engineers with the aim of promoting composite developments in design, materials integration and manufacturing, and some state-of-the-art structural design solutions.

The need for rigid lightweight construction has stimulated considerable developments within the space, aeronautical, and high technology industries, with material advancements often being an integral part of innovation offering high performance components.

Contents cover RS-3 polycyanate ester resin—claimed to be the satellite community's choice for high performance composites; Analysis of the buckling behavior of stiffened prismatic structures; Buckling of thin-skinned stiffened-panels; The hollow wide chord fan blade—a stiffened metallic structure; Unidirectional carbon fibre rods for high performance structures; and Stiffened composite structures for aviation and marine applications.

1N24. Failure Analysis Case Studies II. - Edited by DRH Jones *(Dept of Eng, Univ of Cambridge, Trumpington St, Cambridge, UK).* Pergamon, Oxford UK. 2001. 456 pp. ISBN 0-08-043959-4. $170.00.

This book comprises 40 case studies describing the analysis of real engineering failures which have been selected from Volumes 4, 5, and 6 of *Engineering Failure Analysis*. The case studies have been arranged in sections according to the specific type of failure mechanism involved. The failure mechanisms covered are overload, creep, brittle fracture, fatigue, environmental attack, environmentally-assisted cracking and bearing failures.

1N25. Fatigue and Fracture Mechanics of Offshore Structures. Engineering Research Series No 4. - LS Etube. Professional Eng Publ, Suffolk, UK. 2001. 176 pp. ISBN 1-86058-312-1. $131.00.

The tubular welded joints used in the construction of offshore structures can experience millions of variable amplitude load cycles during their service life. Such fatigue loading represents a main cause of degradation in these structures. As a result, fatigue is an important consideration in their design.

This book presents novel research and the results of wave-induced stress on the operational life of offshore structures.

Containing results of an investigation undertaken to assess the fatigue and fracture performance of steels used in the offshore industry, this book examines the methodology to develop a typical Jack-up Offshore Standard load History (JOSH); factors that influence fatigue resistance of structural steels used in the construction of Jack-up structures; methods used to model the relevant factors for inclusion in JOSH (with particular emphasis on loading and structural response interaction); results and details of experimental variable amplitude corrosion fatigue (VACF) tests conducted using JOSH; and novel and improved generalized methodology for fast assessment of offshore structural welded joints.

1N26. Fracture Mechanics Testing for Polymers, Adhesives and Composites. - Edited by DR Moore *(ICI plc, UK),* A Pavan *(Dept di Chimica Industriale e Ing Chimica, Politecnico di Milano, Milan, Italy),* JG Williams *(Dept of Mech Eng, Imperial Col, London, UK).* Elsevier Sci BV, Amsterdam, Netherlands. 2001. 250 pp. ISBN 0-08-043689-7. $145.50.

This book is an overview of ESIS Technical Committee 4's activities since the mid- 1980s. A wide range of tests is described.

With the establishment of the Technical Committee 4, two major areas were identified as appropriate for the activity: an urgent need for stan-

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dard, fracture and mechanics based test methods to be designed for polymers and composites; and a perceived need to explore the use of such data in the design of plastic parts.

1N27. Gearing, Transmissions, and Mechanical Systems. Proc of Int Conf, held July 2000, Nottingham Trent Univ, UK. - Edited by Diazhong Su *(Dept of Mech and Manuf Eng, Nottingham Trent Univ, UK).* IMechE, London. Distributed in USA by ASME, New York. 2000. 931 pp. ISBN 1- 86058-260-5. $568.00.

Gears, power transmission, power-drives, related mechanical systems, and the associated control technologies are widespread in their use and application. This book is geared for tribologists and lubricant specialists, those working in transport engineering, process engineering, plant machinery and maintenance, and engineering design, through to those concerned with control systems.

Topics covered include Bevel/facial gears and helical screws; Worm/spiroid/hypoid gears; Gear design and manufacturing; CAD and CAE of gearing; Gear kinematics and measurement; Agile manufacturing; Internet-based technology; Virtual reality and computer simulation/integration; Measurement and control of mechanical systems; CVT and roller chain transmission; Coupling and linkage; Synthesis and analysis of mechanisms; Tribology; Fluid systems; Dynamics; and Engineering production.

1N28. Joining of Advanced and Specialty Materials III. Proc of Materials Solutions '00, October 2000. - Edited by M Singh, JE Indacochea, JN DuPont, TJ Lienert. ASM Int, Materials Park OH. 2001. 177 pp. ISBN 0-87170-730-6. $123.00.

The papers in this volume review various aspects of advanced joining technologies, processing, characterization, and joint performance. The main topics addressed include various joining techniques (brazing, welding, microjoining, etc), joint properties, microstructural characteristics, the science and technology of interfaces, ceramic-metal joints, wetting and diffusion, and specific examples of successful applications.

1N29. Proceedings of the 14th International Ship and Offshore Structures Congress. ISSC 2000, Nagasaki, Japan, October 2000. - Edited by H Ohtsubo *(Dept of Env and Ocean Eng, Univ of Tokyo, Tokyo, 113-8655, Japan)* and Y Sumi *(Dept of Naval and Ocean Eng, Yokohama Natl Univ, Yokohama, 240-8501, Japan).* Elsevier Sci BV, Amsterdam, Netherlands. 2001. 1500 pp. 3-vol set. ISBN 0- 08-043602-1. $259.00.

This proceedings offers a comprehensive overview of the structural integrity of ships and offshore structures. The proceedings consists of three volumes containing the eight Technical Committee, six Specialist Committee, and two Special Task Committee reports which were presented at the congress. Discussions of these reports are also included.

1N30. Proceedings of the 20th International Conference on Offshore Mechanics and Artic Engineering, Volume 1, Offshore Technology—Print Version. Held in June 2001, Rio De Janeiro. - Edited by SK Chakarbrati. ASME, New York. 2001. 1112 pp. ISBN 0-7918-3534-0. ASME Book No I0502A. $300.00. (ASME members $150.00).

This is a compilation in print format of the 120 full-length, peer-reviewed technical papers presented at and published for the conference. Topic areas include: offshore application of vortex induced vibration; mooring structures and systems; riser and cable dynamics; offshore structural mechanics and structure dynamics; ships and floating systems; SPAR and TLP platforms; vortex induced vibration; hydrodynamics; ocean wave mechanics; dynamics of FPSO in the horizontal plane; FPSO systems; numerical and physical modeling; developments of offshore platforms; and dynamics stability in ships and floating offshore structures.

1N31. Proceedings of the 20th International Conference on Offshore Mechanics and Artic Engineering, Volume 3, Materials—Print Version. Held in June 2001, Rio De Janeiro. - Edited by M Salama. ASME, New York. 2001. 428 pp. ISBN 0-7918-3534-0. ASME Book No I0502C. $170.00. (ASME members $85.00).

This compilation in print format includes the 47 full-length, peer-reviewed technical papers presented at and published for the conference. Topic areas include advances in welding/underwater technology; deformation and strength of pipelines; design and performance of flexible and titanium catenary risers; integrity and performance of pipelines; integrity and fatigue capacity of floating production systems (FPSO); performance/inspection of flexible pipes; fatigue and crack growth; evaluation of strength and toughness of steel joints; fatigue and fracture assessment of pipelines; properties and performance of flexible pipes; advances in design and analysis; fracture control and assessment; developments in high strength steels and welding technology; and application and performance of new materials.

1N32. Proceedings of the 20th International Conference on Offshore Mechanics and Artic Engineering, Volume 4, Pipeline Technology and Polar and Artic—Print Version. Held in June 2001, Rio De Janeiro. - Edited by T Jones and H Yamaguchi. ASME, New York. 2001. 424 pp. ISBN 0-7918-3534-0. ASME Book No I0502D. $170.00. (ASME members $85.00).

This proceedings includes 37 full-length, peer-reviewed technical papers presented at and published for the conference. Topic areas include:

Pipeline: pipeline interaction with the environment and repair; design considerations for pipelines and flowlines; and thermal effects in pipelines and flowlines.

Polar and Artic: ice mechanics and structures in ice; ice conditions; sea ice in meso to global scale areas; flow design and operation; pipeline risers; mechanical aspects of pipeline design; and ice/propeller interaction structures in low temperature conditions.

1N33. Proceedings of the 20th International Conference on Offshore Mechanics and Artic Engineering, Volume 5, Ocean Space Utilization—Print Version. Held in June 2001, Rio De Janeiro. - Edited by H Maeda. ASME, New York. 2001. 328 pp. ISBN 0-7918-3534-0. ASME Book No I0502E. $200.00. (ASME members $100.00).

This compilation in print format covers the 46 full-length, peer-reviewed technical papers presented at and published for the conference. Topic areas include marine environment; wave energy; very large floating structures; floating bridge and VLFS construction; very large floating structures concepts; very large floating structures hydrodynamics; and control of VLFS and underwater technology.

