BOOK REVIEWS

Items with a reviewer byline (coded R) are by AMR's corps of dedicated outside volunteer reviewers. AMR will attempt to get critical reviews of all relevant textbooks, reference works, and monographs. Items without a reviewer byline (coded N) are prepared by AMR in-house staff and are largely based on material such as a book's table of contents and editor's preface or foreword. In the interest of timeliness, most conference proceedings and multi-author contributed volumes will receive descriptive notes in this fashion. Books deemed to be somewhat peripheral to AMR's basic scope may simply be listed by title. Also listed by title when first received are books under review.

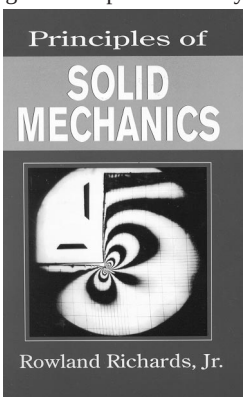
I. FOUNDATIONS & BASIC METHODS

9R1. Principles of Solid Mechanics. - R Richards Jr *(SUNY, Buffalo NY).* CRC Press LLC, Boca Raton FL. 2001. 446 pp. ISBN 0-8493-0114-9. $89.95.

Reviewed by J-C Roegiers (Rock Mech Inst, Univ of Oklahoma, Sarkeys Energy Center, Ste P119C, 100 E Boyd, Norman OK 73019-0628).

This book should be considered somehow as a compilation of Prof Richards' notes accumulated over his extensive academic experience. It constitutes an excellent text as well as reference book, for seniors as well as graduate students.

The book covers many aspects of the mechanics of deformable solids, starting from fundamental concepts, taking the reader step-by-step to more complex and interesting applications. The subject index is clear and the figures, drawn by hand, are of good quality and bring back—for some of us—the nostalgia of the past. The only negative



comment stems from the fact that, with the exception of the Preface and some footnotes, no systematic references are included at the end of each chapter or at the end of the book. This is unfortunate as the curiosity of the reader is often challenged by the text, but his desire to pursue further details is constrained. This reviewer also recommends that the author provides an additional solution manual for the multitude of interesting and judiciously selected problems included at the end of each chapter, encouraging self-study.

The first three chapters (Introduction, Strain and Stress, Stress-strain Relationship) cover well-established fundamentals; they constitute somehow the *building blocks* for the remainder of the book. The author reviews here first-order concepts with the theoretical rigor required for the reader to fully appreciate the implied assumptions and limitations. Chapter 4 (Strategies for Elastic Analysis and Design) starts to introduce engineering applications and stresses the importance of graphic visualization in tackling inverse problems. The author also discusses in some detail the importance of existence and uniqueness, as well as the assumed boundary conditions. For the sake of completeness, the extension to 3D could have been mentioned, at least via a few example problems.

Chapters 5 through 9 review different geometries and situations in a very orderly fashion. The presentation of the various subjects is extremely clear and allows researchers to quickly locate the appropriate formulas. On a regular basis, the author provides some additional non-traditional insights into solutions of complex problems. Chapters 10 and 11 introduce the reader to fundamental plasticity concepts, attempting to unify this approach to previously covered elasticity. He also discusses, in some detail, the inverse strategies for optimum design. Finally, in Chapter 12, he reviews the concept of slip lines and proposes to extend this geomaterials' approach to steel and concrete. He also compares this approach to other existing solutions.

In summary, this reviewer recommends this captivating book, *Principles of Solid Mechanics*, both for individuals as well as libraries. Its style makes it pleasant to read. The included problems often extend the content of the book by addressing additional or even unsolved situations. Finally, the footnotes often provide the reader with candid comments and refreshing anecdotes.

Crystals, Defects and Microstructures: Modeling Across Scales. - R Phillips *(Brown Univ, Providence RI).* Cambridge UP, Cambridge, UK. 2001. 780 pp. Softcover. ISBN 0-521-79357-2. $47.95. (Under review)

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. (Under review)

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. (Under review)

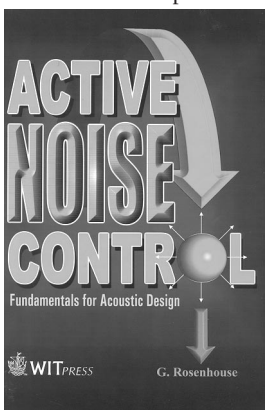
Nonlinear Continuum Mechanics of Solids: Fundamental Mathematical and Physical Concepts. - Y Basar *(Inst fur Statik und Dynamik, Ruhr-Univ Bochum, Universitatsstr 150, Bochum, 44780, Germany)* and D Weichert *(Inst fur Allgemeine Mech, RWTH Aachen, Templergraben 62, Aachen, 52056, Germany).* Springer-Verlag, Berlin. 2000. 193 pp. ISBN 3-540-66601-X. $59.95. (Under review)

II. DYNAMICS & VIBRATION

9R2. Active Noise Control: Fundamentals for Acoustic Design, Volume 1. - G Rosenhouse *(Technion-Israel Inst of Tech, Haifa, Israel).* WIT Press, Southampton, UK. 2001. 407 pp. ISBN 1-85312-373-0. $279.00.

Reviewed by GC Gaunaurd (Code AMSRL-SE-RU, Army Res Lab, 2800 Powder Mill Rd, Adelphi MD 20783-1197).

This is really a ''Handbook'' of acoustics that covers a variety of its subjects in a sketchy fashion, and then refers the reader to a list of references for further details. The topics are numerous, and there are over 1000 references, mostly dealing with applications. A student in an Acoustics Program would not profit much from this book, which is intended for an audience of researchers and more experienced design



consultants. There is no emphasis on teaching the material; only in providing some more or less useful formulas as the answers to various problems, and in the introduction of some definitions of the sub-fields treated. The book/handbook is divided into three long chapters: a) The essence of active noise and vibration cancellation, b) sources of sound, including radiation from surfaces

and active noise control, and c) superposition of sound fields near surfaces. The whole effort covers 408 pages including seven brief Appendices and an Index. There are so many topics (briefly) covered in each chapter that it will only be possible here to give an outline of the most important ones.

The first chapter is essentially historical and covers/reviews the early work of Thomas Young on interference lines (ca 1850), a little-known 1936 patent by P Lueg on sound cancellation, and the nearfield of a sound radiating piston on a baffle. Advances in modern electronics permitted active control schemes to become viable outside the laboratory, and a number of these later developments are described next. The list is quite lengthy and extends to the present day. It includes the names and works of CR Fuller and JE Ffowcs-Williams. A 1984 paper by Ffowcs-Williams is cited as providing an exhaustive analysis of the energetics of anti-sound. An immense bibliography on active noise and vibration control (ANVC) prepared by D Guicking (1988) is also repeatedly cited.

Chapter 2 starts with the wave equation, linearized, and nonlinear, as it applies for lossless and lossy media. Then, various multipole sources (ie, monopoles, dipoles, quadrupoles...) are introduced. This leads to some key problems in aero-acoustics including the celebrated Lighthill's ''acoustic analogy'' and vorticity-induced sound. Some authors cited here include D Crighton and H Levine.

The radiation of sound by moving multipole sources follows this presentation. Many authors have dealt with various aspects of this problem, and some of these are cited, while many others are not! The vibration of surfaces also generated radiated sound. This large topic is reviewed in about four pages. Parametric arrays, end-fire arrays, and thermal sources of sound are also mentioned. Three other extensive topics are included. Of these, we will only mention one, viz, the sound radiation by vibrating plates. Hundreds of papers have also been published on this topic, particularly, for fluid-loaded plates. The classical work of C Wallace (1972) is reproduced in some detail, including his various plots of radiation efficiency vs aspect ratio, b/a. Other classical works (ie, R Lyon and G Maidanik (1962), P Laura (1967), and A Leissa (1969)) are also included, as well as some work on the effects of joints/stiffeners and ribs on the radiated sound fields (ie, E Shenderov (1980), L Cremer (1973), etc...) of vibrating plates.

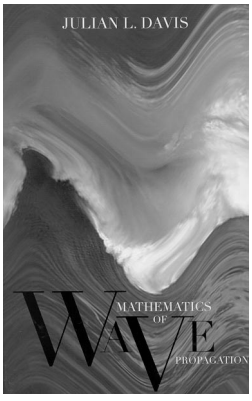
The final chapter, 3, deals with superposition of sound fields near surfaces. This is the longest (and most interesting) chapter. It also has all the periods at the end of sentences missing from the text. A few highlights follow. It starts with sound transmission, reflection, and absorption by layers of materials (''a la Brekhovskikh'') or by half-spaces, or by moving boundaries, or by rough surfaces, or by corrugated moving boundaries. Then, the acoustic effect of obstacles is covered. This becomes a section on acoustic Scattering. First, by a single rigid cylinder as the scatterer, and later by a rigid sphere, or an array of such spheres, or a prolate spheroids, or by elastic, sound-absorbing and *coated* cylinders and spheres. There is a vast literature (over 400 references) cited, and many more not cited. The important topic of Acoustic Resonance Scattering is briefly mentioned, but for some reason it is said to be beyond the scope of the book. Also mentioned in passing are the topics of opto-acoustics, bubble acoustics, levitation, and sonoluminescence, for which a biblical explanation from Genesis is given(!).

The seven Appendices deal with some mathematical definitions, with methods of discretization of continuous data, and with three brief studies of the tinnitus, an ear disease related to noise cancellation, and its cure by electric stimulation. The lists of references have many entries repeated and the names of many authors are misspelled. The high cost of the book ($279) will undoubtedly reduce its marketability. *Active Noise Control: Fundamentals for Acoustic Design, Volume 1* is certainly a valuable addition for some institutional libraries and for its intended audience.

9R3. Mathematics of Wave Propagation. - JL Davis *(consultant).* Princeton UP, Princeton. 2000. 395 pp. ISBN 0-691-02643-2. $49.50.

Reviewed by LN Sankar (Sch of Aerospace Eng, Georgia Inst of Tech, Atlanta GA 30332-0150).

There are a number of textbooks and references that have been published on wave propagation in fluids. One may also find numerous books that individually address the propagation of waves in solids, surface waves in water, and tidal waves. There are very few books that treat all of these related phenomena in a clear, unified manner. This book does this challenging job admirably well.



The first chapter deals with the physics of propagating waves. Many classical problems such as the transverse oscillations of a string, acoustic waves in a duct, and compression waves in a bar are discussed. Topics such as the Doppler effect, dispersion, and group velocity are also covered. The mathematical aspects of these problems are not emphasized in this chapter.

The second chapter deals with the theory behind hyperbolic partial differential equations. The method of characteristics is discussed and illustrated with increasingly complex model problems: 1D advection equation, 2D wave equation, and a system of first order linear and nonlinear partial differential equations, etc.

Chapter 3 deals with how the partial differential equations developed in Chapter 2 may be solved. Classical mathematical techniques such as the separation of variables and Laplace transforms, as well as numerical methods that solve ODEs or algebraic equations along characteristic lines are covered. Numerous applications ranging from the vibration of a rectangular membrane to the propagation of current in an LC circuit are discussed.

Having established the common mathematical foundation and the solution techniques for these problems, this book moves on to individual topics: wave propagation in viscous and inviscid fluids, elastic, viscoelastic and thermoelastic solids, and water waves. Each of these chapters may be read individually without reference to others. All the governing equations are derived from first principles, making it easier for the reader to understand and appreciate the physics behind these problems.

This book ends with variational calculus based approaches (eg, Hamilton's variational principle, Hamilton-Jacobi theory) to deriving the governing equations. Asymptotic approaches that rely on expansion of the solution for large wave numbers or frequency are also briefly discussed.

There are numerous worked-out examples throughout the book. There are also exercises at the end of most of the chapters. These features make this work a suitable textbook for a senior-level or a graduate-level course on the theory of waves.

In summary, *Mathematics of Wave Propagation* is an excellent book that covers seemingly diverse wave phenomena in a unified, coherent manner. Students and practicing engineers and physicists will find this book a useful addition to their collections.

9R4. Optimal Protection from Impact, Shock, and Vibration. - DV Balandin *(Res Inst of Appl Math and Cybernetics, Nizhny Novgorod State Univ, Russia),* NN Bolotnik *(Inst for Prob in Mech, Russian Acad of Sci, Moscow, Russia),* and WD Pilkey *(Dept of Mech and Aerospace Eng, Univ of Virginia, Charlottesville VA, Russia).* Gordon Breach Sci Publ, Newark NJ. 2001. 436 pp. ISBN 90-5699-701-7. $110.00.

Reviewed by C Cetinkaya (Dept of Mech and Aeronaut Eng, Clarkson Univ, CAMP 241, Box 5725, Potsdam NY 13699-5725).

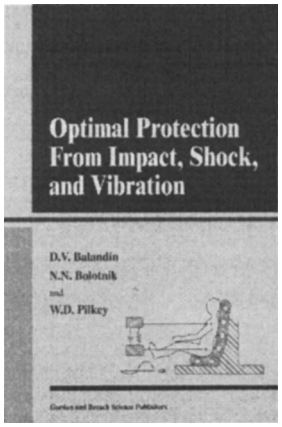
It is reported that only 5% of the total

SUVs (sport utility vehicles) sold in the United States have ever been driven in off-road conditions even though the prime feature of an SUV, which has considerably higher price tag than an average sedan, is its off-road capabilities. A typical SUV is heavier and more rigid than a typical sedan. While a slew of explanations could be offered for this consumer behavior, one possible reason is their reportedly better impact protection. In light of this information, a driver of a none-SUV might rightfully wonder about the potential risk implications in case of his/her collision with an SUV, especially, when that driver is an engineer. The topics covered in this book are about how the principles of optimal control can be put to use to narrow risk gaps such as this one in impact protection by design of dynamic isolators.