1N34. Proceedings of the 7th ASME NDE Topical Conference. Held April 2001, San Antonio TX. - Edited by C Darvennes and T Kundu. ASME, New York. 2001. 224 pp. ISBN 0-7918-1938-8. ASME Book No H01225. $100.00. (ASME members $50.00).

This is a compilation of 22 full-length, peer-reviewed technical papers on the following topics: microscopic NDE of materials; structural health monitoring and Mems; advanced NDE techniques; thermal imaging and computer technology; guided waves; radiography, eddy current, process control; and thermal and optical techniques. The book also includes plenary, honors, and award papers.

1N35. Tribology—Lubrication, Friction, and Wear. Tribology in Practice Series. - Edited by IV Kragelsky *(Deceased),* V Alisin *(Inst of Machine Sci, Russian Acad of Sci, Moscow, Russia),* NK Myshkin *(Trib Dept, VA Velyi Metal-Polymer Inst, Belarus Natl Acad of Sci, Gomel, Russia),* MI Petrokovets *(Trib Dept, Belarus Natl Acad of Sci, Gomel, Russia).* IMechE, London. Distributed in USA by ASME, New York. 2001. 948 pp. ISBN 1-86058-288-5. $314.00.

This classic work edited by the world-renowned tribologist Prof Kragelsky has been updated by Nikolai Myshkin and Mark Petrokovets to provide a valuable reference source. The extra data, along with the original material, make this book useful for all tribologists.

It is comprehensive, authoritative, and brings together information that is unavailable elsewhere. Much of the information is in a form directly useable by engineers involved with design and troubleshooting on tribological devices. The information is practical in nature and directly useful to engineering designers and tribologists.

Heterogeneous Media: Micromechanics Modeling Methods and Simulations. Modeling and Simulation in Science, Engineering and Technology Series. - Edited by K Markov *(Fac of Math and Informatics, Univ of Sofia, St Klimentohridski, Sofia, BG-1164, Bulgaria)* and L Preziosi *(Dept di Matematica, Politecnico di Torino, Torino, I-10129, Italy).* Birkhauser Boston, Cambridge MA. 2000. 477 pp. ISBN 0-8176-4083-5. $79.95. (Under review)

Mechanics of Non-Homogeneous and Anisotropic Foundations. Foundations of Engineering Mechanics Series. - GB Muravskii *(Geotech Dept, Technion, Haifa, 32000, Israel).* Springer-Verlag, Berlin. 2001. 364 pp. ISBN 3-540-41631-5. $139.00. (Under review)

Rolling Contacts. Tribology in Practice Series. - TA Stolarski *(Mech Eng Dept, Brunel Univ, UK)* and S Tobe *(Ashikaga Inst of Tech, Japan).* Professional Eng Publ, Suffolk, UK. 2000. 445 pp. ISBN 1-86058-296-6. $188.00. (Under review)

V. MECHANICS OF FLUIDS

1R36. Dynamics of Droplets. - A Frohn and N Roth *(Inst fur Thermodynamik, Univ of Stuttgart, Pfaffenwaldring 31, Stuttgart, 70550, Germany).* Springer-Verlag, Berlin. 2000. 292 pp. ISBN 3- 540-65887-4. $82.00.

Reviewed by Y Chisti (Inst of Tech and Eng, Massey Univ, Private Bag 11 222, Palmerston N, New Zealand).

Many natural and technical processes depend on generation of droplets and interaction among droplets and other phases. Droplet dynamics influence processes as diverse as cloud formation, rain, spray painting, and dispersal of aerosols. Because of its wide-ranging significance, substantial research literature has accumulated on droplet dynamics, but not many books treat this subject.

This book provides a useful discussion of droplet dynamics in a compact volume. Some of the theoretical aspects relevant to drop dynamics are covered in an extensive first chapter. The major topics discussed include surface tension and internal pressure;

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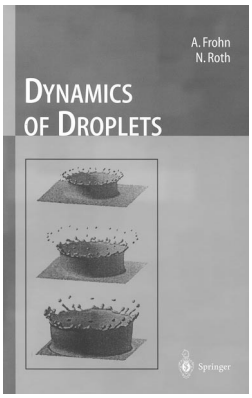
liquid-liquid and solid-liquid interfaces; charged droplets; small-amplitude droplet oscillations; internal circulation; instability of droplets; instability of jets; relaxation phenomena; thermodynamics; phase transition processes; droplet evaporation; and interaction of light with droplets. Topics, such as internal circulation and how it is affected by droplet dimensions and the presence of surfactants, are addressed quite poorly despite the importance of these topics in many processing scenarios.

A chapter is devoted to droplet generation. This subject is discussed in less depth than some of the other topics in the book. Much practical information exists on design, selection, and operation of spray nozzles and other droplet generation devices, but the book does not reflect this



knowledge. Pressure atomizers, rotary atomizers, and ultrasonic atomizers are barely mentioned. A chapter entitled ''Droplet systems'' addresses topics such as sprays, streams and arrays of droplets, and single droplets suspended by various means. An extensive chapter deals with the relevant measurement techniques such as the photographic methods, techniques of measuring velocity and size, measurement of optical properties, temperature, and surface tension. Not all available methods are discussed sufficiently or thoroughly.

In most practical droplet systems, droplets interact among themselves with the suspending gas and with the suspended solids. Methods for the study of such physical interactions in flow systems are devoted a chapter. Many droplet-related processes involve phase transitions. Examples are condensation of water vapor into clouds, evaporation of fuel droplets during combustion, and spray-drying of droplets to powders. Some of the experimental methods for study of phase transition in droplet systems are discussed in an extensive chapter devoted entirely to this subject. Combustion related phase transition phenomena are discussed in particular depth.

Some of the applications of droplet dynamics are outlined briefly, perhaps superficially, in a chapter entitled ''Miscellaneous applications.'' The applications mentioned include everything from ink jet printing to gaining an understanding of development of condensation trails of high-flying aircraft.

The book covers many topics, but also leaves out a great deal. Nevertheless, this book should prove useful to anyone working on droplet dynamics and related fields such as spray technology and aerosol science. The book's emphasis on experimental methods is one of its strong points. The book cites more than 500 references and is illustrated with more than 200 figures of generally good quality.

On the negative side, the writing is needlessly verbose and sometime irritatingly so. The book's short index is not especially useful, but this shortcoming is partly compensated for by a detailed table of contents. The text is hardbound, of good quality, and is reasonably priced ($82.00) for a specialist monograph. *Dynamics of Droplets* is a recommended acquisition for research libraries and individuals working on droplet dynamics.

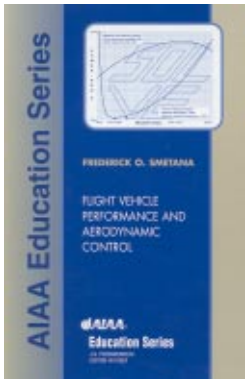
1R37. Flight Vehicle Performance and Aerodynamic Control. AIAA Education Series. - FO Smetana *(N Carolina State Univ, Raleigh NC).* AIAA, Reston VA. 2001. 359 pp. CD-ROM included. ISBN 1-56347-463-8. $119.95.

Reviewed by EE Covert (Dept of Aeronaut and Astronaut, MIT, 77 Massachusetts Ave, Rm 9-466, Cambridge MA 02139-4307).

The author's purpose is ''...to explain to beginning aerospace engineering students typical methods used to estimate performance of aircraft...[and] how various parameters derived from aircraft geometry can be used to estimate size, shape and location of control surfaces and aerodynamic forces to actuate these surfaces.'' The author adds, ''A unique feature of this volume is the inclusion of time tested computer programs...intended to be pedagogical tools....'' The author provides detailed explanations for the student users of these codes.

The chapter titles are: 1) Basic Notation; 2) The Atmosphere; 3) Characteristics of Power Plants; 4) Flight Vehicle Lift Drag Characteristics; 5) Equations of Motion; 6) Determination of Aerodynamic Characteristics; 7) Flight Vehicle Performance; 8) Aerodynamic Control Forces and Static Stability; and 9) Flight Vehicle Control.

The selection of material in such a text is partly a matter of personal philosophy and partly experimental. For example, the author has chosen to provide a detailed development of the rigid body dynamics in Chapter 5, including those terms which account for the variation of mass and moments of inertia with time. He then develops the standard small perturbation approximation and makes the underlying assumptions clear at each step in the simplification. For simplicity, the author restricts the aerodynamics and geometries to low speed flows in both the text and the examples.



Each chapter ends with a large number of homework problems, each of which were well stated for the problems the reviewer worked. The author's love of aircraft is evident in the photographs, the examples, and in the homework problems.

The book has unusually few typographical errors. On page 114, an upper case ''W'' is used in place of a lower case ''w,'' which may confuse some students as will the use of ''Z'' for ''X'' on page 253; #8. On page 115, in Eq. (5.25) the use of ''W'' for weight has the potential to confuse the student since the preceding discussion uses ''W'' as vertical velocity. The use of alpha for angle of attack was not introduced prior to page 76 and is never defined. Its use in that capacity can be inferred by discussion as the slope of the lift curve with respect to alpha. [Added comment — There is a typographical error in Eq. (6.1) p 75, and (6.2) p 76; a ''1/2'' is missing from the denominator, which the users of the text will want to correct explicitly.]

On occasion, the author introduces other terms prior to their definition. This reviewer is sympathetic with this kind of omission because the terms in question are so commonly used by aeronautical engineers, but the students have yet to reach this level of sophistication. Users of this text must be prepared for this type of question.

In this reviewer's experience, considerable care must be taken not to confuse the beginning student, which at times requires an author to use a more careful choice of words and a more extended explanation than otherwise might be needed. For example, in Section 2.1.2 on page 42, on model testing, this reviewer feels that the explicit addition of the requirement of geometric similarity as a similarity condition together with the uniform flow Reynolds number would clarify the discussion. This statement relieves the student from inferring such a condition through the use of the word model (which has come to have a wider meaning, such as in the term *mathematical model*), and is broader since geometric similarity includes the angle with respect to the relative wind.

Another concern along this line is the discussion of induced angle of attack in Section 4.4 on page 76. The statement is made

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that the change in flow direction is a reaction to the lift and thus a consequence of Newton's Second Law. This misuse of Newton's Second law raises two pedagogical difficulties. First as the induced angle of attack vanishes for an infinite aspect ratio (or span), the perceptive student might ask why there is no downwash in two-dimensional flow (there is lift, but no downwash). Second, the perceptive student may recall that pressure was important in the use of the momentum theorem to model actuator disk model for generation of thrust (page 56) and wonder why the pressure is not included here.

This reviewer feels that the idea of downwash can be introduced without a detour into the horseshoe vortex model by merely looking at the wing from in front. One notes the higher pressure on the lower surface at the tip drives the flow around the tip towards the region of lower pressure on the upper surface. A simple sketch makes downwash plausible.

A few other small complaints. On Fig. 4.11 (p 93) the airfoil has a stagnation point at the trailing edge. Rauscher has proved that there is no stagnation point on an airfoil with a cusped trailing edge. Joukowski airfoils have a cusped trailing edge. Thus the legend on the figure must be in error. A number of the figures in Section 7.41, starting on page 171, are computer drawn with no regard to the value of interval on the ordinate and abscissa. As such, the figures are less than a crude depiction of the variation of one parameter as another is changed. On page 179, the Fig. 7.13 wing area is given to five significant figures, and the weight to three significant figures. This reviewer feels that introductory students need a sense of size, so the use of numbers is laudable, but these same students need to develop a sense of the false accuracy implied by an inappropriately large number of significant figures.

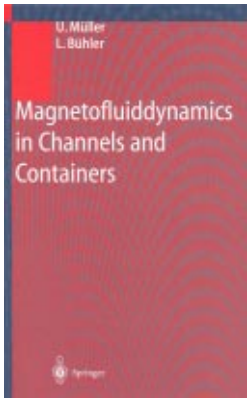
All this being said, the author has met his goal, and *Flight Vehicle Performance and Aerodynamic Control* contains a great deal of practical information and ought to be in university libraries. As for the selection of this as a textbook, the reviewer has not taught for several years and cannot judge the readiness of current second-year students, and will thus suggest that those who teach introductory aerodynamics and design make this judgment after reading the book.

Finally, two practical issues seem to warrant general comments. First, this reviewer assumes that the author retains responsibility for the codes and users of the text should correspond with the author about code maintenance. Second, the reviewer readily admits he neither tried to use the programs included on a floppy disk, nor tried to evaluate the source code. This leads to an open question for reviewers in general. Should reviewers take the time and effort to learn to validate and use the codes included with the text as part of the review process?

1R38. Magnetofluiddynamics in Channels and Containers. - U Muller and L Buhler *(Inst fur Kern- und Energietechnik, Postfach 3640, Karlsruhe, D-76021, Germany).* Springer-Verlag, Berlin. 2001. 210 pp. ISBN 3-540-41253-0. $65.95.

Reviewed by GS Dulikravich (Dept of Mech and Aerospace Eng, Univ of Texas, PO Box 23023, Arlington TX 76019).

If a person with no prior knowledge of the general area of interacting fluid flow and electric and magnetic fields would like to quickly and easily learn the fundamental aspects of analytical modeling of these phenomena, this reviewer would suggest this short book as an excellent text. The book was written with an ease of understanding and expression that only authors with extensive experience in practical applications of the subject matter can offer. Since



the entire field is simply too broad, the authors have prudently focused on the magneto- hydro-dynamics (MHD) only, that is, on the analytical modeling of incompressible fluid flow under the influence of an externally applied magnetic field. Furthermore, they have decided not to incorporate the effects of electro- hydrodynamics (EHD) which means that they choose not to account for the effect and transport of free electric charges in the fluid. Consequently, the basic equations of MHD were developed from the basic principles and their non-dimensional forms were explained in a clear and condensed fashion. Interface and boundary conditions were also clearly delineated as a prelude to a sequence of well-documented classical analytic solutions for various MHD flows. These analytic solutions were often substantiated with experimental data and numerical solutions in order to demonstrate the validity of the basic MHD models used. The emphasis was on the physics that leads to the analytic basics, thus offering excellent verification examples for more up-to-date issues like numerical techniques appropriate for multi-dimensional MHD flow analysis.

The assumptions used when simplifying and adapting the full MHD model to each particular flow configuration were clearly explained and documented with appropriate referencing of the original publications. Thus, chapters covering classical solutions of high Hartmann number pipe and duct flows, free shear layers, developing flows, unbounded flows, flow transition and stability, turbulent duct flows, and buoyancy driven MHD flows have been clearly and concisely presented. The book is written using a style and notation that should be equally familiar to mathematicians, physicists, and engineers. Figures are highly educational, innovative, and clear, and the typesetting fonts are sharp and easy to read. An extensive bibliography and a good subject index conclude the text with an extensive appendix detailing practical instrumentation, measuring techniques, and probes used in an actual MHD experimental laboratory.

For those individuals and libraries that cannot find the classical texts on MHD from four decades ago when this field was culminating and then suddenly disappearing from the popular scene, this reviewer highly recommends acquiring this book. *Magnetofluiddynamics in Channels and Containers* should be a required textbook for the first course on MHD in any engineering program.

1R39. Measurements of Thermophysical Properties by Laminar Flow Methods. - SV Ponomarev, SV Mishchenko *(Tambov State Tech Univ, Russia),* TF Irvine Jr *(SUNY, Stony Brook NY).* Begell House, New York. 2001. 273 pp. ISBN 1-56700-151-3. $97.50.

Reviewed by E Logan (Dept of Mech and Aerospace Eng, Arizona State Univ, Tempe AZ 85287- 6106).

This reference book is recommended for use by engineers, scientists, and postgraduate students who are concerned with the measurement of thermophysical properties of fluids. The present book emphasizes laminar flow methods to measure thermophysical properties of liquids. The reader should have a minimal background in partial differential equations, boundary value problems, the theory of viscous incompressible flow, the mechanics of non-

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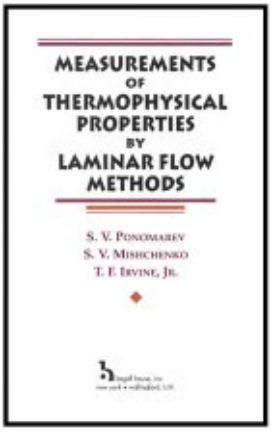
Newtonian fluids, and convection heat transfer.

The first chapter of this book comprises a review of the classical methods for the measurement of thermophysical properties of fluids. This includes measurements of laminar flow in tubes, between cylinders, and across a wire, from which thermal conductivity and thermal diffusivity are inferred. The second part of the book comprises three chapters, Chapters 2-4, which



treat the theoretical methods for the analysis of laminar flows. Chapter 2 develops the theory for the determination of thermal diffusivity from data taken from Newtonian and non-Newtonian laminar flows in tubes having a constant temperature wall, with and without internal heat generation. Chapter 3 develops the theory for the determination of thermal diffusivity, heat capacity, and thermal conductivity of liquids in laminar flows in tubes having a constant wall heat flux, with internal heat generation. The fourth chapter describes a method for determining thermophysical properties of liquids placed between concentric cylinders and sheared at various rates by the rotation of the outer cylinder.