As the title of the book clearly reflects, it is concerned with the problem of protection of structures under impulsive loading and vibration conditions. The subject matter has been the subject of long-term intensive research, and the size of the literature reflects that fact well. The book reports a wide spectrum of results in optimization techniques applied to finite-dof (degree-of-freedom) systems, and offers methodologies for design of optimal protection systems. The mathematical principles of optimality adopted in the book are based on the maximum principle and the principle of optimality by Pontryagin and Bellman, respectively, developed in the late '50s and early '60s. As stated by the authors, the focus of the book is on the application of the optimal control theory to multi-body dynamic systems. The book is concerned with idealized systems consisting of rigid base and the object to be protected from the impulsive load applied to the base. Two typical performance criteria utilized in the book are the maximum relative displacement of the object with respect to the base and the maximum force transmitted to the object. It appears that the main application field the authors have in mind is transportation systems (vehicles, airplanes, etc). The protection of civil engineering structures under seismic loads can also be maximized with the aid of the techniques presented. The target audience of the book is stated as "mathematically oriented researchers and engineers interested in the optimal design of systems for protection from shock and vibration." To follow the derivations and proofs, a decent background in functional analysis should be sufficient.

This book could be used as text for a specialized graduate-level course following a graduate course in dynamics and vibration, as well as a basic course in control theory in which the state-space representation of systems is introduced. The practicing engineer working on protective systems and structures from impulsive loads and vibrations should also find the book useful as a valuable reference.

The brief background provided in Chapter 1 includes mathematical modeling of mechanical systems and isolators, and control theory for open and closed loop systems. The proofs to the basic theorems employed throughout the book are provided in the first chapter. Some readers would find a section devoted to a graphical method "for solving the fundamental problem of optimal isolation" rather interesting. Chapters 2 and 3 focus on the optimal protection of (single-dof) objects moving in rectilinear and rotational coordinates by designing optimal (passive) isolator under impulsive loading conditions. Chapters 4 and 5 deal with uncertainties in the impact process: uncertainty in loading conditions and the mass of the other object, respectively. The focus of Chapter 6 is on the isolation under harmonic loads. In addition to linear systems, vibration isolation with dry friction is covered in this chapter. In the first six chapters of the book, only single-dof systems are discussed.



Chapter 7 extends the concept of optimal damping of transient motion into multi-dof and distributed systems. Various computational methods for certain classes of disturbances are covered in Chapter 8. The main theme of Chapter 8 is the reduction of a continuous-time optimal control problem to a discreet time problem. Many practical applications, such as performance of a helicopter seat for the prevention of spinal injury and performance of seat belts for thoracic injury prevention, are included. Chapter 9 is on the optimal design of (single-dof) shock isolators using standard elements such as springs and dampers. It is shown that the limiting performance analysis requires that the shock absorber generates a constant force for minimizing the peak force to which the object is subjected. Chapter 10 demonstrates how optimal control can be achieved without the constant force controllers, thus a larger class of controllers are possible with the approach presented. This technique is also referred to as bang-bang control.

The notation adopted in the book seems consistent throughout the chapters. Even though the subject matter is mathematical in its nature, a typical reader should find the notation reasonably easy to follow and consistent. A brief section on the terminology used in the book is also included. Somewhat awkwardly large, but clear, plots are included in the text. System diagrams and figures in the book are clear. The book has a detailed table of contents, a rich subject index, and an extensive list of references. A detailed literature review is provided in *Forward: Historical Perspective*. A good introduction to Russian and Soviet research on the subject is also provided. Almost every chapter has a section making some closing remarks on the subject matter of the chapter, such as summary of basic results and practical recommendations.

It is somewhat surprising that this book has no coverage on some modern applications such as electronic equipment/device protection, electronic packaging, etc, even though the concepts and methods offered in the book should be directly applicable to such systems. It should be noted that the freedom in selection of the performance index provides a flexibility of the use of the book in a wider spectrum of applications than those covered in the text. Since mechanical systems tend to scale down well, the techniques covered in this book should find applications in the mechanical isolation of small-scale structures (eg, MEMS).

The book's main focus is on linear finite-degree-of-freedom systems. The coverage for distributed systems is quite limited except for a brief reference in Chapter 7. In addition, the book neglects the effects of plastic deformations on the impact protection. For example, no mention of crumble zones in vehicles, which are often used in modern vehicles as energy absorbing elements, is made. This is partly because of the initial modeling assumption, a rigid base connected to an object to be protected through an isolator; crumbling zones and plastic deformations affect only the force exerted on the rigid base. The reader should keep in mind that more realistic analysis under impulsive loading conditions should include plastic effects. The coverage for nonlinear behavior is also limited. However, a dry-friction damper is introduced and discussed in Chapter 2.

If you are designing and/or analyzing systems which may be subjected to impulsive loads and vibrations during their operational life cycles, such as transportation systems, civil engineering structures, and protective systems (seat belts, helmets, airbags, seats, etc) and are concerned with their optimality, you must have a copy of this book, *Optimal Protection from Impact, Shock, and Vibration*. Also, control people who are interested in some good practical applications of the control theory in the subject matter might wish to have a look at this book. Vibrations engineers willing to expand their horizons into impact and transient response of systems could also find the book useful. Libraries should seriously consider the title for their collection.

9R5. Reciprocating Machinery Dynamics: Design and Analysis. - AS Rangwala *(Center for Eng Tech, Cincinnati OH).* Marcel Dekker, New York. 2001. 761 pp. CD-ROM included. ISBN 0-8247-0531-9. $195.00.

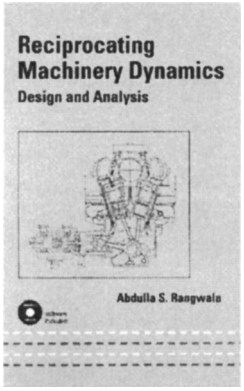
Reviewed by EL Amromin and S Kovinskaya (Mechmath LLC, 2109 Windsong, Edmond OK 73034).

In recent decades, diverse structural dynamics software has became an important tool in machinery design. However, the application of software requires from a designer or an engineer deep understanding of structural dynamics and physics of modeling machines. The author considers probably all significant mechanical, acoustical, thermal, and fluid-related processes in reciprocating machinery. Because of the comprehensive analysis of numerous processes that has to be taken into account in design, this book is an excellent textbook for students and a helpful guide for practicing engineers. The author has put together problems that the engineer can meet. There are conceptual design, dynamic analysis, problems of optimization, and corresponding measurements.

Because reciprocating machinery is broadly used in numerous engines, pumps, and other devices, this book includes classification and construction of reciprocating machines. The dynamic analysis of the machinery in the book is based on several selected topics of classical vibration theory described in a few chapters that are thoughtfully distributed in the text. As was mentioned above, the range of described physical phenomena is very wide. It seems that a reader can find any problem related to this machinery.

Reciprocating machinery transfers significant flux of energy, but some part of energy is spent for troubling vibration and noise. It is both a technical and environmental problem to reduce this. The book contains procedures for noise evaluation, methods to control noise, and some measurement and signal processing techniques.

There are 14 chapters namely, Vibrational Theory Fundamentals, Classification and Construction of Reciprocating Machinery, The Crankshaft and Associated Components, Crank Mechanism Dynamics, Balancing of Periodic Inertia and Gas Pressure Loads, Torsional Vibrations, Flexural Vibrations, Advanced Analytical Methods, Vibration Measurement and Balancing, Applications from Computational Fluid Dynamics, Pressure Pulsations in Compressors and Pumps, Reciprocating Machinery Dynamics and Noise, Design Optimization, and Computer Programs Illustrating Case Histories. Fundamentals of vibration theory are introduced in Chapter 1. The overall description of contemporary reciprocating machinery in Chapter 2 and a detailed description of crankshafts in Chapter 3 give the necessary knowledge for any reader, regardless of his background. Chapter 4 gives initial information on dynamics of some selected devices. The general explanation on mechanical equilibrium of reciprocating machinery elements and their vibration is done in Chapters 5, 6, 7, and 11; the noise-related issues are discussed in Chapter 12. Chapters 8, 9, and 10 give an introduction to employment of analytical, experimental, and computational methods to the above mechanical problem. Some information on employment of custom software and design optimization can be found in Chapters 13 and 14. Each chapter has references and a bibliography and helpful solutions of example problems.



The book's mathematical basis looks optimal for the wide audience of engineers. There are several unavoidable differential equations where it is necessary for operations with principal categories, but many secondary details are avoided. The author prefers to discuss rather quite simple formulas, and this is generally reasonable in a textbook. The author's intent is to describe a large variety of physical phenomena; their profound description would be impossible in this one book.

All chapters are well illustrated, and figures are clear enough. One can find a weakness in their certain simplification; for example, flow-related measurements (like in Figs. 10.8, 10.10, 11.21) should be presented with dispersion that always occurs in experiments. However, such illustrations correspond to the author's aim. Some definitions should be described with the additional conditions that are default.

Nevertheless, based on an overall impression, *Reciprocating Machinery Dynamics: Design and Analysis* is an excellent textbook. Its price does not look too high, and it is appropriate for purchase by both libraries and individuals.

9N6. Noise and Vibration: From High-Speed Trains. - Edited by VV Krylov *(Nottingham Trent Univ, UK).* Thomas Telford Ltd, London. 2001. 300 pp. ISBN 0-7277-2782-6.

This reference work covers numerous theoretical and practical questions that need to be answered on this subject.

This comprehensive book provides the reader with new experimental data, combining informative illustrations and authoritative information. It presents the views of leaders on the problem of noise and vibration from high-speed trains and suggests possible ways of reducing its environmental impact.

A brief list of the contents includes Theory of generation of wheel/rail rolling noise; Wheel and rail excitation from roughness; High-speed train noise barrier tests at reduced scale; Generic prediction models for environmental railway noise; Measurements of railway noise; Means of controlling rolling noise at source; Micropressure waves radiating from a Shinkansen tunnel portal; Emergence of an acoustic shock wave in a tunnel and a concept of shock-free propagation; Generation of ground vibration boom by high-speed trains; Free-field vibrations during the passage of high-speed train: experimental results and numerical predictions; High-speed trains on soft ground: track-embankment-soil response and vibration generation; Ground vibrations alongside tracks induced by high-speed trains: prediction and mitigation; Prediction and measurements of ground vibrations generated from tunnels built in water-saturated soil; and Measures for reducing ground vibration generated by trains in tunnels.

9N7. Proceedings of the ASME Noise Control and Acoustics Division-2000. November 2000, Orlando. - Edited by ML Pollack. ASME, New York. 2000. 536 pp. ISBN 0-7918-1909-4. ASME Book No H01196. $150.00. (ASME members $75.00).

This is a collection of 54 full-length, peer-reviewed technical papers from the annual symposia. Major areas of discussion include computational acoustics; macrosonics; novel sensing techniques; pump unsteady flow and acoustics; use of sound and vibration for system characterization; and vibration and noise control with multifunctional materials.

9N8. Rolling Contact Phenomena. CISM Courses and Lectures No 411. - Edited by B Jacobson *(Lund Univ, Lund, Sweden)* and JJ Kalker *(Delft Univ of Tech, Netherlands).* Springer-Verlag, Wien, Austria. 2000. 394 pp. Softcover. ISBN 3-211-83332-3. $76.95.

This book contains lecture notes from a course organized by Kalker and Jacobson. Lecture notes from the different speakers were updated and written in a form, similar for all lecturers.

Contents include a Preface and the following seven contributions: Rolling contact phenomena - Linear elasticity, Finite element methods for rolling contact, Plastic deformation in rolling contact, Non-steady state rolling contact and corrugations, Modeling of Tyre force and moment generation, Rolling noise, and Lubrication.

9N9. Wind and Structures for the 21st Century. Proc of 1st Int Symp, Cheju, Jan 2000. - Edited by Chang-Koon Choi, G Solari, J Kanda, A Kareem. Techno-Press Ltd, Taejon, Korea. 499 pp. ISBN 89-950042-9-0. $47.00.

This proceedings covers bridge; wind climate; bluff body aerodynamics; civil engineering; building; computational wind energy; and code and regulations.

Engineering Mechanics: Dynamics. - 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. 772 pp. ISBN 0-534-95162-7. $104.95. (Under review)

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. (Under review)

Fundamentals of Vibrations. - L Meirovitch *(Col of Eng, VPI, Blacksburg VA 24061).* McGraw-Hill, New York. 2001. 806 pp. ISBN 0-07-041345-2. $95.50. (Under review)

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. (Under review)

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. (Under review)

III. AUTOMATIC CONTROL

9R10. Lyapunov-Based Control of Mechanical Systems. - MS de Queiroz *(Dept of Mech Eng, Louisiana State Univ, Baton Rouge LA 70803-6413),* DM Dawson, SP Nagarkatti, and Fumin Zhang *(Dept of Elec and Comput Eng, Clemson Univ, Clemson SC 29634-0915).* Birkhauser Boston, Cambridge MA. 2000. 316 pp. ISBN 0-8176-4086-X. $69.95.

Reviewed by J Bentsman (Dept of Mech and Indust Eng, MC-244, Univ of Illinois, 1206 W Green St, 140 Mech Eng Bldg, Urbana IL 61801).

This book is unique in taking a rigorous approach to controller synthesis for mechanical systems incorporating both flexible and rigid components and making it mathematically accessible to graduate students with relatively modest background. This approach is characterized by generating Lyapunov functions for the entire system using full distributed parameter description of the flexible part in terms of the partial differential equations (PDEs). The strong point of the book is also the presentation of the implementation results where the authors demonstrate the feasibility and the effectiveness of the algorithms proposed. The book is suitable for a graduate course in nonlinear control, with the material on infinite dimensional systems introduced at the outset. The book is also of considerable interest to researchers in control theory, since, in addition to the original theoretical results followed by the detailed proofs, it provides physical examples of the systems, accompanied by their detailed mathematical models, to which the infinite dimensional control technique can be successfully applied.

The book consists of seven chapters followed by four appendices and a relatively detailed index. A number of pertinent figures are incorporated into the text, as well. Chapter 1 briefly introduces the concept of Lyapunov-based control, and rigid and flexible mechanical systems description in terms of ordinary differential equations (ODEs) and PDEs, respectively. It also briefly discusses real-time controller implementation. Chapter 2 addresses the problem of controller design for systems with friction. Here several design issues, such as parametric uncertainty and state inaccessibility are considered in the single-input-single-output (SISO) case, setting the stage for the multi-input-multi-output (MIMO) case considered in Chapters 3 and 4. Chapter 3 presents adaptive tracking controller design for a full state feedback. Motivated by the inaccuracy of the velocity measurements in mechanical systems, Chapter 4 extends the results of Chapter 3 to output feedback. Chapters 5 through 7 consider controller design for mechanical systems with both rigid and flexible components that produce combined ODE/PDE-based control laws. These chapters consider the case of known parameter values, giving rise to model-based control laws, as well as the challenging case of known equation structure, but unknown parameter values, giving rise to the infinite-dimensional adaptive control laws. Chapter 5 gives controller design methods for boundary control of string-type systems, while Chapter 6 gives boundary control laws for flexible beams. Chapter 7 presents controller design for several mechanical systems, including an axially moving string system, a robotic manipulator with flexible link, and a flexible rotor system.

All chapters (2 through 7) present experimental evaluation of the algorithms proposed. Each chapter has an extensive list of references. Appendices provide some of the relevant mathematical facts, derivation of the bounds on the variables in the control laws, and C real-time program codes of the control laws.

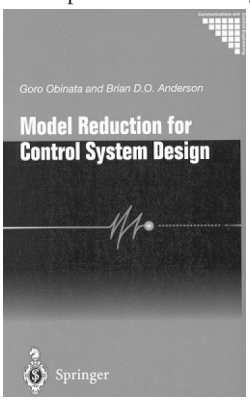
Lyapunov-Based Control of Mechanical Systems is a very valuable addition to the literature on control of mechanical systems, nonlinear control methods, adaptive control, and control of the infinite dimensional systems. It is strongly recommended for purchase both by libraries and individual researchers.

9R11. Model Reduction for Control System Design. - G Obinata *(Dept of Mech Eng, Akita Univ, 1-1 Tegatagakuen Univ, Akita City, 010-8502, Japan)* and BDO Anderson *(Res Sch of Info Sci and Eng, Australian Natl Univ, Canberra, ACT 0200, Australia).* Springer Verlag London Ltd, Surrey, UK. 2001. 168 pp ISBN 1-85233-371-5. $99.00.

Reviewed by FH Lutze (Dept of Aerospace and Ocean Eng, VPI, Blacksburg VA 24061-0203).

This book is one of many in the series *Communications and Control Engineering,* published by Springer Verlag. It was originally printed in Japanese in 1999. Those of you familiar with this series know that it is not for those faint at heart. This book is no exception to this norm. The material in the book is presented in a logical, well-thought-out progression of methods starting with dominant modes ideas developed prior to 1960, to more modern techniques which take advantage of the modern control theory developments of the 1980s and 1990s. The problem addressed is that of designing low order controllers for high order plants. Generally, using conventional controller design techniques, the controller has the same (or nearly the same) order as the plant. For practical reasons (hardware-software limitations, or expense), one would like to use a lower order controller to provide similar performance as the higher order controller. This book approaches this problem along two paths, 1) reducing a high order system to an approximating low order system and then designing the controller, and 2) designing a high order controller for the high order system and then reducing the controller. Dealing with the first approach depends on the definition of what is meant by ''approximating'' the higher order system, while dealing with the second approach requires retaining the closed-loop behavior, including stability, of the higher order controller using the reduced order controller. These problems, along with their nuances, are the subject of this monograph.

The book consists of four chapters. Loosely, the first two deal with system reduction methods and error approximations, and the latter two deal with the controller reduction. The titles of the chapters are, respectively, Methods for Model Reduction (54 pages), Multiplicative Approximation (29 pages), Low Order Controller Design (31 pages), and Model and Controller Reduction Based on Coprime Factorizations (30 pages). The ideas presented in the first chapter are essentially the foundations of much (but not all) of the material in subsequent chapters. Hence it is useful to list some of these topics as indicated by the titles of the subsections: Model reduction by truncation, Singular perturbation, Reduced order models based on balanced realization truncation, Methods involving minimizing an approximation error norm, Hankel norm approximations, and Markov and covariance parameter matching.



The second chapter defines the multiplicative approximation problem and its treatment using balanced stochastic truncation. The third chapter deals with the problems of reduced order controller design and the importance of including plant information in the developments. To this end, the topics include, Controller and plant reduction via

frequency weighted approximation, Frequency weighted balanced truncation, Frequency weighted Hankel norm reduction, Frequency weighted reduction using partial fractions, and Multicative approximation with frequency weighting. In addition, at the end of each chapter are examples showing the comparison of the results of applying the different methods presented in the chapter. These examples present figures showing the amplitude and phase angle characteristics of each system as they depend on frequency.

This book is written primarily for the practitioner in the field. It has no exercises for the student or worked problems. The material is presented, for the most part, in a concise fashion with details left to the references, of which there are 90. This ''concise fashion'' requires the reader to be current in the modern methods of control theory and in some cases makes the reading difficult. Occasionally when new material is presented, a theorem-proof scenario is used. In several of the sections, one can directly code the presented results to produce software to attack the problem at hand. In other sections, reducing the results to an algorithm would be a non-trivial exercise. At the end of each section, there is a summary of that section under a heading, *Main points of the section*. These summaries allow the reader to step back and look at the big picture and are quite helpful.

Overall, *Model Reduction for Control System Design* presents an overview of the most recent methods for reducing the order of controllers for higher order systems. It gives several techniques, and presents results indicating how these techniques perform on a specified system. Translating the results presented into a computer code is non-trivial. However, the material is well documented. The practical implementation of feedback controllers for controlling high order systems requires such model and/or controller reduction. This book is the only place where one would find all this material in one place and certainly would be a good place to start if entering to this area of control implementation.

9R12. Nonlinear Control Based on Physical Models. Lecture Notes in Control and Information Sciences, Vol 260. - A Kugi *(Dept of Auto Control and Control Syst Tech, Inst for Auto Control and Elec Drives, Johannes Kepler Univ, Altenbergerstr 69, Linz, 4040, Austria).* Springer-Verlag London Ltd, Surrey, UK. 2001. 172 pp. Softcover. ISBN 1-85233-329-4. $62.80.

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

This timely book is important because most physical systems are nonlinear (NL) in nature, and control success is linked to the need for progress in a number of areas in order to achieve practical nonlinear control. These areas are: 1) Practical applications and their requirement for more demanding performance than theoretical applications alone, 2) Increasing computer power for both numeric and symbolic computation, 3) Real-time execution of the complicated NL control laws.

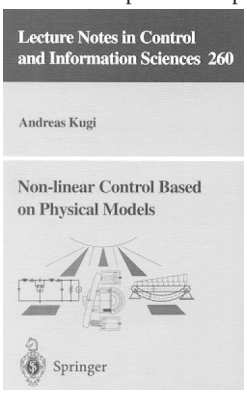
The book emphasizes electromagnetic, mechanical, and hydraulic systems that can be described well analytically. Most of these applications fall under the following categories:

- PCH-port-controlled Hamiltonian systems
- PCHD-port-controlled Hamiltonian systems with dissipation
- PBC-passivity-based control systems
- PWM-(pulse-width-modulation)-controlled systems
- HGC-hydraulic gap control systems

There are some examples of PD controllers. Typical of the author's approach on these different systems are the postulation of explicit system definitions followed by theorems and propositions and solutions to several of the simplest cases. The approach progresses in complexity, usually culminating in experimental cases with graphic results. For example, in the chapter on electromagnetic systems, the applications are a simple electric circuit, a three-phase power system, a dc-to-dc converter with four switches, concluding with both theory and experimental results for a Cuk converter.

In the chapter on mechanical systems, a very appropriate topic for today is the author's approach to actuator and sensor design of piezoelectric structures. Beams with various loading and support motions are utilized as examples.

In the chapter on hydraulic-drive systems, the success of linear controllers in practical applications is summarized, and the use of controllers that take into account the NL nature of the systems is addressed. This culminates in a four-high mill stand model, a pump-displacement-controlled rotational piston actuator, and the swash-plate mechanism of a variable-displacement pump.



The book has excellent figures, 147 references, a brief index, and while mathematically complex, reads well. An excellent feature is the use of nomenclature tables for the more complex models. This reviewer recommends *Nonlinear Control Based on Physical Models* as primarily a reference book intended for control engineers, professors, and libraries. The author succeeds in his goals, elaborating the link between modeling and NL control, and demonstrating how the physics behind the mathematical models can contribute to the success of certain control strategies.

9R13. Optimal Control. - R Vinter *(Dept of Elec Eng, Imperial Col of Sci, Tech, and Med, London, SW7 2BT, UK).* Birkhauser Boston, Cambridge MA. 2000. 507 pp. ISBN 0-8176-4075-4. $79.95.

Reviewed by S Sieniutycz (Dept of Chemical Eng, Fac of Chem and Process Eng, 1 Warynskiego St, Warszawa, 00-645, Poland).

In recent decades, control science has attained a high level of competence in advanced design of practical devices, complex industrial systems, robotics, and flying objects. One of the key concepts of the classical optimal control and its distinguishing feature is that it can take account of dynamic and pathwise constraints. Early key aspects were the Pontryagin's maximum principle and an intuitive understanding of the relationship between the optimal profit function and the Hamilton-Jacobi equation of dynamic programming. The nature of the maximum principle and the techniques first applied to prove it, based on approximation of reachable sets, suggested that an essentially new sort of necessary conditions was required to deal with the constraints of the optimal control problems and new techniques to derive them. However, recent developments in optimal control, aimed at extending the range of application of available necessary conditions of optimality, stress its similarities rather than its differences with the variational calculus. In fact, the book in question represents one of the approaches of this sort in which constraints of optimal control are replaced by extended-valued penalty terms in the integral to be extremized. In this way, problems in optimal control are reformulated as extended problems in the calculus of variations with nonsmooth data. It is then possible to derive, in the optimal control context, optimality conditions of remarkable generality, analogous to classical necessary conditions in the variational calculus, in which classical derivatives are replaced by certain generalized derivatives of nonsmooth functions. A crucial role in these developments is played by the nonsmooth analysis which gives meaning to generalized derivatives and provides the mathematical apparatus for interpreting generalized solutions to the Hamilton-Jacobi equation. One highlight of these approaches is the clarification of the relationship between the optimal profit function and the Hamilton-Jacobi equation.

Of many books on optimal control theory written to date, this is one of a few that penetrates the subject matter in both a nonstandard and fundamental way. *Optimal Control* is the one of the first books to provide a comprehensive treatment bringing

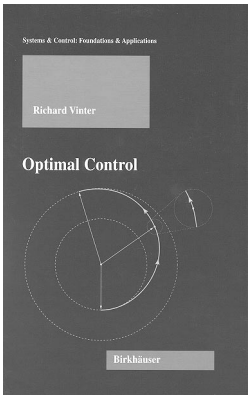
together many of the important advances in nonsmooth optimal control concerning such basic issues as: necessary optimality conditions, minimizer regularity, and global optimality associated with the Hamilton-Jacobi theory. The analysis is largely self-contained and provides a unified perspective on those optimization problems which are beyond the realm of conventional analytical and computational techniques. Moreover, this analysis includes many of the unifying properties and simplifications discovered in recent research.

While the book constitutes an advanced text, it is intended for a relatively broad audience comprising postgraduates, researchers, and professionals in system science, process control, optimization, and applied mathematics. The book is written well; it has a readable preface, self-contained main-body text consisting of 12 chapters, a suitable reference section, and a good subject index. It also has simple and clear, good quality figures whose number is perhaps too small relative to needs of the whole treatment. To warrant the self-contained structure of the treatise, five preparatory chapters are included on nonsmooth analysis, measurable multifunctions, and differential inclusions.

The basic intention of the book is to bring together as a single treatise many important developments in optimal control based on the nonsmooth analysis in recent years and thereby render them accessible to a broader audience. With regards to nonsmooth optimal control, FH Clarke's book *Optimization and Nonsmooth Analysis* (Wiley, New York, 1983), which was crucial for winning an audience for the field, remains the standard reference. The present book extends the range of topics covered therein by including some contemporary evergreen problems which are still at the research stage.

The Preface well defines the main goals of the book and important breakthroughs which culminated in setting the nonsmooth analysis and optimization as a new field. Chapter 1 is a brief overview of background of optimal control in historical and contemporary context, along with a passage from smooth to nonsmooth optimization problems. Throughout this chapter the principal results of the classical theory of optimal control and a basic philosophy of new approaches which abandon the concept of continuous state are well summarized. Chapter 2 introduces and treats measurable multifunctions and differential inclusions. Chapter 3 deals with variational principles. The author's standpoint stresses the important role of exact penalization in the derivation of optimality conditions for constrained optimization problems. Mini-max theorems are pointed out as powerful tools in nonconvex optimization. Chapters 4 and 5 concern those aspects of nonsmooth analysis which are required to support future chapters on necessary conditions and dynamic programming of nonsmooth systems. These chapters also contain discussion of problems unsolved to date which are associated with nonsmooth analysis and the field of subdifferential calculus.

Chapters 6 is crucial for development of the new theory of maximum principle. Essentially three different versions of the maximum principle are proved, namely, for necessary conditions for problems with smooth data and free right endpoints, for problems with smooth data and general endpoint constraints, and, finally, for nonsmooth problems with general endpoint constraints. In the most general (nonsmooth) case, the approach used by the author is similar to those in fundamental works of AD Ioffe and FH Clarke: the nonsmooth maximum principle is a collorary of the generalized Euler-Lagrange condition of variational calculus and the Hamiltonian inclusion is used as a stepping stone to derive a nonsmooth maximum principle.



Extended Euler equations, related Hamiltonian conditions, and equations of motion generalizing the unconstrained theory are derived in Chapter 7. Chapter 8, based on the author's work with FH Clarke, presents a number of valuable results supporting the new theory via a synthesis of some original results on necessary conditions for free end-time problems, terminating with a free end-time maximum principle. Chapter 9 develops the maximum principle for nonsmooth systems with state constraints, whereas Chapter 10 deals with necessary conditions for differential inclusion problems with state constraints. Chapter 11, which is based largely on the author's original research, is a modern exposition of regularity of minimizers. The closing chapter, 12, deals with Bellman's dynamic programming in the context of relation between smooth and nonsmooth problems. Among a number of basic issues, a dual problem is set up, in which Hamilton-Jacobi inequality features as a constraint. All problems are presented in the book at an advanced level. As they are not always easy to understand for a layman, some experience in the topic and knowledge based on other sources will be helpful. For these purposes, Clarke's valuable book (cited above) can be recommended.