The third part of the book focuses on errors found in the measurement of thermophysical properties of liquids. In the fifth chapter, the authors discuss sources of errors arising from the measurement methods presented in Chapters 2-4. The assumptions used in the mathematical models are clearly delineated in Chapter 5. Chapter 6 emphasizes the design details of the apparatus needed for the measurement of thermophysical properties of liquids, and Chapter 7 provides a tabulation of the formulas needed to estimate errors in the measurement of thermophysical properties. Additionally, in this chapter, the formulas are applied to experimental data for water, toluene, and glycerine; the resulting numerical data are presented in the appendices. The book concludes with Chapter 8, which applies the methods presented in the book to specific problems, viz, the measurement of the thermophysical properties of alcohol, sewage, and polymer solutions.

Measurements of Thermophysical Properties by Laminar Flow Methods is recommended for use as a reference book for university or corporate libraries, or for personal libraries of engineers and scientists. The authors' presentation follows a logical course and is written in clear and succinct language. It presents the subject methodically and in great detail. The theory is reinforced by illustrative examples drawn from industrial situations and accompanied by detailed practical information. The reader quickly becomes aware of the authors' vast knowledge of the theory and practice of the measurement of thermophysical properties of liquids in laminar flows. The book will undoubtedly prove practically useful to anyone attempting to measure the thermophysical properties of liquids. To aid in further comprehension of their work, the authors have provided the reader with over 200 carefully-selected references to background materials.

1R40. Microcontinuum Field Theories II: Fluent Media. - AC Eringen *(15 Red Tail Dr, Littleton CO 80126-5001).* Springer-Verlag, New York. 2001. 340 pp. ISBN 0-387-98969-2. $149.00.

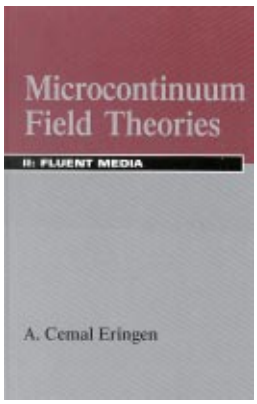
Reviewed by ME Ryan (Dept of Chem Eng, SUNY, 505 Furnas Hall, Buffalo NY 14260).

The book, *Microcontinuum Field Theories II. Fluent Media*, is a mathematically-based exposition of the continuum mechanics of structured fluid media, such as anisotropic fluids, liquid crystals, suspensions, etc. Volume II builds upon and extends the theoretical foundation of the subject developed in the first volume, *Microcontinuum Field Theories I. Foundations and Solids.*

The development in Volume II extends the classical field theories of elasticity, fluid dynamics, and electromagnetism to continua constituted of material points or internal structures having directors that may be deformable as well as orientable. The book is largely based on the author's contribution to the subject over the past few decades. The book is a reference source that assumes the reader has sufficient background in the subject to follow the derivation and application of the field equations to a variety of different situations. The book is intended for research scientists and graduate students in the disciplines of mathematics, physics, engineering, and related fields.

This volume comprises nine chapters (Chs 9-17) which can be divided into four parts: I) Theory of micropolar fluids (Chs 9-11), II) Liquid crystals (Chs 12-14), III) Microstretch fluids (Chs 15-16), and IV) Micromorphic fluids (Ch 17). Electromagnetic interactions are also incorporated into the first three parts.

Chapter 9 introduces basic measures of strain and rotation, constitutive equations, and the basic field equations. Analyses of pipe flow, flow in an orthogonal rheometer, lubrication in a journal bearing, Stokes flow around a sphere, stagnation flow, thermal instability, and boundary layer flow are provided. Mixed convection in vertical flow and a discussion of turbulence are also provided within the context of micropolar fluid dynamics. Chapter 10 develops the constitutive and field equations of magnetohydrodynamics. Analyses of channel flow, shear flow, and thermal stability are presented. Chapter 11 addresses anisotropic fluids and suspensions. The basic theory is developed and applied to channel and couette flows.



Chapter 12 gives a detailed presentation of the kinematics, balance laws, constitutive equations, and field equations of liquid crystals. The electrodynamics of liquid crystals is presented in Chapter 13. A variety of problems involving liquid crystals are analyzed in Chapter 14 including shear flow and heat conduction in a channel.

The kinematics, constitutive equations, and field equations relating to microstretch fluids are provided in Chapter 15. Applications to the theory of acoustic waves in bubbly fluids and blood flow in small arteries are presented. Chapter 16 presents a continuum theory of the electrodynamics of polymeric liquid crystals.

The last chapter addresses the subject of micromorphic fluids with applications of the theory to channel flow, the rheological behavior of blood in arteries, and the behavior of deformable suspensions.

A few problems are briefly stated at the end of each chapter. A list of references, a subject index, and a list of errata for Volume I are provided at the end of the book. The treatment provided in this monograph will serve as a useful reference for the academician or research scientist interested in the fundamental theoretical development of this subject.

1R41. N-Vortex Problem: Analytical Techniques. - PK Newton *(Dept of Aerospace and Mech Eng, Dept of Math, Univ of S California, Los Angeles CA 90089-1191).* Springer-Verlag, New York. 2001. 415 pp. ISBN 0-387-95226-8. $59.95.

Reviewed by MF Platzer (Dept of Aeronaut and Astronaut, Naval Postgraduate Sch, Code AA/PL, Monterey CA 93943-5000).

In this book the author presents a comprehensive treatment of the Hamiltonian as-

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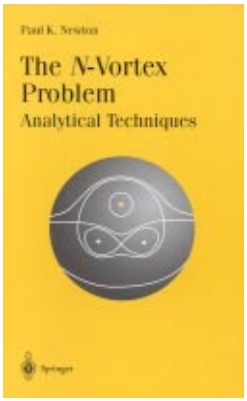
pects of incompressible vortex dynamics, complementing recent books on vortex dynamics by Saffman, Pulvirenti, Doering and Gibbon, and Majda and Bertozzi, by concentrating in depth on integrable and nonintegrable point vortex motion. In the first chapter, he presents an overview of vorticity dynamics and Hamiltonian systems, followed by chapters on the planar N-vortex problem with and without boundaries, the N-vortex problem on a spherical shell, and the problem of determining the growth rate of spiral interfaces in vortex-dominated flows. The remainder of the book is devoted to the statistical mechanics treatment of point vortex motion and to vortex patch and vortex filament models.



Newton's goal in writing this book was to provide graduate students and researchers in the field of vortex dynamics with a thorough and rigorous introduction to current work. He deliberately limited himself to the discussion of analytical methods and omitted numerical techniques. The book, therefore, will be of greatest value to readers interested in rigorous analytical solutions. Nevertheless, atmospheric scientists, aero-, and hydrodynamicists will also find *N-Vortex Problem: Analytical Techniques* a useful reference book for the analysis of vortex dynamics.

1R42. Science and Engineering of Droplets: Fundamentals and Applications. - Huimin Liu *(Prod and Dev Div, Citation Corp, Southfield MI).* Noyes Publ, Park Ridge NJ. Distributed in USA by William Andrew Publ, Norwich NY. 2000. 527 pp. ISBN 0-8155-1436-0. $139.00.

Reviewed by MC Altan (Sch of Aerospace and Mech Eng, Univ of Oklahoma, 865 Asp Ave, Room 212, Norman OK 73019).

This book contains a detailed review of applications and fundamentals of droplet processes. It systematically presents a wide variety of practical as well as theoretical issues in processes involving drop formation. It is well written and logically structured, even for a casual reader. In the first two chapters, it presents different processes and techniques for droplet generation. It addresses the scientific fundamentals, analytical correlations, and microscale analysis of droplets in the subsequent chapters. It is comprised of six chapters and contains a total of 715 references and a comprehensive 18-page index.

Chapter 1, General Introduction, briefly describes the science and engineering applications of droplets. It also introduces various methods of droplet generation and the size scales of droplets. The author classifies the droplets into two primary types: droplets of normal liquids and droplets of melts, and uses this classification to structure the rest of the manuscript.

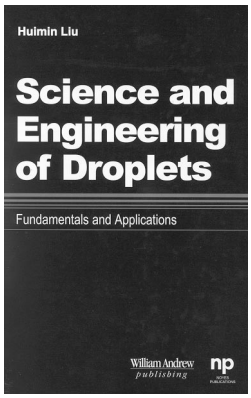
Chapter 2, Processes and Techniques for Droplet Generation, describes various methods of atomization. It is comprised of two main sections: Atomization of Normal Liquids and Atomization of Melts. It does not address scientific fundamentals or mathematical modeling and analysis. Instead it focuses on the application details and practical issues such as the advantages and limitations of different atomization methods. Chapter 2 also contains useful tables of the thermophysical properties of gases, metals, and alloys that are commonly used in atomization processes.