However, in the context of mathematical physics problems, the contemporary trend of nonsmooth analyses can also be seen in a different way: we may tend to use them either to include systems which are discontinuous by nature due to suitable discretizing of ODEs or to describe the inherently discrete systems. When considered physical objectives have these features, tasks of nonsmooth analyses can be seen somewhat differently. First, the present tendencies in physics are towards constructing numerical integration schemes for ordinary differential equations (ODEs) in such a way that a qualitative property of the solution of the ODE is exactly preserved. For Poisson-structure-preserving integration schemes (symplectic integrators), symmetries and related invariants, see, for example, a number of papers by RI McLachlan and GRW Quispel in the physics literature; for example: RI McLachlan and GRW Quispel, *Physica D* **112**, 298–309 (1998), and references therein. Examples are symplectic integrators for Hamiltonian OD equations, volume-preserving integrators for divergence-free OD equations, time-reversing symmetries preserving integrators, and integrators preserving the structure of gradient and Lyapunov systems.

Second, for optimally-controlled systems, there are discrete canonical (symplecticlike) structures, which exist for discrete algorithms with optimization-determined, free variable intervals of time along the optimal path, as shown, for example in the monograph: S Sieniutycz, *Hamilton-Jacobi-Bellman Framework for Optimal Control in Multistage Energy Systems*, Physics Reports 326, No 4, March 2000, 165–285, Elsevier, Amsterdam, 2000 (ISBN:0370–1573).

For the latter approaches, the constraint on the size of the time interval is absent or any inequality imposed on this interval is inoperative, in which cases an enlarged Hamiltonian vanishes and the discrete optimal set becomes canonical. The optimal-performance-based choice of time intervals, which involves global or integral criteria, may be compared with the first group of special-purpose integration methods for OD equations. Of course, all these are different problems than those considered in the book under review. Yet, it would be interesting to fill the gap between the two classes of problems discussed above and non-smooth optimization problems analyzed in the book.

To conclude, *Optimal Control* is not an easy book, but it is a deep, ambitious, and a novel book; a rigorous approach which should be read by researchers and graduate students interested in revision and extension of recent findings in optimal control theory and solution of evergreen problems, in particular nonsmooth maximum principles. The book is well written and well edited in terms of organization, technical writing, and the use of illustrations; its is also attractively printed. This reviewer warmly recommends that mathematically-

oriented individuals and scientific libraries do purchase this inspiring and valuable book.

9N14. Proceedings of the 2000 ASME Design Engineering Technical Conferences and Computers and Information in Engineering Conference: Print Version, Volume 7. DETC2000, September 2000, Baltimore. - ASME, New York. 2000. 1504 pp. ISBN 0-7918-3517-0. ASME Book No I00484. $350.00. (ASME members $175.00).

This printed collection of 168 full-length, peer-reviewed technical papers covers the following topics: kinematic analysis of spatial mechanisms; workspace and robot configurations; vibration and control issues; dynamics and vibration; parallel robots: special cases; micro-electro-mechanical systems; path planning and workspace; robotic applications in medicine; dynamic models of manipulators; manipulator applications; rapid prototyping of mechanisms and robotic systems; euclidean group and motion generation; screw theory and kinematic geometry; inverse kinematics; spatial mechanism synthesis; design of and kinematics of parallel manipulators; dynamic issues and control in parallel manipulators; robotic systems design; kinematic analysis; design of compliant systems; compliant mechanisms; control, sensing, and actuation in robotic systems; design of special mechanisms; mechanism synthesis; and rapid protoyping and other applications.

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. $690.00. (Under review)

Nonlinear and Robust Control of PDE Systems: Methods and Applications to Transport-Reaction Processes. - PD Christofides (*Dept of Chem Eng, UCLA, Los Angeles CA 90095-1592*). Birkhauser Boston, Cambridge MA. 2001. 248 pp. ISBN 0-8176-4156-4. $69.95. (Under review)

IV. MECHANICS OF SOLIDS

9R15. Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design. - Y Altintas *(Manuf Autom Lab, Univ of British Columbia, Canada).* Cambridge UP, Cambridge, UK. 2000. 286 pp. Softcover. ISBN 0-521-65973-6. $39.95.

Reviewed by AA Ber (Dept of Mech Eng, Technion Israel Inst of Tech, Technion City, Haifa 32000, Israel).

This reviewer wishes to congratulate the author for writing this book. This combination of the three subjects, Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design under one roof, is actually done for the first time. Furthermore, integration of these three subjects gives the readers, students (mostly graduates), design engineers, as well as practitioners, a better outlook on the subject dealt with in the book *Manufacturing Automation*. The book is well written, and the sequence of subjects is perfect.

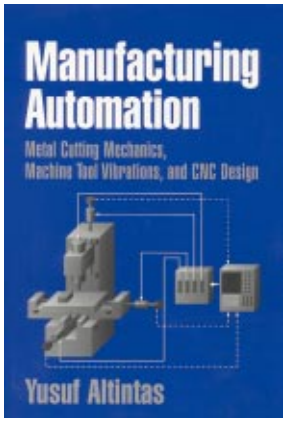
The author was aware that each of the major subjects can fill up a book by itself, and he mentioned it in the introduction. Inserting a *Problem Section* after each chapter, emphasizing the main points discussed in it, turns the work into a textbook. However, it can also serve as a reference book for engineers and practitioners.

Chapter 1 is a general introduction to manufacturing and a short overview of what one will find in this book chapter by chapter.

Chapter 2 presents the mechanics of cutting. It is introduced under the most classical approach and written in an orderly and systematic way, except for the section on *Milling and Tool Breakage* which introduces a refreshing modern approach. Most of the equations are brought in their final form, which is quite acceptable for graduate students, engineers, and practitioners.

The nomenclature and symbols are sometimes confusing; the author mixes old American standards with the ISO standards and puts them together in the same equation. This reviewer suggests that in future editions only ISO standard 3002/I through IV be considered. In this chapter, this reviewer missed the roles of *Surface Finish* and *Tolerances* in the cutting operations.

Tool life is defined geometrically and not in a modern way, namely ''The tool terminates its life when it ceases to fulfill its function.'' In other words, the tool life ends on reaching the geometrical life (as defined in the book), or when the Surface Finish exceeds the demand and or the part is out of the defined Tolerance. It is a pity that the author did not include a section dealing with tool materials in this chapter. The materials composing the tool play a major role in the mechanics of cutting. For example, the contact length between tool and chip is a function of the tool's properties (primarily its thermal conductivity) and of other factors.



In Chapter 3, the static and dynamic deformation in machining is treated in a very extensive and clear way that even this reviewer (whose field is not dynamics) could understand the factors and problems involved. The analysis presented emphasizes, by sample formulation, prediction of the magnitude and location of static deformation of bar turning and end milling. The section dealing with chatter is most impressively introduced. By introducing modal analysis techniques, the author shows how one can represent a complex machine tool structure using commonly used mathematical expressions and analyze the chatter as well as other sources of vibrations.

In Chapter 4, the practical side of manufacturing is discussed. The author introduces the CNC technology and its principles of operation and leads the reader through NC programming of a part. The methodology of NC programming is well presented. All elements involved in CNC are discussed and theoretically supported. In the paragraph on Computer Assisted NC Part Programming, the author succeeded in showing in a compact and very clear form how complicated forms can be dealt with and successfully machined. The basics of Computer-Aided Manufacturing (CAM) is introduced. The author focuses on the teaching aspects of the subject.

Chapter 5 contains conventional textbook material. The chapter is well written. The reader is led systematically through the various aspects of the CNC systems. A typical CNC machining center, including all necessary hardware, mechanical, electrical, and hydraulic and their combinations necessary to operate CNC systems, is well described. The various elements required, like machine tool drives, mechanical as well as electrical (and others), are described in detail and accompanied by the relevant formulation on which they are based upon. The mathematical modeling of drive systems is covered both in the time and frequency domain. The author directs some attention to the accuracy of the system. At the end of the chapter, the author presents an example of a design of an Electro-Hydraulic CNC Press Brake. The design contains the various elements of the system and may serve as a guide to the inexperienced reader (mostly students) while dealing with any CNC design.

Chapter 6 is mostly an abstract of the author's research works in the area of Sensor Related Machining. This chapter is based on material published by the author in various publications. The dominant direction is the one established by Prof Tlusty. It might have been more fruitful if the author had discussed other approaches as well.

Basic principles and techniques appear in Chapters 7 and 8. Chapter 7 contains the Laplace and z Transforms and includes several examples. In Chapter 8, the author introduces Off-Line and On-Line Parameters Estimation with Least Squares.

At the end of the book, one can find a very extensive bibliography covering all aspects of the subjects discussed in the book.

This reviewer recommends *Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design* as a textbook for students, undergraduate as well as graduate. It can also serve as an excellent reference book for those engaged in manufacturing, ie, engineers, technicians, and other practitioners.

9R16. Materials for High Temperature Engineering Applications. - GW Meetham *(Rolls-Royce, Derby, UK)* and MH Van de Voorde *(Dept of Mat Sci and Tech, Fac of Appl Sci, Delft Univ of Tech, Rotterdamse Weg 137, Delft, 2628 AL, Netherlands).* Springer-Verlag, Berlin. 2000. 164 pp. ISBN 3-540-66861-6. $42.00.

Reviewed by L Mishnaevsky Jr (MPA, Univ of Stuttgart, Pfaffenwaldring 32, Stuttgart, D-70569, Germany).

This book is a reference of high temperature materials, their properties, and manufacturing technologies. The intended audience includes practicing engineers and industry managers, as well as students and the academic community. The layout is pleasant, the figures are original, and a well done subject index is available.

The purpose of this book was to bring together the key features of all high temperature materials in one volume. The authors are successful in their aim of providing a concise, yet comprehensive overview of properties, areas of applications and technology of materials used for structural, tool, or other applications under high temperature conditions.

The book is logically divided into four major parts. The first two chapters (*Introduction* and *Design and Manufacture*) deal with the general questions of development and application of the high temperature materials, as the history of development of different high temperature materials, methods of the material selection, available manufacturing technologies, and possibilities of the component life extension. The history of the development of manufacturing technologies for high temperature materials is described.

The second part of the book (Chapter 3, *Requirements of High Temperature Materials* and Chapter 4, *Increasing Temperature Capability*) describes requirements to the mechanical and physical properties of high temperature materials (such as environmental resistance, wear resistance, strength, creep, mechanical and thermo-mechanical fatigue resistance, etc), as well as physical mechanisms of the behavior of materials with different microstructures under loading. The strengthening mechanisms of metallic materials (solid solution, precipitation, dispersion strengthening) as well as different toughening mechanisms in composites are explained.

In the third part (Chapters 5–15), authors provide concise and very informative descriptions of high temperature materials, including their properties and special technologies of manufacturing, peculiarities of microstructures, their advantages and disadvantages as compared with other materials, and areas of their industrial application. Practically all materials for high temperature engineering applications are considered, ranging from the traditional materials, as steels, cast iron and cemented carbides, to refractory metals, intermetallic materials, zirconia and alumina ceramics, and composites. For each material, interrelations between the microstructure, mechanical and physical properties, and the areas of industrial applications are explained in a clear, concise, and simple manner. Typical chemical compositions, phase diagrams, and strength/temperature relations are given for the materials.

The last chapter of the book, *Coatings for High Temperature Materials*, deals with the corrosion and oxidation resistant coating, and thermal barrier coats. The technologies of diffusion and overlay coating are discussed in the chapter.

The big merit of this book is that it covers virtually all materials used for high temperature applications in industry as well as materials which are in their early development stages. In fact, this book is unique in gathering together widely scattered materials and in presenting an up-to-date overview of the properties, applications, and peculiarities of high temperature materials.

Another advantage of the book is that many complex concepts and mechanisms of materials behavior are explained clearly and exactly, with the use of original illustrations and comparisons with other materials or technologies.

It is also essential that the book is developed with the needs of the practitioner in mind: the microstructures and properties of the materials are discussed not only from the standpoint of materials science, but with relation to the industrial requirements and the industrial applications of each material.

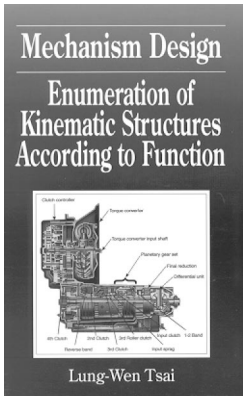
The list of references includes many pioneering scientific papers on different aspects of technology and properties of high temperature materials. However, some more references to special monographs on each of the themes discussed in the book would be helpful for a reader who needs detailed information on the materials.

In general, *Materials for High Temperature Engineering Applications* is highly recommended to libraries and specialists in the areas of production, research, and application of high temperature materials.

9R17. Mechanism Design: Enumeration of Kinematic Structures According to Function. - Lung-Wen Tsai *(Dept of Mech Eng, Bourns Col of Eng, UC, Riverside CA).* CRC Press LLC, Boca Raton FL. 2001. 311 pp. ISBN 0-8493-0901-8. $89.95.

Reviewed by RL Norton (Dept of Mech Eng, WPI, 100 Institute Rd, Worcester MA 01609).

In the preface, the author states that this book *Introduces a systematic methodology for the creation and classification of mechanisms*. The book presents nine chapters and several appendices containing diagrams of linkage configurations in 306 pages, and has a four-page index. The book is labeled as a textbook and offers a small



number of exercises at the end of each chapter. Its subject matter is somewhat narrow and specialized for use in an undergraduate kinematics course, though it might find use in a graduate course or as a supplemental text. It also should be of value to engineers engaged in machine design, especially where linkages are used.

The author uses a combination of graph theory, combinatorial analysis, and computer algorithms to define all the possible combinations of links and joints that yield usable isomers of both planar and spatial mechanisms having one or several degrees of freedom (dof). He provides atlases of these linkage combinations in the appendices and also defines the computational methods to generate them.