Chapter 3, Fundamental Phenomena and Principles in Droplet Processes, reviews the dynamics of droplet generation and deformation. It starts with the review of droplet formation in atomization of normal liquids. Different modes of droplet formation, such as dripping, and column, jet, ligament, sheet, and free- surface breakup are described. Criteria for the break up of various types of liquid streams and equations for the resulting drop diameters are complied and presented. The details of the governing equations and the mathematical derivations are not included, yet a comprehensive list of references is included for those who seek additional information. A significant part of this chapter is devoted to droplet formation in atomization of melts, which is affected by the non-isothermal nature of the process. Splashing, spreading, and evaporation of droplets on a solid surface are also discussed.

Chapter 4, Empirical and Analytical Correlations of Droplet Properties, reviews the properties such as the droplet size distribution and deformation generated by different atomization processes. The first part of this chapter presents the mathematics of distribution functions used to analyze various properties of the droplets. It then gives the correlation equations for the droplet sizes of normal liquids and melts. The last part of the chapter discusses deformation of droplets impinging on a solid surface. Correlation equations are given for the final splat diameter of an impinging drop.

Chapter 5, Theoretical Calculations and Numerical Modeling of Droplet Processes, describes the basic theory and modeling of droplet formation and breakup. It mainly discusses and compiles results published in the literature without going into complexities of the mathematics involved in theoretical and computational modeling.

Chapter 6, Measurement Techniques for Droplet Properties and Intelligent Control of Droplet Processes, presents various methods for measuring droplet size, velocity, number density, temperature, and deformation on a surface. The section on intelligent control is very brief with less than five pages.



The quality of most of the charts and pictures is good. However, the quality of a few figures that are reproduced from older articles is marginal. Some of the legends and axes labels are too small for comfortable reading. The strength of this book is in its excellent review and compilation of the vast literature on the fundamentals and practical applications of droplet generation, deformation, and processing.

In summary, Science and Engineering of Droplets: Fundamentals and Applications is comprehensive enough to be a useful resource for application engineers and scientific researchers. It is a valuable contribution to the literature, and this reviewer strongly recommends it to researchers and libraries as a reference book on droplets.

1N43. Computation of Unsteady Internal Flows: Fundamental Methods with Case Studies. - PG Tucker *(Univ of Warwick, Coventry, UK).* Kluwer Acad Publ, Dordrecht, Netherlands. 2001. 376 pp. ISBN 0-7923-7371-5. $160.00.

This book provides an in-depth understanding of unsteady flow modeling and algorithms. This understanding enables suitable algorithms and approaches for particular fields of application to be selected. In addition, the understanding of the behavior of algorithms gained allows practitioners to use them more safely in existing codes, enabling meaningful results to be produced more economically.

Features of this book include specialized unsteady flow modeling algorithms, their traits, and practical tips relating to their use. Case studies considering complex, practically significant problems are given. Source code and set-up files are included. Intended to be of a tutorial nature, these enable the reader to reproduce and extend case studies and to further explore algorithm performances.

Mathematical derivations are used in a fashion that illuminates understanding of the physical implications of different numerical schemes. Physically intuitive mathematical concepts are used. New material on adaptive time stepping is included.

1N44. Fixed and Flapping Wing Aerodynamics for Micro Air Vehicle Applications. - Edited by TJ Mueller *(Univ of Notre Dame).* AIAA, Reston VA. 2002. 650 pp. ISBN 1-56347-517-0. $94.95.

Recently, there has been a serious effort to design aircraft that are as small as possible for spe-

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cial, limited-duration missions. These vehicles may carry visual, acoustic, chemical, or biological sensors for such missions as traffic management, hostage situation surveillance, rescue operations, etc. The goal is to develop aircraft systems that weigh less than 90 grams, with a 15-centimeter wingspan. Since it is not possible to meet all of the design requirements of a micro air vehicle with current technology, research is proceeding.

This book reports on the latest research in the area of aerodynamic efficiency of various fixed wing, flapping wing, and rotary wing concepts. It presents the progress made by over 50 active researchers in the field from Canada, Europe, Japan, and the United States.

1N45. Physical and Chemical Processes in Gas Dynamics: Cross Sections and Rate Constants. - Edited by GG Chernyi, SA Losev *(Moscow State Univ, Moscow, Russia),* SO Macheret *(Princeton Univ, Princeton NJ),* BV Potapkin *(Kurchatov Inst).* AIAA, Reston VA. 2002. 320 pp. ISBN 1-56347-518-9. $84.95.

This book and accompanying software provides concise, exhaustive, and clear descriptions of terms, notations, concepts, methods, laws, and techniques necessary for engineers and researchers dealing with physical and chemical processes in gas and plasma dynamics. It reflects state-of-the-art physico-chemical gas dynamics and is designed to serve the modern needs of the related areas of science and technology. This first volume of a two-volume set treats the dynamics of elementary processes (cross sections and rate coefficients of chemical reactions, ionization and recombination processes, and inter- and intramolecular energy transfer). Volume II will discuss complex physical and chemical kinetics in gases and plasmas.

The text and Windows-based computer programs carry widely diversified numerical information about 87 models for collision processes in gases and plasmas with participation of atoms, molecules, ions, and electrons. The processes include elastic scattering, electronic-vibration-rotation energy transfer between colliding molecules, and chemical and plasma-chemical reactions. The databases of recommended particle properties and quantitative characteristics of collision processes are built in. The computer implementation of model base allows one to calculate cross sections for elastic and inelastic collisions, and rate constants for energy transfer processes and reactions within a wide range of parameters and variables, ie, the collision energy, gas temperature, etc. Estimates of the accuracy of cross sections and rate coefficient represent an important part of the description of each model.

1N46. Proceedings of the 2001 ASME Fluids Engineering Division Summer Meeting - FEDSM2001, Volume 1, Forums. Held May/June 2001, New Orleans. - ASME, New York. 2001. 1032 pp. ISBN 0-7918-3532-4. ASME Book No I0500A. $250.00. (ASME members $125.00).

This compilation includes 137 full-length, peer-reviewed technical papers presented at the following forums: High speed jet flows; Fluid machinery; Cavitation and multiphase flow; Turbulent flows; Unsteady flows; CFD applications in automotive flows; Supersonic flow; Three-dimensional flows; CFD applications at DoE/DoD National Laboratories; Advances in fluids engineering education; Fluid measurements and instrumentation; Industrial and environmental applications of fluid mechanics; Advances in free surface and interface fluid dynamics; CFD applications in large facilities; Mems for fluid measurements; CFD applications in automotive flows; Fluidics; and Fluid mechanics of mixing phenomena: Fundamentals and industrial applications.

1N47. Proceedings of the 2001 ASME Fluids Engineering Division Summer Meeting—FEDSM2001, Volume 2, Symposia and General Papers. Held May/June 2001, New Orleans. - ASME, New York. 2001. 804 pp. ISBN 0-7918-3532-4. ASME Book No I0500B. $250.00. (ASME members $125.00).

This is a compilation of 128 full-length, peer-reviewed technical papers presented at the following symposia: Separated and complex flows; Numerical development in CFD; Pumping machinery; Industrial application of swirling flows; Fluid-structure interaction and flow induced noise in industrial applications; Active flow control; CFD applications in aerospace; and Fluid power: The role of industry in development of fluid power generating systems, marine propulsion, and renewable energy (wind and hydro) technology. The general papers in fluids engineering presented at the conference are also included.

Navier-Stokes Equations and Turbulence. Encyclopedia of Math and its Applications, Vol 83. - C Foias *(Dept of Math, Indiana Univ, Bloomington IA),* O Manley *(Consultant),* R Rosa *(Univ Fed do Rio de Janeiro, Rio de Janeiro, Brazil),* R Temam *(Univ Paris-Sud, Orsay, France).* Cambridge UP, New York. 2001. 347 pp. ISBN 0-521-36032-3. $90.00. (Under review)

Systems of Conservation Laws: Two-Dimensional Riemann Problems. Progress in Nonlinear Differential Equations and Their Applications, Vol 38. - Yuxi Zheng *(Dept of Math, Indiana Univ, Bloomington IN 47405).* Birkhauser Boston, Cambridge MA. 2001. 317 pp. ISBN 0- 8176-4080-0. $69.95. (Under review)

VI. HEAT TRANSFER

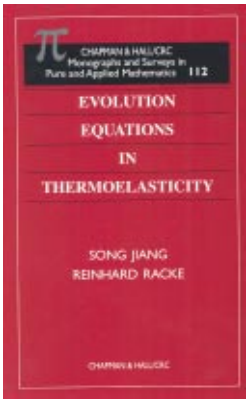
1R48. Evolution Equations in Thermoelasticity. Monographs and Surveys in Pure and Applied Mathematics, Vol 112. - Song Jiang *(Inst of Appl Phys and Comput Math, Beijing, Peoples Rep of China)* and E Racke *(Univ of Konstanz, Konstanz, Germany).* Chapman and Hall/CRC, Boca Raton FL. 2000. 308 pp. ISBN 1-58488-215-8. $84.95.