The book provides a useful collection of information on this kinematic topic, drawing from the available literature including much of the author's previously published work. The early chapters provide definitions of terminology, the fundamentals of structural representation of mechanisms, and a review of graph theory, which is used extensively for mechanism classification in subsequent chapters.

Later chapters provide detailed analyses of the classification of planar linkages, geared mechanisms, and cam mechanisms. Spherical and spatial mechanisms are also addressed. A comprehensive enumeration of epicyclic gear trains of 1, 2, and 3-dof is provided along with atlases of these devices. Variable-stroke engine mechanisms, constant velocity shaft couplings, and automatic transmission gear trains are all addressed. Robotic wrist mechanisms and par-

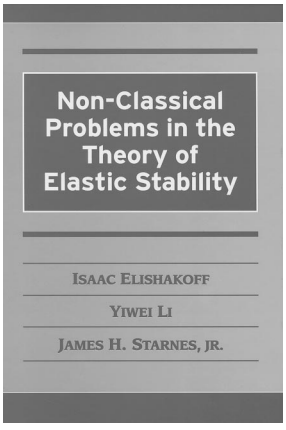
allel manipulators such as the Stewart platform are also analyzed and classified.

In summary, the author has provided a very useful reference on the subject of mechanism classification. Extensive bibliographic references are provided as well. *Mechanism Design: Enumeration of Kinematic Structures According to Function* will be a useful addition to the bookshelf of any engineer involved with the design of mechanisms involving linkages and gear trains.

9R18. Non-Classical Problems in the Theory of Elastic Stability. - E Elishakoff *(Dept of Mech Eng. Florida Atlantic Univ, Boca Raton FL 33431-0991)*, Y Li *(Alpine Engineered Prod)*, and JH Starnes Jr (*Struct Mech Branch, NASA Langley Res Center, Hampton VA 23665*). Cambridge UP, New York, 2001. 336 pp. ISBN 0-521-78210-4. $85.00.

Reviewed by JA Cheney (Dept of Civil and Env Eng. UC, Davis CA 95616).

This monograph presents two competing yet complementary theories which incorporate ever-present uncertainty in the stability of elastic structures in the real world. These uncertainties are first and foremost due to unavoidable initial imperfections, deviations of the structure from its intended, nominal, ideal shape. Other uncertainties are in material properties and/or realizations of the boundary conditions. These considerations are addressed by a unified probabilistic theory of stability and the alternative, based on the notion of *anti-optimization*, that is useful when the necessary information for probabilistic analysis is absent. The book is non-classical in the sense that it goes beyond deterministic methods to probabalistic and set-theory approaches to the buckling of structures.



The first two chapters are devoted to some new deterministic problems in local buckling of multispan plates and columns and the influence of thickness variation of perfect or imperfect, isotropic or composite, circular cylindrical shells. Chapters 3 and 4 deal with stochastic buckling of structures with random imperfections. Chapter 3 uses the Monte Carlo technique while Chapter 4 discusses approximate analytical and numerical techniques, including the asymptotic analysis, the first-order second moment method, the mode localization due to random displacements, and the finite element method for structures with random material properties.

What is called convex modeling of uncertainty in buckling problems is presented in Chapter 5 wherein data scarcity and uncertain material properties are involved in an ensemble of plates and shells. Chapter 6 discusses the Godunov-Conte shooting method, and Chapter 7 deals with the applications of computerized symbolic algebra.

The treatment is scholarly, having about 900 items in the bibliography and additional contributors in the writing of almost every chapter. In addition to the extensive bibliography, an author index of those referenced in the text and a subject index are included. This reviewer believes that *Non-Classical Problems in the Theory of Elastic Stability* should be a useful reference for researchers, engineers, and graduate students in aeronautical, mechanical, civil, nuclear, and marine engineering, and in applied mechanics.

9R19. Nonlinear Problems in Machine Design. - E Zahavi *(Ben-Gurion Univ, Beer Sheva, Israel)* and D Barlam *(Israel Aircraft Indust, Israel)*. CRC Press LLC, Boca Raton FL. 2001. 406 pp. ISBN 0-8493-2037-2. $99.95.

Reviewed by PJ Eagle (Exp and Comput Mech, DaimlerChrysler Corp, 800 Chrysler Dr, Auburn Hill MI 48326-2757).

This book is a monograph devoted to methods for solving mechanical design problems using hand-calculated and computer-based nonlinear analytical techniques. The stated aim of the text is to ''acquaint readers with the modern analytical methods of machine design, enabling them to use them in daily applications.'' The book intends to divide the emphasis between the theoretical basis of machine design methods and practical applications (generally within the context of commercial FEM codes). While the intended audience is not clearly spelled out, it would appear to be senior undergraduate or master's level mechanical engineering students. This audience might use this text as a reference in design projects, but not as a primary course textbook.

The book consists of two main sections, *Theoretical Fundamentals and Design Cases*, divided over 12 chapters. There is an exhaustive list of nomenclature and symbols, a fairly elaborate index, and three appendices. The appendices are strangely selected for a text that is clearly not a teaching textbook. The first appendix is a review of very basic tensor calculus. No reader who would be capable of following the presentation on solid mechanics would benefit from this summary. The second appendix is a three-page review of matrix fundamentals that is incomplete and overly elementary. The third appendix is a collection of tabular data that is apparently not referred to anywhere in the text. There are relatively few typesetting irregularities and typographic errors. While the abundant figures are clearly and consistently executed, some are quite fuzzy in their reproduction suggesting that they may have been copied from a less than camera-ready source.

The *Theoretical Fundamentals* section provides an extensive review of basic solid mechanics with less extensive coverage of the finite element method, nonlinear problems, plasticity, contact, and fatigue. The review of solid mechanics is very concise and well written and would serve as an excellent teaching resource, except for the shortage of examples. The overview of energy methods in elastic problems is especially well written and documented with illustrations. The coverage of plasticity is equally clear, but suffers from no clear connection to any applications. It appears to be an edited version of some instructional materials that may have been used in lectures. The section on contact problems goes into greater depth than most machine design texts and ends with a commentary on the pluses and minuses of various solution methods. Unfortunately, without more extensive theoretical development and solved examples, any reader who would benefit from this terse review of contact stresses would not appreciate this critical review of the techniques. The review of fatigue methods lacks any derivation whatsoever and is simply a presentation of formulas and diagrams available in numerous other sources.

The *Design Cases* section considers applications that include leaf springs, threaded fasteners, flanges, and fatigue. Each case study section reviews (without derivation), the principal design equations related to each application area followed by an example of a finite element solution. There are no additional problems for consideration by the reader (as one would use a textbook) and only limited information about the construction of the finite element models (precluding their reconstruction in most cases).

This text claims to provide access to the author's experience in applying both theoretical methods to practical problems in the area of machine design. In many cases, the practical grounding of the case studies is in question. For example, there is no attention paid to significant figures in any solved problem. Calculations of circular areas are reported to seven significant figures in cases where only two have any practical meaning. One especially troubling example is in the section on flanged connections. Comparisons are made between standard hand calculations and the results of an extensive finite element model. The authors observe that the hand calculation results in a critical pressure of 50.462 MPa whereas the MSC.NASTRAN result produces 56.242 MPa. (No standard practices on the use of significant figures were followed in this ex-

ample. The five reported here do not have any justification.) The apparent 10% discrepancy is regarded as a justification for the application of the elaborate computer modeling of the flange. There is a significant ''practical'' matter which appears to be overlooked here: in any reasonable application (excepting missiles or race cars where every gram of excess weight is torturously sought out), a 10% error resulting from hand computations would be absorbed in the factor of safety, and the engineering team would move on to the next problem. How could a week-long (or longer) modeling excise be justified in such a case?

In summary, this reviewer would not recommend *Nonlinear Problems in Machine Design* to students or libraries seeking mechanical design reference texts. More complete and practical sources are available in traditional texts such as Shigley and Norton. The addition of examples in this text which use computer-aided engineering do not justify its selection as a learning resource. A second edition of this book should be considered with a more extensive review process and the addition of more example problems.

9R20. Primer in Elasticity. - P Podio-Guidugli *(Dept of Civil Eng, Univ di Roma ''Tor Vergata,'' Rome, Italy).* Kluwer Acad Publ, Norwell MA. 2000. 108 pp. ISBN 0-7923-6642-5. $59.00.

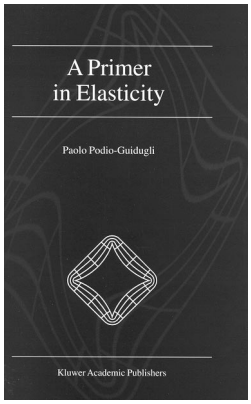
Reviewed by J Petrolito (Sch of Sci and Eng, La Trobe Univ, PO Box 199, Bendigo, Vic 3550, Australia).

As the author states in the preface, ''linear elasticity is the 'mother of all theories' in continuum physics.'' Given this, it is not surprising that there are numerous books that cover the theory at varying levels of sophistication depending on the target audience. Books in this area can generally be grouped depending on whether they concentrate on theory or applications. The current book belongs to the first group, and it aims to provide a concise introduction to the fundamental concepts of the subject. In an unusual development, the book was originally published in a special issue of the *Journal of Elasticity*.

The book is divided into four chapters that discuss the basic aspects of the theory, namely strain, stress, constitutive equations, and equilibrium. The theory is mainly developed using direct tensor notation, and a good background in tensor analysis is assumed. The book includes a good range of exercises that are partly used to develop the theory.

The first chapter introduces the notion of deformation and strain. It emphasizes the exact nonlinear definition of strain and provides a clear discussion of the small strain approximation. These concepts are illustrated by some representative deformation patterns. Chapter 2 discusses the concept of stress and derives the equilibrium equations via the fundamental balance laws of mechanics. The distinction between equilibrium in the deformed and undeformed positions is also discussed.

Chapter 3 links the notions of strain and stress using linear constitutive relationships. The general relationships are specialized for materials with that display symmetry in their behavior, and those that are subjected to internal constraints such as incompressibility. The final chapter combines the previous work by developing the alternative forms of the governing differential equations, including a discussion of variational principles and appropriate boundary conditions.



Given the book's emphasis on basis theory and its size, there is little in the way of practical applications. Moreover, it is not clear from the book how the theory would be used to solve practical problems. Hence, this limits the book's usefulness in subjects that include a considerable amount of detail on specific applications. Despite this, *Primer in Elasticity* offers a clear introduction to the fundamental concepts, and it would be a useful text for graduate students who want to gain an understanding of theoretical aspects of elasticity.

9N21. Brittle Matrix Composites, Volume 6. - Edited by AM Brandt, VC Li, IH Marshall. Woodhead Publ Ltd, Cambridge, UK. 2000. 600 pp. ISBN 1-85573-551-2. $239.00.

The sixth in a series of symposia, this book contains the papers presented at BMC6 held in Warsaw, Poland in October 2000. The papers review the status and developments on all aspects of brittle matrix composites associated with four main groups: high strength composites, brittle polymer composites, ceramics, and cement based materials.

Seventy papers were presented at the following sessions: Design studies and computational methods; Theoretical considerations; Prediction of behavior, durability; Fracture mechanics; Experimental methods and results, and Applications and manufacturing.

9N22. Durability 2000: Accelerated and Outdoor Weathering Testing. (STP 1385). - Edited by WO Ketola and JO Evans. ASTM, W Conshohocken PA. 2000. 192 pp. Softcover. ISBN 0-8031-2856-9. $85.00.

The latest advances and innovations in weathering and durability testing are examined. The 13 peer-reviewed papers are divided into these sections:

Material Characterization—Four papers explore the characteristics of materials that have been subjected to exposure tests. They cover image analysis techniques for a variety of materials that can significantly improve the repeatability and reproducibility of appearance characterization and attributes; and monochromatic and polychromatic techniques for determining activation spectrum.

Developments in Exposure Tests—One paper demonstrates the varying types and rates of degradation using the same type of test in different climates. Three papers describe stress analysis, test design, and exposure results for accelerated tests designed to simulate interior light environments. Another discusses developments in techniques used to control irradiance, temperature, and humidity for more consistent exposure conditions. The last paper in this section explores the development of a laboratory accelerated test based on freeze/thaw immersion that has been successfully used to estimate durability of building stone.

Service Life Prediction—Three papers examine the prediction of service life, the ultimate goal of any exposure program which is contingent upon reliable measurements of the exposure stresses that can affect durability. They explore the use of a computer model that can determine the spectral power distribution of daylight in many different locations, and thermal load and other construction and design parameters to determine the durability of a variety of roofing materials. The last paper shows how characterization of the properties of a glass and its response to accelerated environmental stresses can be used to determine that a sculpture made of the glass will remain relatively unchanged for at least 20 years.

9N23. Environmentally Assisted Cracking: Predictive Methods for Risk Assessment and Evaluation of Materials, Equipment, and Structures. (STP 1401). - Edited by RD Kane. ASTM, W Conshohocken PA. 2000. 500 pp. ISBN 0-8031-2874-6. $195.00.

This book features the latest international developments on the generation of relevant materials and properties data based on laboratory tests, and methodologies for the evaluation and assessment of environmental assisted cracking in equipment and structures exposed to corrosive service environments.

There are 27 peer-reviewed papers, written by leading scientists and experts worldwide which discuss uses of electrochemical, surface analysis, slow strain rate, and fracture mechanics techniques; correlation between laboratory and in-service cracking resistance; state-of-the art developments in fitness-for-service and risk assessment methodologies; monitoring of equipment and structures for environmentally assisted cracking; and uses of corrosion models to understand mechanisms and predict service life of equipment.

9N24. Extrusion of Polymers: Theory and Practice. - Chan I Chung. Hanser Gardner Publ, Cincinnati. 2000. 340 pp. ISBN 1-56990-288-7. $98.00.

The author presents single-screw extrusion technology together with the relevant polymer fundamentals, with an emphasis on screw design. The presentation begins on a physical level providing an in-depth tutorial for conceptual understanding, followed by an analytical level with mathematical models. Practical applications of the mathematical models are illustrated by examples. A brief description of twin-screw extrusion technology is also presented.

Contents include physical description of single-screw extrusion; fundamentals of polymers; theories of single-screw extrusion; screw design, high-performance screws, and scale-up; gear pumps, static mixer, and dynamic mixer; physical description of twin-screw extruders; and appendices.