Reviewed by MV Shitikova (Dept of Struct Mech, Voronezh State Univ of Architec and Civil Eng, ul Kirova 3-75, Voronezh, 394018, Russia).

The authors' aim is to present a state of the art in the treatment of initial value problems and of initial boundary value problems both in linear and nonlinear thermoelasticity. From the very beginning, the authors restrict themselves by considering the conventional thermoelasticity theory formulated on the principles of the classical theory of heat conduction, and consequently, the heat transport equation of the theory is of parabolic type. The second grave limitation is connected with the boundary conditions used throughout the monograph, namely: the ideal heat exchange between a thermoelastic body and its surrounding medium and heat insulation on the body's boundary are considered. The more general condition—condition of heat exchange between thermoelastic bodies or between a body and surrounding medium, from which the conditions of constant temperature or heat insulation follow as particular limiting cases—is not investigated at all. But the condition of heat exchange is the most interesting and important for engineering applications, especially in contact problems. That is why this reviewer cannot agree with the authors that ''the intended audience includes not only graduate students of both mathematics and physics, but also the foremost expert looking for a survey.'' This book may be useful only for students wanting to be familiar with the basics of mathematical aspects of the convectional thermoelasticity theory.

The book includes nine chapters followed by two appendices, lists of main and supplemental references, notation, and an index. The first chapter gives a short summary of the derivation of the equations describing the nonlinear behavior of a thermoelastic body within the framework of the conventional thermoelasticity theory. Using Taylor expansions, the corresponding linearized equations are also written. The well-posedness of the linear initial boundary value problem in the case of the ideal thermal contact between a rigidly clamped body and surrounding medium is discussed in Chapter 2.

The asymptotic behavior as time tends to infinity of such a thermoelastic system with zero exterior forces and heat supply is investigated in linearized one-dimensional formulations in Chapter 3; two- or three-dimensional formulations are investigated in Chapter 4. A local existence theorem for the initial boundary value problem of hyperbolic-parabolic type and for the Cauchy problem is proved in Chapter 5. One-dimensional and three-dimensional thermoelastic nonlinear equations are considered in Chapters 6 and 7, respectively.



Chapter 8 analyzes the evolution of temperature and displacement in an elastic body that may come into contact with a rigid foundation. The system consists of the linearized equations together with the ideal thermal contact between the body and rigid foundation and Signorini's nonlinear conditions for mechanical contact. In the final chapter, the following problems are briefly described: the linear boundary value problem in the presence of external forces and heat supply, resulting in an additional

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damping; the far field asymptotic behavior of the solution, as well as a numerical scheme for the numerical solution of the initial boundary value problem.

Thus, the majority of the book, Chapters 2–8, is devoted to the proof of the obvious results about the exponential damping of energy and displacements as time goes to infinity by the use of different mathematical methods. In this reviewer's opinion, some results dealing with the asymptotic behavior of the desired values at large times can be obtained by the Laplace transformation methods with the corresponding limiting theorems.

Much to this reviewer's surprise, the authors, when discussing the behavior of the surfaces of strong discontinuity, did not even mention the works by VI Danilovskaya, RB Hetnarski, J Ignaszak, W Nowacki, and many others who have shown that singularities propagate in the stressed-strained thermoelastic medium of the hyperbolic-parabolic type with damping which has exponential character and is defined by the coupling of the strain and temperature fields. All the researchers mentioned above in one way or another investigated the asymptotic behavior of the solutions obtained as $t\rightarrow\infty$ or $x\rightarrow\infty$. As for the thermoelastic contact problems, then the authors completely ignore the results by Barber and his coauthors. That is why this reviewer does not share the opinion of the authors that their book ''presents a state-of-the-art treatment of initial boundary value problems in thermoelasticity and includes the most extensive bibliographies on the subject published to date.'' Quite to the contrary, the lists of main and additional references are very limited and do not cover a huge amount of monographs and original papers dealing with solving the boundary value problems even in the framework of the conventional thermoelasticity theory, not to mention the extended thermoelasticity theories predicting a finite speed of the propagation of thermal signals.

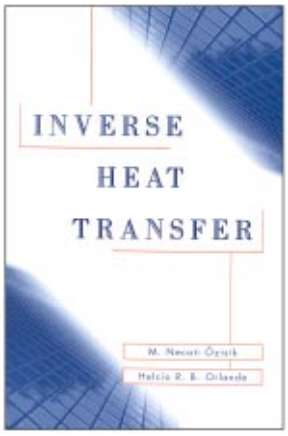
Applications of the mathematical treatment described in the book are of limited usefulness, and this book cannot attract the attention of engineers and researchers involved with a practical implementation of thermoelasticity. This reviewer thinks that *Evolution Equations in Thermoelasticity. Monographs and Surveys in Pure and Applied Mathematics, Vol 1* can be useful only for students who want to have some basic mathematical knowledge in classical thermoelasticity, but it cannot be recommended for purchase by libraries for mechanical or civil engineering departments, or by individuals with an interest in the practical utility of thermoelasticity.

1R49. Inverse Heat Transfer: Fundamentals and Applications. - MN Ozisik *(Dept of Mech and Aerospace Eng, N Carolina State Univ, Raleigh NC)* and HRB Orlande *(Dept of Mech Eng, EE-COPPE, Fed Univ, Rio de Janeiro, Brazil).* Taylor & Francis Publ, New York NY. 2000. 330 pp. ISBN 1-56032-838-X. $95.00.

Reviewed by AJ Kassab (Dept of Mech, Mat, and Aerospace Eng, Col of Eng, Univ of Central Florida, Orlando FL 32816-2450).

This is a book specifically focused on the solution of inverse heat transfer problems, that is problems that, for instance, address the reconstruction of unknown heat fluxes, the determination of unknown thermophysical properties such as thermal conductivities and diffusivities, or the determination of unknown energy generation (source term) in the governing heat conduction equation. The authors focus on the Levenberg-Marquardt method and Alifanov's method of iterative regularization for both parameter and function estimation. In the latter approach, the authors adopt the conjugate gradient method and use the adjoint method.

The book is divided into two parts. The first part consists of Chapters 1 and 2 which



cover fundamentals, and the second part consists of Chapters 3–6 which cover applications of the fundamentals to various 1D and 2D inverse problems. The first chapter provides a detailed literature review on inverse problems and develops basic concepts of inverse problems in heat transfer. The notes at the end of the chapter introduce elementary concepts in statistics. The second chapter details the Levenberg–Marquardt (LM) and conjugate gradient (CG) methods for solution of parameter estimation and function estimation problems. The LM method is derived in detail for linear and nonlinear problems, and criteria selection for stopping the iteration is provided. Three methods are identified to find the requisite sensitivity coefficients. Next, the authors develop the details of the conjugate gradient method along with the adjoint problem as a means of solving inverse problems. Stopping criteria are enumerated, and best practices are discussed. For each method, the authors provide step-by-step derivations and procedures. The chapter concludes with an example problem of reconstruction of the source term in the heat conduction equation and is supplemented by seven notes covering topics ranging from statistical analysis for parameter estimation, design of experiments, to issues involved in various approaches to stopping criteria.

The second part of the book addresses applications of inverse problems to various heat conduction, convection, and radiation problems. Chapter 3 applies the methods of the first part to inverse conduction problems of retrieving the initial condition, identifying unknown thermal conductivity of an othotropic medium, determining space wise and temporal variations of sources terms, estimating thermal diffusivities in the hyperbolic heat conduction equations, and estimating contact conductances. The formulation and solution procedure for each problem is detailed and solutions are presented in much detail in chart and tabular formats. This style is maintained throughout the book, where in the next chapters' various inverse problems in convection and radiation are treated. For instance, the problems of estimation of inlet temperature profiles and variation of wall fluxes in laminar and turbulent flows are considered in Chapter 4. While in Chapter 5, a very brief review of solutions methods for direct or forward radiation problems is followed by inverse problem applications in identifying the unknown radiative source term and identifying the unknown surface reflectivity. Both the LM and CG methods are used, and results are compared. The book concludes with Chapter 6 which addresses multi-dimensional solutions of the direct problem using body-fitted coordinates. This is followed by a generalized approach to inverse problems which is illustrated in an inverse problem addressing the cooling of electronic components.

There are ample examples supported by a copious number of tables, plots, and illustrations. The book has a detailed table of contents and an index. There are several problems at the end of each chapter, and each of the topics presented is presented in a detailed manner rendering the book quite suitable for teaching. Each chapter features a rather complete reference list. Moreover, most chapters are appended with notes exploring certain concepts and providing the mathematical details of derivations which are drawn-upon in the chapter.

Inverse Heat Transfer: Fundamentals and Applications is an excellent reference for researchers involved in inverse problems. The book should certainly be acquired by university and research laboratory libraries as a solid reference on the increasingly important subject of inverse problems. It should also be considered by instructors as a text for a course dedicated to inverse heat transfer problems or as a reference to

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supplement graduate heat transfer courses in heat conduction or intermediate heat transfer.