9N25. Fracture Resistance of Aluminum Alloys. - JG Kaufman. ASM Int, Materials Park OH. 2001. 220 pp. ISBN 0-87170-732-2. $139.00. (Co-published by Aluminum Association).

This book is a compendium of notch-tensile,

tear, and fracture toughness data. Information and data are included for a wide range of aluminum alloys, tempers, and products (sheet, plate, extrusions, forgings, and castings). Typical and minimum plane-stress and plane-strain fracture toughness values are given for many of the high strength alloys for which such values have been generated. The effects of temperature are covered extensively, especially for the notch-tensile and tear data. Fracture data for welds as well as the parent alloys and products are also included. This volume will be helpful for alloy selection and design, and particularly useful in assisting materials specialists and designers in judging the relative toughness of aluminum alloys, tempers, and products being considered for critical applications.

9N26. Handbook of Mechanical Properties of Structural Materials at Complex Stress State. - Edited by AA Lebedev, BI Koval'chuk, FF Giginjak, VP Lamashevsky *(Natl Tech Univ, Kiev, Ukraine).* Begell House, New York. 2001. 500 pp. ISBN 1-56700-152-1. $135.90.

Severe stress conditions of modern structures and strict weight limitations call for continuous refining of the methods of strength and analysis and optimization of the technologies. This handbook contains a Preface to the English translation, a Preface to the Russian edition, as well as information on the influence of stress on the material properties.

Topics covered include strength criteria and methods of material testing under a complex stress state; and deformation behavior, plasticity, and strength of materials under complex stress state. Strength and plasticity of materials of various classes under three-dimensional (triaxial) stress, and three-dimensional compression in particular are discussed. The lifetime of structural materials under conditions of high-cycle loading and complex stress is considered. The influence of the stress mode on the crack growth resistance has been covered in detail. All numerical data are given in the metric system.

9N27. Handbook of Residual Stress and Deformation of Steel. - Edited by G Totten, M Howes, T Inoue. ASM Int, Materials Park OH. 2001. 550 pp. ISBN 0-87170-729-2. $165.00.

Distortion, cracking, and residual stresses are among the most important concerns for heat treaters, manufacturing engineers, and design engineers. This work includes practical information and data to help minimize and control the effects of residual stresses and distortion. Topics covered include recommended heat treating practices, methods for maintaining temperature uniformity during heating, tips for preventing oxide formation, and techniques for measuring residual stresses, and more.

Designed as both a practical and theoretical reference, this book features contributions from leaders from around the world.

9N28. Modern Tribology Handbook, Volumes 1 and 2. - Edited by B Bhushan *(Dept of Mech Eng, Ohio State Univ, Columbus OH 43210).* CRC Press LLC, Boca Raton FL. 2001. 1690 pp. ISBN 0-8493-8403-6. $199.95.

The objective of this handbook is to cover modern tribology with an emphasis on all industrial applications. A large number of leading tribologists from around the world have contributed chapters dealing with all aspects of the subject.

This two-volume handbook is divided into four sections. Volume 1 contains sections 1 and 2. The first section, on macrotribology, covers the fundamentals of conventional tribology. It consists of 15 chapters on topics including surface physics, surface roughness, solid contact mechanics, adhesion, friction, contact temperatures, wear, lubrication and liquid lubricants, friction and wear measurement techniques, design of friction and wear tests, and friction and wear data bank. The second section on micro/nanotribology covers the fundamentals of the emerging field of micro/nanotribology. It consists of studies using surface force apparatus, scanning probe microscopy, and molecular dynamic simulations.

In Volume 2, the third section on solid tribological materials and coatings covers the materials; hard, wear-resistant, and solid lubricant coatings; and surface treatments used in tribological applications as well as coating evaluation techniques. The fourth section on tribology of industrial components and systems covers a large range of industrial applications. A Glossary of Terms in Tribology is included.

9N29. Multiaxial Fatigue and Deformation: Testing and Prediction. (STP 1387). - Edited by S Kalluri and PJ Bonacuse. ASTM, W Conshohocken PA. 2000. 452 pp. ISBN 0-8031-2865-7. $250.00.

This book examines state-of-the-art multiaxial testing techniques and methods for characterizing the fatigue and deformation behaviors of engineering materials. There are 25 analytical, peer-reviewed papers which are divided into the following sections:

Multiaxial Strength of Materials—addresses multiaxial strength, stress, and failure modes of materials;

Multiaxial Deformation of Materials—investigates constitutive relationships and deformation behavior of materials under multiaxial loading conditions;

Fatigue Life Prediction under Generic Multiaxial Loads—examines the challenging task of estimating fatigue life under general multiaxial loads;

Fatigue Life Prediction under Specific Multiaxial Loads—describes biaxial and multiaxial fatigue and life estimation under combinations of cyclic loading conditions, such as axial tension/compression, bending, and torsion;

Multiaxial Fatigue Life and Crack Growth Estimation—covers crack growth monitoring under cyclic multiaxial loading conditions and determination of fatigue life; and

Multiaxial Experimental Techniques—explores state-of-the-art experimental methods to generate multiaxial deformation and fatigue data to develop and verify both constitutive models used to describe the flow behavior of materials and fatigue life estimation models.

9N30. Nonlinear Elasticity: Theory and Applications. - Edited by Yibin B Fu *(Univ of Keele, UK)* and RW Ogden *(Univ of Glasgow, UK).* Cambridge UP, New York. 2001. 470 pp. Softcover. ISBN 0-521-79695-4. $59.95.

This collection of papers by leading researchers in the field of finite, nonlinear elasticity concerns itself with the behavior of objects that deform when external forces or temperature gradients are applied. This book covers the various aspects of the subject comprehensively with careful explanations of the basic theories and individual chapters each covering a different research direction. The authors discuss the use of symbolic manipulation software as well as computer algorithm issues.

9N31. Proceedings of the 2000 ASME Design Engineering Technical Conference and Computers and Information in Engineering Conference - Print Version, Volume 2. DETC2000, September 2000, Baltimore. - ASME, New York. 2000. 1088 pp. ISBN 0-7918-3512-X. ASME Book No 100479. $250.00. (ASME members $125.00).

This printed collection of 118 full-length, peer-reviewed technical papers covers the following topics: distributed design/knowledge-based design; dynamic systems analysis; layered manufacturing; multi-objective/multi-disciplinary design optimization; intelligent design; optimization; solid modeling/surface modeling; solid freeform fabrication; parametric design/geometric design; concurrent product/process design; computer-aided engineering tools; genetic optimization; simulated annealing/optimal layout; compliant and spatial mechanisms; robust design; surface modeling; assembly/disassembly; automotive design; product family design; topology optimization; system design; web-based design; crash analysis; tolerance analysis; and manufacturing; reverse engineering.

9N32. Proceedings of the 2000 ASME Design Engineering Technical Conference and Computer and Information in Engineering Conference -Print Version, Volume 6. DETC2000 September 2000, Baltimore. - ASME, New York. 2000. 888 pp. ISBN 0-7918-3516-2. ASME Book No 100483. $220.00. (ASME members $110.00).

This is a printed collection of 105 full-length, peer-reviewed technical papers covering the following topics: gear analysis and design; durability; chains, belts, CVTs; gear dynamics and noise; gear geometry; engineered surfaces; hypoid/spiroid, spiral bevel, and worm gears; gear manufacturing; and components.

9N33. Recent Advances in Solids and Structures - 2000. November 2000, Orlando. - Edited by HH Chung and YW Kwon. ASME, New York. 2000. 216 pp. ISBN 0-7918-1905-1. ASME Book No H01192. $100.00. (ASME members $50.00).

This is a collection of 26 full-length, peer-reviewed technical papers from the annual symposium that highlights the state-of-the-art technology and research in the area of solid and structural mechanics. Topics discussed include fracture, fatigue, damage, and failure in homogeneous or multi-phase composite materials; stability; thermal and residual stress; vibration and dynamics; computational techniques; virtual manufacturing; and biomechanics.

9N34. Solid Phase Processing of Polymers. - Edited by IM Ward, PD Coates, MM Dumoulin. Hanser Gardner Publ, Cincinnati. 2000. 408 pp. ISBN 1-56990-307-7. $128.00.

This book provides a comprehensive up-to-date account of the solid phase processing of polymers with particular emphasis on the production of oriented polymers in the form of fibers, films, and solid sections, including rods, sheets, and tubes. Various processing methods, such as tensile drawing, die drawing, ram extrusion, and hydrostatic extrusion are covered.

9N35. Surface Wear: Analysis, Treatment, and Prevention. - R Chattopadhyay. ASM Int, Materials Park OH. 2001. 250 pp. ISBN 0-87170-702-0. $149.00.

This book provides a multidisciplinary approach to understanding wear, diagnosing its causes, and prescribing appropriate treatments and preventive measures. The surface engineering techniques and practical guidance provided can be applied to the design, manufacture, and maintenance of machinery to provide cost-effective improvements in the performance of engineered components. The book also describes using appropriate systems and materials for maintaining and reconditioning equipment to extend service life.

9N36. Welded Design: Theory and Practice. - J Hicks. Woodhead Publ Ltd, Cambridge, UK. 2000. 160 pp. ISBN 1-85573-537-7. $107.00.

A thoroughly practical text, but with sufficient theory for understanding the welding parameters of strength, fatigue, and failure, provides specialist information on a topic often omitted from engineering courses. It explains why certain methods are used and gives the basis of commonly performed calculations and derivation of data which is often called up.

Contents include an Introduction; The engineer; Metals; Fabrication processes; Considerations in designing a welded joint; Static strength; Fatigue cracking; Brittle fracture; Structural design; Offshore structures; Management systems; Weld quality; and Standards.

Engineering Mechanics: Statics. - AP Boresi and RJ Schmidt *(Dept of Civil and Ar-*

chitec 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. (Under review)

Engineering Rock Mechanics: Part 2: Illustrative Worked Examples. - JP Harrison and JA Hudson *(Huxley Sch of Env, Earth Sci, and Eng, Imperial of Col of Sci, Tech, and Med, Univ of London, London, UK).* Pergamon, Oxford UK. 2000. 506 pp. ISBN 0-08-043010-4. $128.50. (Under review)

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

Fundamentals of Geotechnical Engineering. - BM Das *(Col of Eng and Comput Sci, California State Univ, Sacramento CA).* Brooks/Cole, Pacific Grove CA. 2000. 593 pp. ISBN 0-534-37114-0. $106.95. (Under review)

Intermediate Mechanics of Materials. - JR Baber *(Dept of Mech Eng and Appl Mech, Univ of Michigan, Ann Arbor MI).* McGraw-Hill, New York. 2000. 594 pp. ISBN 0-07-232519-4. $102.95. (Under review)

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. (Under review)

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). (Under review)

Stability of Elastic Structures. Foundations of Engineering Mechanics. - NA Alfutov *(M-1 Dept, Moscow State Univ of Tech, 2-nd Baumanskaya Str 5, Moscow, 107005, Russia).* Springer-Verlag, Berlin. 2000. 337 pp. ISBN 3-540-65700-2. $99.00. (Under review)

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. (Under review)

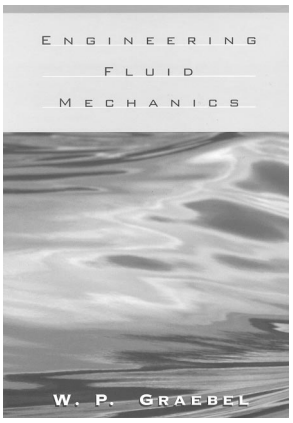
Theory of Porous Media: Highlights in Historical Development and Current State. - R de Boer *(Inst fur Mechanik, Univ Essen, Fachbereich 10 Bauwesen, Essen, D-45117, Germany).* Springer-Verlag, Berlin. 2000. 618 pp. ISBN 3-540-65982-X. $95.00. (Under review)

V. MECHANICS OF FLUIDS

9R37. Engineering Fluid Mechanics. - WP Graebel *(Dept of Mech Eng and Appl Mech, Univ of Michigan, Ann Arbor MI).* Taylor & Francis Publ, New York NY. 2001. 676 pp. ISBN 1-560-32711-1. $89.95.

Reviewed by AS Paintal (Eng Dept, Metropolitan Water Reclamation District, 100 E Erie St, Chicago IL 60611).

This is a text for an introductory course in engineering fluid mechanics. Fluid mechanics is one of the basic courses required for an undergraduate degree in engineering. The purpose of the book is to provide basic theory as well as to develop analytical skills in the engineering students. The book helps the students to get a feel for flow patterns; pressure variations; and continuity, energy, and momentum principles.



The book is organized into 12 chapters and seven appendices. The chapters provide orderly development of the subject. Chapter 1 gives a brief introduction of the subject. Fluid properties are defined and procedures for solving engineering problems are suggested. Chapter 2 deals with hydrostatics and pressure variations and distributions in fluids subjected to rigid body accelerations. Chapter 3 is devoted to fluid dynamics. The ideas of control volume and control surface are introduced, and concepts of incompressibility and discharge are defined. The fundamental equations of fluid mechanics in one dimension are formulated using the concepts of conservation of mass, linear momentum, angular momentum, and energy. Application of these equations for problem solving is emphasized. In Chapter 4, the differential equations using the continuity, energy, and momentum concepts are derived in two- and three-dimensions. The concepts of potential flow are also introduced. Chapter 5 deals with the dimensional analysis and model-prototype relationships. Chapters 6 and 7 concern laminar and turbulent flows. The equation for laminar flows between parallel plates and circular tubes are formulated, and the concept of boundary layer is introduced in Chapter 6. The concept is further developed for turbulent boundary layers in Chapter 7. Turbulent flow in pipes is thoroughly analyzed. The chapter also covers drag and lift forces. Chapter 8 considers the hydraulics of open channel, and the effect of gravity on flow is analyzed. Chapter 9 deals with the compressible flow problems and the effect of Mach Number on the flow. In Chapter 10, various flow, pressure, and velocity measurement techniques are evaluated. Chapter 11 is devoted to hydraulic machines. In Chapter 12, suggestions are made for additional study of various engineering disciplines involving the principles of fluid mechanics.

There are a number of solved problems included in every chapter to explain the principles involved. At the end of each chapter, a set of unsolved problems is provided for practice. The answers to even-numbered problems are given at the end of the book.

There are seven appendices. Appendix A deals with conversion of units and gives useful constants. Appendix B summarizes the fluid properties of water air and other common fluids in British (US) and SI units. Appendix C covers mathematical aids used for solving fluid mechanics problems. Appendix D provides compressible flow tables for air ($k=1.4$). A brief history of fluid mechanics is given in Appendix E. Appendix F's focus is on the design of a pump system. The purpose is to demonstrate how the design and other broader issues are considered in the design.

Engineering Fluid Mechanics provides a balanced treatment of engineering fluid mechanics. The theory as well as problem solving skills are emphasized. The book should be considered for adoption as a text for an introductory undergraduate course in fluid mechanics. It will be useful for engineers working in the area of fluid mechanics or preparing for the examination leading to a professional engineer license.

9R38. Perspectives in Fluid Dynamics: A Collective Introduction to Current Research. - Edited by GK Batchelor, HK Moffatt *(Isaac Newton Inst for Math Sci, Univ Cambridge, 20 Clarkson Rd, Cambridge, CB3 0EH, UK),* and MG Worster *(Inst of Theor Geophys, DAMTP, Univ Cambridge, Silver St, Cambridge, CB3 9EW, UK).* Cambridge UP, Cambridge, UK. 2000. 631 pp. ISBN 0-521-78061-6. $160.00.

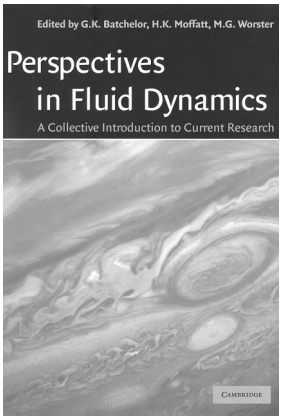
Reviewed by M Gad-el-Hak (Dept of Aerospace and Mech Eng, Univ of Notre Dame, Notre Dame IN 46556).

This book is an eclectic assemblage of 11 introductory articles on different topics in fluid mechanics. The three editors as well as the authors of all chapters are established authorities on their specialities and are well known within the fluid dynamics community at large. All three editors and 5 of the 11 authors are from the Department of Applied Mathematics and Theoretical Physics, Cambridge University, an important center for fluid mechanics research since George K Batchelor founded the department in 1959.

The chapter titles and authors are: Interfacial Fluid Dynamics (Stephen H Davis); Viscous Fingering as an Archetype for Growth Patterns (Yves Couder); Blood Flow in Arteries and Veins (Timothy J Pedley); Open Shear Flow Instabilities (Patrick

Huerre); Turbulence (Javier Jiménez); Convection in the Environment (Paul F Linden); Reflections on Magnetohydrodynamics (H Keith Moffatt); Solidification of Fluids (M Grae Worster); Geological Fluid Mechanics (Herbert E Huppert); The Dynamic Ocean (Christopher Garrett); and On Global-Scale Atmospheric Circulations (Michael E McIntyre). The order has a sense of progression: laminar flows, instabilities, turbulence, physical processes that act on fluids, and finally, geophysical phenomena.

The idea for *Perspectives in Fluid Dynamics* was born when Batchelor set out to prepare a sequel to his famous textbook *An Introduction to Fluid Dynamics*, first published in 1967. For the reason that fluid mechanics has broadened so much in the intervening 30 years, Batchelor concluded that the task was beyond any one person. He then invited Professors Moffatt and Worster to join him in editing the present book with the goal of providing an introduction to different topics in fluid mechanics of current research interest. Each author was charged with being didactic rather than providing a comprehensive survey of the literature surrounding their subject. The 11 distinguished authors, including two of the editors, succeeded marvelously carrying out their charge.



The average length of a chapter is 57 pages. All chapters are exquisitely written and do provide a superb introduction to and significant understanding of their respective topics. Davis' coverage of interfacial phenomena, Pedley's description of artery and vein flows, and Moffatt's reflections on magnetohydrodynamics are particularly delightful to read. Jiménez was charged with the inhumane task of covering turbulence in 58 pages, and he cavalierly agreed. Imagine a first-timer trying to tour the magnificent Madrid in 58 minutes! Linden, Huppert, Garrett, and McIntyre all write about fluid flows at the geophysical scale. The book is well produced and meticulously copyedited and typeset in crisp LaTeX by Cambridge. A hard search yielded only a meager typographical error. The book contains plenty of illustrations including several color photographs.

Despite all the positives, this reviewer has a slight concern with three issues; all have to do with the book's *raison d'être*. First, no subject is so broad as to preclude covering its fundamentals in a single textbook, at the graduate or undergraduate level. This reviewer has three books on his personal bookshelves simply titled *Physics*. Fluid mechanics, as broad and important as it is, is a minor sub-branch of physics. Thus, justifying the present book because no one person can do a sequel to Batchelor's textbook is simply not convincing. Secondly, the present book is not quite suited as an alternative or even as a supplement to a good, graduate-level textbook in fluid mechanics. Insufficient introductory materials are provided here for either purpose. Despite a statement by the editors to the contrary, a student needs to comprehend Batchelor's classical textbook or equivalent first before he or she ventures to read the present book. Lastly, the 11 topics covered in the present book, as important as they may be, are by no means exhaustive. Many other topics missing here are just as important, for example astrophysical flows, combustion, flow control, microfluidics, rotating flows, stratified flows, granular flows, multi-phase flows, rarefied gas dynamics, acoustics, fluid-structure interaction problems, and finally the application to fluid dynamics of modern mathematical tools such as wavelets and dynamical systems theory. In fairness, the editors do state at the outset that the present coverage is not intended to be exhaustive.

The present book's chapters compare well with the typical article in *Annual Review of Fluid Mechanics*. There are around 20 articles per volume, and so the *Annual Review* covered literally dozens of topics since its inception in 1972; some of course more than once. Another peer is *Research Trends in Fluid Dynamics*, edited by Lumley, Acrivos, Leal, and Leibovich (American Institute of Physics, Woodbury NY, 1996). There the 28 chapters were typically shorter, but were more forward looking and covered more fluid mechanics territories.

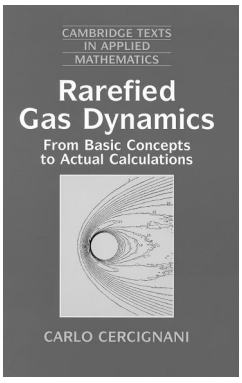
In summary, *Perspectives in Fluid Dynamics* includes contributions from 11 distinguished scholars who cover very well important topics in fluid mechanics. Researchers in all areas of fluid mechanics can be introduced painlessly, gently, and fruitfully to newer areas. The book is a joy to read for those who already know fluid mechanics.

9R39. Rarefied Gas Dynamics: From Basic Concepts to Actual Calculations. Cambridge Texts in Applied Mathematics. - C Cercignani *(Dept of Math, Politechnic Univ, Milan, Italy).* Cambridge UP, Cambridge, UK. 2000. 320 pp. Softcover. ISBN 0-521-65992-2 $29.95.

Reviewed by C Michaelis (Appl Phys Lab, Mission Concept and Anal Group, Johns Hopkins Univ, 11100 Johns Hopkins Rd, Laurel MD 20723-6099).

Cercignani's latest book delves into a broad and mostly theoretical overview of rarefied flows. The aim of the book is to present the concepts, methods, and applications of kinetic theory to rarefied gas dynamics. The book begins with a discussion of fundamentals, including the derivation of the Boltzmann model and the development of various approximations based principally on the BGK model. Following this introduction, several model problems are introduced to aid in understanding the basic concepts in what is otherwise a very complex and difficult topic. To accomplish this, the author presents several variations of the classic one-dimensional Couette flow problem which are mathematically simple enough for a theoretical treatment. Perturbation methods and numerical computations are used to further the development and to gain insight.

Following a discussion of the simple one-dimensional problem, the focus turns to flows with multiple dimensions. Specifically, perturbation methods are used to study the linearized, steady Boltzmann equation. The resulting models are studied in both the continuum, free molecular, and nearly free molecular flow regimes to further illustrate the concepts of rarefied gas dynamics. The author then moves on to a brief discussion of gas mixtures and polyatomic gases where internal energies and chemical reactions are important. The book excludes any discussion of ionized and radiating flows. The theoretical development in the book concludes with a detailed discussion of condensation and evaporation phenomena in rarefied flows, including a development of appropriate boundary conditions for the Boltzmann equation. Once again, a simple one-dimensional parallel plate (Couette) model is used to emphasize the basic concepts.



In addition to the numerous theoretical discussions, this book includes a detailed introduction to numerical solutions of rarefied flows along with a few representative solutions. Cercignani introduces the reader to the Direct Simulation Monte Carlo method developed by GA Bird in the early 1960s. This engineering method is the most widely used for rarefied flows. Often omitted from many classic texts in the field, the

discussion of numerical methods compliments well the vast theory that is otherwise the focus of the book.

The author's expertise in kinetic theory is unrivaled and certainly evident in the work. The author has written several other books on rarefied flows, including *The Mathematical Theory of Dilute Gases, Mathematical Methods in Kinetic Theory*, and *The Boltzmann Equation and Its Applications*. Stylistically speaking, the book reads well, despite the heavy emphasis on mathematics and theory. The figures and tables are generally concise and informative. One complaint is that in a few figures, the plotted variables were not well defined.

However, the book falls short of its aim to emphasize methods and applications. With the exception of the chapter on numerical methods, the author primarily focuses on theoretical discussions and academic problems that are generally geared toward graduate classes in applied mathematics and physics. Practicing engineers and graduate students in related engineering fields will probably find the book to be too mathematical to be helpful. For engineering students new to the field of rarefied gas dynamics, other classic texts, such as *Physical Gas Dynamics* by Vincenti and Kruger, will provide a better introduction to the study of rarefied flows. However, for engineers and scientists with a moderate level of prior expertise in the field, *Rarefied Gas Dynamics: From Basic Concepts to Actual Calculations*, is a great comprehensive reference that is certainly worth the low cost.

9N40. Applied Tribology: Bearing Design and Lubrication. - MM Khonsari *(Dept of Mech Eng, Louisiana State Univ, Baton Rouge LA)* and ER Booser *(Eng Consultant, Niskayuna NY)*. Wiley, New York. 2001. 512 pp. ISBN 0-471-283302-9. $99.00.

There is a growing interest in tribology with the advent of the CD-ROM and other information storage techniques which use the concepts of tribology to store and read data. This book focuses on the design and analysis of machine elements. In particular, it covers tribology in bearings and demonstrates the application of the same principles to other machine components, including piston pins, piston rings, pumps, hydraulic lifts, wet clutches, and more. The discipline of tribology deals with friction and wear between surfaces as well as the lubrication necessary to maintain systems. In recent years, tribology has advanced to encompass new technologies such as frictionless bearings using air to drive the system.

This book offers numerous examples that reinforce concepts and share procedures for the design and performance analysis of components. It provides examples of the full Reynolds equation to support the understanding of computer solutions for evaluating load capacity, power loss, temperature rise, and material and lubrication factors in machine element behavior.

Coverage also includes: Properties of mineral and synthetic oils and greases; Guidelines for lubricant supply systems; Properties of full-film bearing alloys and partially lubricated materials; Gas bearing applications in high-speed machines and compute read-write devices; Performance analyses and application limits for ball and roller bearings; Problems and projects related to cutting-edge developments in tribology; and Coverage of the classical forms of tribology and the more recent cutting edge technology.

9N41. Closure Strategies for Turbulent and Transitional Flows. - Edited by B Launder. *(Univ of Manchester Inst of Sci and Tech, UK)* and N. Sandham. *(Univ of Southampton, UK)*. Cambridge UP, New York. 2001. 600 pp. ISBN 0521-79208-8. $120.00.

Turbulence modeling is a critically important area in any industry dealing with fluid flow, and it has many implications for Computational Fluid Dynamics codes. This collection of papers was presented at a Newton Institute instructional conference on the title's topic. Each paper has been edited or rewritten to provide a coherent account suitable for self study.

The book is divided into three sections: the first, written for newcomers to the subject, outlines the principal modeling and computational strategies currently employed. The second, the core of the book, deals with different flow features. The third outlines some future directions. A vast wealth of material is covered.

9N42. Intermittency in Turbulent Flows. From Workshop on Intermittency in Turbulent Flows and other Dynamical Systems, June 1999, Cambridge UK. - Edited by JC Vassilicos *(Univ of Cambridge, Silver St, Cambridge, CB3 9EW, UK)*. Cambridge UP, Cambridge, UK. 2001. 276 pp. ISBN 0-521-79221-5. $74.95.

The dynamics of many nonlinear systems gravitate around a few common central themes: intermittency, order/coherence and disorder. These features affect scalings and lead to deviations from Gaussian behavior. Intermittency may be the universal outcome of a large class of nonlinear systems; however, the universality properties of specific nonlinear systems, that is the dependencies of the intermittent structure of initial and boundary conditions, remain open questions.

This volume consists of 16 articles by leaders in the field. It reflects the aims of the workshop: age cross-fertilization of ideas; lay out research directions for the future; and provide an overview of current understanding of the subject.

9N43. Intermittency in Turbulent Flows. - Edited by JC Vassilicos *(Univ of Cambridge, Silver St, Cambridge, CB3 9EW, UK)*. Cambridge UP, New York. 2001. 288 pp. ISBN 0-521-79221-5. $74.95.

The dynamics of many nonlinear systems gravitate around a few common central themes: intermittency, order/coherence, and disorder. Intermittency may be the universal outcome of a large class of nonlinear systems, however, the universality properties of specific nonlinear systems remain open questions. This volume consists of articles by leading figures who all participated in a workshop held at the Newton Institute in Cambridge.

9N44. Proceedings of Turbo Expo 2001. Held June 2001, New Orleans. - ASME, New York. 2001. CD-ROM. ISBN 0-7918-3528-6. ASME Book No I496CD. $595.00. (ASME members $476.00).