1N50. Advances in Computational Heat Transfer II, Volumes 1 and 2. Proc of Int Center for Heat and Mass Transfer Symp, Palm Cove, Queensland, Australia, May 2001. - Edited by G de Vahl Davis *(Sch of Mech and Manuf Eng, Univ of New S Wales, Sydney, 2052 NSW, Australia)* and E Leonardi. Begell House, New York. 2001. 1398 pp. 2-vol set. ISBN 1-56700-158-0. $100.00.

With keynote papers by leading international computational heat transfer specialists, this proceedings includes individually-authored papers covering the following topics: applications, combustion, computational and mathematical methods, conduction, forced convection, metal manufacturing and processing, natural convection, porous media, radiation, solidification, turbulence, two-phase flow and heat transfer, and validation and verification.

1N51. Micropropulsion for Small Spacecraft. - Edited by MM Micci *(Penn State, Univ Park PA 16802)* and AD Ketsdever *(Air Force Res Lab).* AIAA, Reston VA. 2000. 491 pp. ISBN 1- 56347-448-4. $89.95.

Micropropulsion is an enabling technology for microspacecraft operations by making missions possible that otherwise could not be performed. For example, the formation and maintenance of platoons of microspacecraft will require a maneuvering capability to counter orbital perturbations. Microspacecraft missions involving large spacecraft resupply, repair, or surveillance will also require maneuverability. The mission requirements for microspacecraft will be varied and in some cases a large range of capability might be required on the same spacecraft. Micropropulsion systems must be extremely versatile to address these requirements.

This new book shows the state of the art in micropropulsion concepts and activities at the early stages in the development of this new and exciting research area.

1N52. On a Class of Incomplete Gamma Functions with Applications. - MA Chaudhry and SM Zubair *(KFUPM, Dhahran, Saudi Arabia).* Chapman and Hall/CRC, Boca Raton FL. 2001. 512 pp. ISBN 1-58488-143-7. $79.95.

This book introduces a class of special functions, developed by the authors, for use in the analytic study of several heat conduction problems. It presents some basic properties of these functions, including their recurrence relations, special cases, asymptotic representations, and integral transform relationships. The authors explore applications of these generalized functions to problems in transient heat conduction, special cases of laser sources, and problems associated with heat transfer in human tissues. They also discuss applications to astrophysics, probability theory, and other problems in theory of functions and present a fundamental solution to time-dependent laser sources with convective-type boundary conditions.

Appendices include an introduction to heat conduction, Fourier conduction, a table of Laplace transforms, and well-known results regarding the improper integrals.

The book provides an in-depth study of incomplete Gamma functions, focusing on heat conduction problems with time dependent boundary conditions. It includes useful generalizations and decompositions of all incomplete Gamma functions. The authors cover Fresnel integral functions, their mathematical properties, recurrence relations, and differentiation formulas. New identities involving Fourier transforms for numerical and scientific computation are investigated. The book presents a unified approach to closed form solutions useful in moving heat source problems, particularly in laser-induced processing of materials.

1N53. Proceedings of the 2001 International Joint Power Generation Conference, Volume 1, FACT - Print Version. Held in June 2001, New Orleans. - ASME, New York. 2001. 512 pp. ISBN 0-7918-3539-1. ASME Book No I0507A. $250.00. (ASME members $125.00).

This printed volume includes 62 full-length, peer-reviewed technical papers presented on the following themes: biomass applications; emission issues, heat transfer and fluid flow applications; NOx control and measurement; opportunity fuels; repowering strategies; combustion modeling; gas turbine combustion issues; low NOx burners; NOx reduction and control; and performance/characteristics of coals.

1N54. Proceedings of the 2001 National Heat Transfer Conference — Print Version, Volume 1. Held in June 2001, Anaheim CA. - ASME, New York. 2001. 996 pp. ISBN 0-7918- 3533-2. ASME Book No I0501A. $250.00. (ASME members $125.00).

This printed collection includes 108 full-length, peer-reviewed technical papers presented on the following topics: aerospace heat transfer; electronics cooling; environmental and renewable energy; materials processing; microscale heat transfer; combustion; bioheat transfer; nuclear engineering; heat exchangers and heat transfer equipment; low temperature heat transfer; and boiling and condensation.

1N55. Proceedings of the 2001 National Heat Transfer Conference - Print Version, Volume 2. Held in June 2001, Anaheim CA. - ASME, New York. 2001. 1000 pp. ISBN 0-7918- 3533-2. ASME Book No I0501B. $250.00. (ASME members $125.00).

This collection of 111 full-length, peer-reviewed technical papers covers the following topics: multiphase heat transfer; control and design; solid-liquid phase change; porous media; conduction; convection; radiation; computational heat transfer; properties and measurements; and keynote papers.

Advanced Thermodynamics Engineering. Computational Mechanics and Applied Analysis Series. - K Annamalai *(Dept of Mech Eng, Texas A&M, College Station TX 77843)* and IK Puri *(Dept of Mech Eng, Univ of Illinois, Chicago IL).* CRC Press LLC, Boca Raton FL. 2002. 786 pp. ISBN 0- 8493-2553-5. $89.95. (Under review)

VII. EARTH SCIENCES

1N56. Large-Scale Atmosphere-Ocean Dynamics, Volume 2: Geometric Methods and Models. - Edited by J Norbury *(Lincoln Col, Oxford, UK)* and I Roulstone *(Met Office and Univ of Reading, Reading, UK).* Cambridge UP, Cambridge, UK. 2001. 400 pp. ISBN 0-521-80757-3. $80.00.

The complex flows in the atmosphere and oceans are believed to be accurately modeled by the Navier- Stokes equations of fluid mechanics together with classical thermodynamics. However, due to the enormous complexity of these equations, meteorologists and oceanographers have constructed approximate models of the dominant, large-scale flows that control the evolution of weather systems and that describe, for example, the dynamics of cyclones and ocean eddies. The simplifications often result in models that are amenable to solution both analytically and numerically. This volume examines and explains why such simplifications to Newton's second law produce accurate, useful models and, just as the meteorologist seeks patterns in the weather, mathematicians seek structure in the governing equations such as groups of transformations, Hamiltonian structure and stability.

VIII. ENERGY & ENVIRONMENT

Environmental Fluid Mechanics. - H Rubin *(Dept of Civil Eng, Technion-Israel Inst of Tech, Technion City, Haifa, 32000, Israel)* and J Atkinson *(Dept of Civil, Struct, and Env Eng, SUNY, Buffalo NY).* Marcel Dekker, New York. 2001. 728 pp. ISBN 0-8247-8781-1. $150.00. (Under review)

IX. BIOENGINEERING

1N57. Computational Models of Auditory Function. NATO Science Series: Life Sciences, Vol 312. - Edited by S Greenberg and M Slaney. IOS Press, Amsterdam, Netherlands. 2001. 350 pp. ISBN 90-5199-457-5. $117.00.

This volume provides summary chapters on computational modeling of auditory processing, including cochlear function, binaural mechanisms, pitch perception, periodicity analysis, speech processing, and auditory scene analysis. The chapters describe computational models germane to these functional modules of auditory processing, as well as background material describing the significance of these models for understanding the physiological, anatomical, and perceptual bases of hearing function.

Bone Mechanics Handbook, 2nd Edition. - Edited by SC Cowin *(CUNY, New York NY).* CRC Press LLC, Boca Raton FL. 2001. ISBN 08-493-9117-2. $169.95. (Under review)

Introduction to Bioengineering. - Edited by YC Fung *(Univ of California, San Diego CA).* World Sci Publ, Singapore. 2001. 292 pp. Softcover. ISBN 981-02-4398-7. $28.00. (Under review)

X. GENERAL & MISCELLANEOUS

1N58. ASME Engineer's Data Book. - C Matthews. ASME, New York. 2001. 268 pp. ISBN 0-7918-0155-1. (Package of 10 copies $150). $24.00. (ASME members $19.00).

Divided into 22 sections, this pocket-sized volume is an exhaustive ''quick reference'' of up-to-date engineering data and rules.

Contents cover essential mathematics; units; engineering design; basic mechanical design; motion; mechanics of materials; material failure; thermodynamics; fluid mechanics; fluid equipment; pressure vessels; materials; machine elements; design and production tools; project engineering; computer-aided engineering; welding; non-destructive examination; corrosion; surface protection; metallurgical terms; and engineering associations and organizations.

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Errata

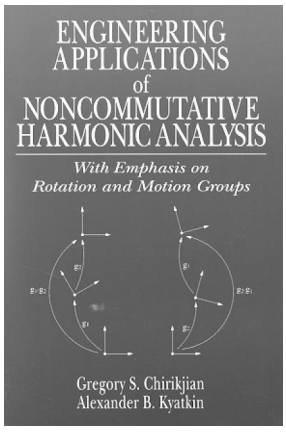
*The following are corrections of Book Reviews **11R1** and **11R2**. These reviews were originally published incorrectly in Applied Mechanics Reviews **54**(6) 2001 on pages B97–B98. We apologize for the errors. —Editor*

11R1. Engineering Applications of Noncummutative Harmonic Analysis: With Emphasis on Rotation and Motion Groups. - GS Chirikjian *(Dept of Mech Eng, Johns Hopkins Univ, Baltimore MD)* and AB Kyatkin. CRC Press LLC, Boca Raton FL. 2001. 674 pp. ISBN 0-8493-0748-1. $89.95.

Reviewed by AC Buckingham (Center for Adv Fluid Dyn Appl, LLNL, Mail Code L-23, PO Box 808, Livermore CA 94551).

In this book, the authors' stated and quite apparent aim is to provide a comprehensive, yet essentially self-contained and explicitly informative text and reference work on a mathematically sophisticated, inherently essential branch of analysis familiar to theoretical physics and mathematics students. Here, however, two obviously enthusiastic and effective teachers and applied researchers in physical science, engineering science, and applied mathematics have purposely created a substantial book for training engineers and engineering science students at the upper division or early graduate level. The authors' emphasis is thereby placed on the instruction of students who are probably not familiar with noncommutative harmonic analysis, generally, as well as lacking the background and preparation in foundation topics such as functional analysis on abstract hyperspaces, algebraic and differential topology, group theory, field theory, etc, more commonly encountered by theoretical physics and mathematics students. It follows that deliberate emphasis is placed on exposition of the title subject by approaching it with methods more familiar to engineering students. To this end, the exposition makes considerable use of linear algebraic matrix theory in physical-coordinate oriented steps proceeding within the framework of differential geometry, but applied to non-abstract configurations readily visualized and familiar to students trained in engineering applications.

The presentation originates with a descriptive overview of the material to be presented and some of the crucial properties and issues associated with the title subject. This is immediately followed by a review of some considerations in well established and familiar engineering applications of commutative harmonic analysis and Fourier transform theory as a foundation for the systematic introduction and instructive discussion of the analysis concepts developed and advanced in this book. Physical coordinate-based examples, descriptions, and many well-planned and positioned figures and sketches enhance the presentation for the student reader's developing understanding and appreciation. Some of the important fundamental topics treated in the ten essentially developmental chapters include the generation and properties of orthogonal functions on finite intervals; functional mapping, convolution, and functional projection operations; discrete and fast discrete transform procedures; recent advances in discrete polynomial transforms; wavelets and their fundamental scale, translation, and modulation properties; topological properties and parameterizations in plane and spherical projections; description and influence of rotations in 2 and 3 spatial dimensions; appropriately strong emphasis on group theory concepts, symmetries, group representations, and representational theory with examples (some historical) from theoretical physics; harmonic analysis and fast fourier transform methods for specialized motion groups. The mathematical notation adapted and adhered to consistently is easily followed, universally recognized symbolic language from set theory and modern analysis. Seven chapters of interesting and sometimes surprising applications complete the basic body of the text. These include applications in analysis and development of robotics for mobile and stationary, manipulative operations (with several very illustrative photographs from the authors' own laboratory); image analysis, pattern recognition, and forward as well as inverse tomography for medical imaging and radiation therapy planning and scheduling in medical applications; stochastic processes in control systems design and analysis; Brownian motion and diffusion studies; and the statistical mechanics and analysis of polymeric macromolecular structure dynamics in physical chemistry, to name just a few. Six supplemental appendices are positioned conveniently for the reader's reference at the end of the general text with useful reminders and information, descriptions, labels, and basic mathematical identities and rules that are used throughout the body of the text.



The presentation is deliberately descriptive and effective for self-instruction. Sections often begin with a brief verbal introduction and explanation of the mathematical relations to follow. These relations are carefully developed with comprehensive steps and most of the matrix operations explicitly identified, followed by verbal explanations connecting the material presented with that which is to follow. The authors avoid the terseness often followed in theoretical physics and mathematics monographs, but pay the price in the added space required to develop (and in many cases) redevelop the material at a different level and in a somewhat different context for reinforcement. Formal mathematical treatment such as the establishment of existence theorems, proofs, and lemmas are avoided. Explicitly developed proofs and the consequences of the development appear only when the issue of clarity and confidence in the results in relation to what has been established appear to warrant them. Each chapter and the six supplemental appendices end with a paragraph or two of summary, reinforcing identification of the primary topics described in the chapter and their role in developing and pursuing the instructional themes of the book. Hundreds of classical historical and newer references are conveniently listed at the end of each chapter or section to which they pertain. There is also a usefully generous, two-level cross index of about 1400 items which is particularly helpful for location, study, and reference of the book's material.

In the opinion of this reviewer, the authors have accomplished their stated aims. *Engineering Applications of Noncommutative Harmonic Analysis* is a comprehensive and generally self-contained exposition appropriate for guiding the engineering student to familiarity and, with practice, perhaps competence in an elegant and useful branch of analysis. The drawback, if one exists is that the length and thoroughness of the descriptions required to provide what the authors perceive to be adequate coverage and instruction results in an abundance of material, with some of it revisited at repeated intervals for emphasis, clarity, and at times additional information. While this is an effective device for thorough instruction on unfamiliar topics, it penalizes and may deter the more accomplished individual seeking to use the book for review or fresh perspective rather than instruction. The authors, themselves, point out that the abundance of material is substantially greater than that associated with a single semester or quarter course. They suggest combinations of the material would be adequate for about *seven* independent semester/quarter courses. Its size and substance precludes carrying the book about casually for occasional inspection as a researcher or a student, but it certainly must be considered as a solid reference addition to personal or institutional libraries. This reviewer welcomes it in his.

11R2. Nonlinear Continuum Mechanics of Solids: Fundamental Mathematical and Physical Concepts. - Y Basar *(Inst fur Statik und Dynamik, Ruhr-Univ Bochum, Universitatsstr 150, Bochum, 44780, Ger-*

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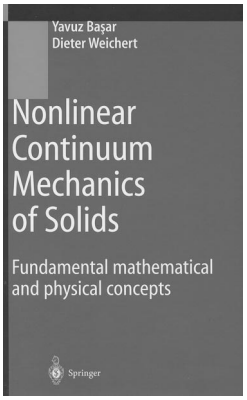
many) and D Weichert *(Inst fur Allgemeine Mech, RWTH Aachen, Templergraben 62, Aachen, 52056, Germany)*. Springer-Verlag, Berlin. 2000. 193 pp. ISBN 3-540-66601-X. $59.95.

Reviewed by J Petrolito (Sch of Sci and Eng, La Trobe Univ, PO Box 199, Bendigo, Vic 3350, Australia).

This is a graduate-level textbook on the fundamental concepts of nonlinear solid mechanics. The authors' stated goal is to provide students with sufficient background to carry out research in this area. As such, the book emphasizes the theoretical aspects of the subject rather than dealing with specific applications. However, given that this is a textbook, it is surprising that there are not many exercises to help students reinforce their learning.

The book, divided into six chapters and an appendix, makes extensive use of tensor analysis, and the first chapter discusses the basic aspects of this theory. This chapter is complemented by the appendix on index notation and general coordinate systems. The combination serves as a concise introduction to tensor analysis in its own right. The second chapter is concerned with the concepts of deformation and strain. There is considerable discussion on the distinction between material and spatial coordinates and the conversions between the two systems. Various nonlinear strain measures are defined, and these are shown to be particular cases of a unified definition of strain. In total, the first two chapters take up around half the book.



Chapter 3 discusses the concept of stress and shows how different stress measures are associated with appropriate energy-conjugate strain measures. This is followed by a very short chapter on time derivatives that could have been incorporated into Chapter 2. The next chapter discusses the various balance laws in mechanics and includes a brief discussion on the principle of virtual work. The final chapter details the requirements of constitutive relationships, with particular emphasis on elastic materials.

It is interesting to compare this book with another recent book that broadly covers the same area [1]. Both books emphasize theory over practical applications, with [1] taking a more abstract approach to the subject. The current book, being around twice the length, devotes considerably more attention to tensor analysis and its use in solid mechanics. But ultimately, both books stop too soon. While they clearly develop the basic concepts, neither book provides any significant insight on how to apply the theory in practice. Even a short chapter on some typical applications would have enhanced both books.

In summary, the current book, *Nonlinear Continuum Mechanics of Solids: Fundamental Mathematical and Physical Concepts*, provides a useful introduction to the theoretical aspects of nonlinear solid mechanics at the graduate level. It will appeal to students who want to quickly gain an understanding of the basic principles. Students who need guidance on particular problems in the area will need to look to other books for this.

References

[1] Podio-Guidugli P (2000), *A Primer in Elasticity*, Kluwer.

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