This is a CD-ROM compilation of 518 full-length, peer-reviewed technical papers on the following topic areas: aircraft engine; controls, diagnostics, and instrumentation; combustion and fuels; education; electric power; industrial and cogeneration; manufacturing materials and metallurgy; structures and dynamics; vehicular and small turbomachines; coal, biomass, and alternative fuels; ceramics; cycle innovations; environmental and regulatory affairs; heat transfer, marine; oil and gas applications; and turbomachinery.

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9N45. Turbulence Structure and Vortex Dynamics. - Edited by JCR Hunt *(Univ Col, London, UK)* and JC Vassilicos *(Univ of Cambridge, Silver St, Cambridge, CB3 9EW, UK)*. Cambridge UP, Cambridge, UK. 2000. 306 pp. ISBN 0-521-78131-0. $80.00.

The 15 articles in this volume, derived from a Symposium held at the Newton Institute in Cambridge, examine a number of key questions that have engaged turbulence researchers for many years. Most involve mathematical analysis, but some describe numerical simulations and experimental results.

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. (Under review)

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. (Under review)

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. (Under review)

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

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. (Under review)

Motion of Bubbles and Drops in Reduced Gravity. - RS Subramanian (*Clarkson Univ, Potsdam NY*) and R Balasubramaniam (*Natl Center for Microgravity Res on Fluids and Combust, NASA John H Glenn Res Center, Cleveland OH*). Cambridge UP, Cambridge, UK. 2001. 471 pp. ISBN 0-521-49605-5. $100.00. (Under review)

The 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. (Under review)

Open Channel Hydraulics. - TW Sturm (*Georgia Inst of Tech, Atlanta GA 30332*). McGraw-Hill, New York. 2001. 493 pp. ISBN 0-07-062445-3. (Under review)

Self-Similarity and Beyond: Exact Solutions of Nonlinear Problems. Monographs and Surveys in Pure and Applied Mathematics, Vol 113. - PL Sachdev (*Indian Inst of Sci, Bangalore, India*). Chapman and Hall/CRC, Boca Raton FL. 2000. 319 pp. ISBN 1-58488-211-5. $94.95. (Under review)

Stability and Transition in Shear Flows. Applied Mathematical Sciences, Vol 142. - PJ Schmid (*Appl Math Dept, Univ of Washington, Seattle WA 98195-0001*) and DS Henningson (*Dept of Mech, Royal Inst of Tech, Stockholm, S-100 44, Sweden*). Springer-Verlag, New York.

2001. 556 pp. ISBN 0-387-98985-4. $79.95. (Under review)

Theory of Engine Manifold Design: Wave Action Methods for IC Engineers. - DE Winterbone (*Dept of Mech Eng. UMIST, Manchester, UK*) and RJ Pearson. SAE, Warrendale PA. 2000. 476 pp. ISBN 0-7680-0656-2. (Under review)

VI. HEAT TRANSFER

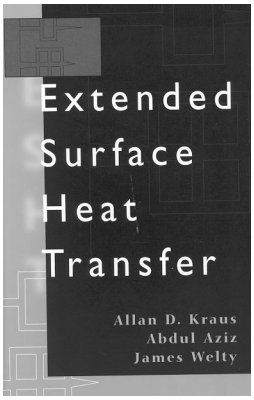
9R47. Extended Surface Heat Transfer. - AD Kraus *(Dept of Mech Eng, Univ of Akron, Akron OH)*, A Aziz *(Dept of Mech Eng, Gonzaga Univ, Spokane WA)*, and J Welty *(Dept of Mech Eng, Oregon State Univ, Corvallis OR)*. Wiley, New York. 2001. 1105 pp. ISBN 0-471-39550-1. $175.00.

Reviewed by DP Sekulic (Col of Eng, Univ of Kentucky, 425 CRMS Bldg, Lexington KY 40506-0108).

This book undoubtedly represents a most thorough compilation of the knowledge related to design and performance of fins and finned surfaces for heat transfer applications. In addition, a very detailed review of the work devoted to various aspects of extended surface convective heat transfer is provided. For those familiar with the first edition of *Extended Surface Heat Transfer*, by Donald Q Kern and Allan D Krauss (1972), the most striking difference, as indicated by the authors of this new edition, is a substantially increased volume of the work done in the field over the last 30 years.

This book should be considered neither as a textbook nor as a monograph focused on a single topic. It rather represents an almost encyclopedic effort of the authors to collect a variety of information about the subject and present this in a user-friendly manner. The authors were not reluctant to include a number of examples to demonstrate the use of various concepts, procedures, and calculation routines. Moreover, the approach to mathematical modeling and corresponding solution findings is very transparent and may assist a reader in developing the skills needed to analyze similar problems. Hence, the book may be recommended not only to the engineers who in their daily practice have to deal with an extended surface design, but also to students at senior and post graduate levels who are familiar with basic heat transfer concepts and are capable of using advanced applied mathematics tools.

The book consists of 20 chapters, which may be conveniently split into two groups. The first set of chapters (Chs 1–3, 5–9, and 13–17) is devoted to steady-state and transient conduction-convection-radiation studies of 2D and some 3D fin configurations and fined surfaces, while the second set of chapters (Chs 4, 10–12, and 18–20) provides information about convective heat transfer characteristics (notably heat transfer coefficients) associated with finned surfaces for single-phase and two-phase conditions, including presentation of extended surface heat exchangers design topics. Clearly, the main contribution of this book is located in the first set of chapters. In the existing literature, there are some more elaborate and very detailed reference sources devoted to determination of heat transfer coefficients in single- and two-phase flows. Also, design of heat exchangers has been a topic of a number of specialized sources devoted to heat exchangers. However, as a guide to designs of fins, finned surfaces, and/or finned array assemblies and their analysis, this book should be considered as a premier source.



Chapter 1, *Convection with simplified constraints*, introduces the basic concept of fin efficiency and treats basic configurations such as longitudinal fins, radial fins and spines assuming the validity of the traditional Murray-Gardner idealizations. This material is extended in Chapter 2, entitled *Convection with real constraints*, following an effort to relax some of the Murray-Gardner idealizations related to geometry, boundary conditions, and presence of internal thermal energy generation. Chapter 3, *Convective optimizations*, considers optimizations of individual fins of rectangular, trapezoidal, triangular, concave parabolic, convex parabolic, and hyperbolic profiles. Chapter 4, *Convection coefficients*, provides a rather basic compilation of information related to heat transfer coefficient determination. The very detailed closure of this chapter provides a balance to this limited set of information through an extensive literature review. Chapters 5 through 8, ie, *Linear transformations, Elements of linear transformations, Algorithms for finned array assembly*, and *Advanced Array methods and array optimization*, are devoted to linear transformations for fins and finned array assemblies and some advanced methods for arrays with loops. Based on the argument that the fin efficiency definition does not use a uniform standard for comparing different fins (ie, ''two fins of different dimensions in the same environment may have the same efficiency but they may transmit different quantities of heat''), an alternative approach (developed over the years by the first author) has been suggested in particular for finned arrays. This approach is based on the realization that there is a linear transformation that leads to mapping of the conditions from the fin base to conditions at the fin tip and vice versa. This approach introduces instead of fin efficiency the so-called thermal transmission ratio (ie, the input admittance).

Chapter 9, *Finned passages*, is devoted to the application of methods for evaluation of the input admittance and fin efficiency of single, double, triple, and quadruple stacks of compact heat transfer cores for different conditions of heat loading. The following three chapters (Chs 10–12) provide information about traditional design methods for *Compact heat exchangers, Longitudinal fin double-pipe exchangers*, and *Transverse high-fin exchangers* (ie, air-fin coolers), respectively. Both the effectiveness-number of transfer units and logarithmic mean temperature difference methods were used. Chapter 13, *Fins with radiation*, explores the analysis and design of fins with thermal radiation as the sole heat transfer mode, while Chapter 14, *Optimum design of radiating and convective-radiating fins*, deals with optimum dimensions of the fins exposed to both types of conditions. Chapters 15 through 17 are adding new dimensions to the study of various fin configurations, ie, focused on additional spatial and temporal dependences. Chapter 15 is devoted to ''*Multidimensional heat transfer in fins and fin assemblies*, Chapter 16 presents the intricacies of *Transient heat transfer in extended surfaces*, and Chapter 17 deals with *Periodic heat flows in fins*. Phase change phenomena associated with extended surfaces is summarized in Chapters 18 and 19, ie, *Boiling from finned surfaces* and *Condensation on finned surfaces*. The book concludes with Chapter 20, *Augmentation and additional studies*, that addresses a variety of issues related to heat transfer augmentation and performance characteristic of some compact heat transfer surfaces, including heat transfer in electronic equipment, heat pipes, solar collectors, and finned regenerators.

For the convenience of the reader, the book is equipped with fairly detailed author and subject indexes. Nomenclatures are listed for each chapter separately, which may be the only plausible solution in a book covering such a vast number of sources. Two detailed appendices, one devoted to gamma and Bessel functions and the other to matrices and determinants, are helpful summaries for those less familiar with the mathematical background information needed to follow the material exposition. The list of references takes more than three-dozen pages and should be considered as the most comprehensive on the subject.

In conclusion, it should be pointed out that in spite of a relatively high price, *Extended Surface Heat Transfer* should find its place in a library of a specialist dealing with extended surface heat transfer, and is a must for libraries supporting various thermal design fields.

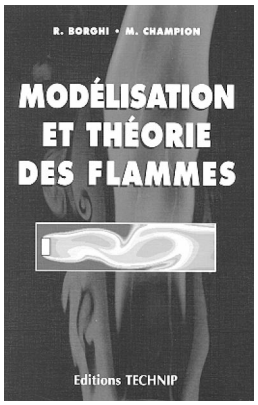
9R48. Modélisation et Théorie des Flammes. Modeling and Theory of Flames. (French). - R Borghi *(l'Ecole Superieure de Mec de Marseille, Univ de la Mediterranee, France)* and M Champion *(Laboratoire de Combust et de Detonique, CNRS, France).* Editions Technip, Paris. 2000. 402 pp. ISBN 2-7108-0758-0. $153.00.

Reviewed by JL Torero (Dept of Fire Protection Eng, Univ of Maryland, 0151 Glenn Martin Hall, College Park MD 20742-3031) and A Atreya (Dept of Mech Eng, Univ of Michigan, 2158 GG Brown Bldg, Ann Arbor MI 48109-2125).

This is a graduate-level textbook dealing with combustion theory. It is intended for graduate students interested in combustion science with the necessary background in graduate-level mathematics. The purpose of the textbook is accomplished in commendable fashion by a clear and compact exposition of laminar and turbulent combustion theory. The book layout is pleasant; the figures are well drawn; and the equations, numbered separately by chapter, are appropriately separated and easy to read. The book is also accompanied by a good subject index.

This textbook comes as a follow-up to *La Combustion et les Flammes* by R Borghi and M Destriau. It is not coincidental that the book under review has a close-up view of the same flame photograph on the cover as the previous book since this is, in essence, what this book is about. Borghi and Champion offer a more in-depth analysis of a narrower area of combustion namely, the modeling of the gas phase phenomena. Their book offers a theoretical framework that allows a better understanding of the processes occurring in reactive flow. While intended for graduate students, the sections on turbulence and turbulent flames can serve as a good reference for engineers practicing in the field of combustion.

The theoretical underpinnings of classical laminar flame theory are covered in detail in Chapters 1, 2, 4, 5, and 6. Chapter 3, however, briefly interrupts the flow with a presentation of turbulent phenomena. It would have been better placed before Chapter 7 to subdivide the book into laminar and turbulent flames. The treatment given to premixed flames is adequate and in many instances original and didactic. In contrast, Chapter 6 treats diffusion flames in a more modest way, the authors omit all references to phase change that would have been a useful precursor for Chapter 9. The presentation of the theory in Chapter 6 is also somewhat scattered. Although it is not difficult to follow, a clear definition of objectives is lacking. Chapters 7 and 8 revert the approach providing an excellent introduction to the problem of turbulent pre-mixed and non-premixed flames, respectively. The discussion of droplet and droplet array burning in Chapter 9 is practically very useful, but it does not logically follow from the first eight chapters. It might have been better to introduce burning of a single droplet along with Chapter 6 on diffusion flames.



The first six chapters show a remarkable absence of experimental data. While this fits well the title of the book and allows the authors to concentrate on the theory, simultaneous presentation of experimental measurements could substantially enhance the theoretical understanding. The final three chapters on turbulent flames incorporate a significant amount of experimental data along with the models. This allows the readers to appreciate the complexity of the problems and assess the extent of scientific uncertainty and the resulting controversy.

This book makes reference to a number of studies in French that are not commonly cited in other books in this field. This is significant for the graduate students since it brings to light important literature that may have otherwise been ignored. The last three chapters are rich in references, but the first six could have incorporated more.

Overall, the reviewers believe that the volume succeeds in its aim of providing a theoretical understanding of the gas phase combustion phenomena. It is considered very suitable for a graduate-level course on combustion theory. However, it would need to be supplemented by appropriate problem sets. It can also serve as a good reference for practising engineers. The authors are to be commended for their effort. *Modélisation et Théorie des Flammes* should be a valuable addition to libraries of institutions or individuals.

9N49. Air Engines: The History, Science, and Reality of the Perfect Engine. - T Finkelstein and AJ Organ. ASME, New York. 2001. 268 pp. ISBN 0-7918-0171-3. ASME Book No 801713. $70.00. (ASME members $56.00). (Co-published with Professional Eng Publishing, UK).

This historical portion of the book is based on four famous articles by Theodor Finkelstein in 1959. He is considered a pioneer of Stirling simulation. The other chapters assess the development of the air engine and put it in the modern contact, as well as investigate its future potential and applications.

The original Air Engines (also known as a heat, hot air, caloric, or Stirling engines) predated the modern internal-combustion engine. This early engine design always had great potential for high efficiency/low emission power generation. However, the primary obstacle to its practical use in the past has been the lack of sufficiently heat-resistant materials. This obstacle has now been eliminated due to the higher strength of modern materials and alloys.

9N50. Diffusion-Wave Fields: Green Functions and Mathematical Methods. - A Mandelis *(Univ of Toronto, Toronto, ON, Canada).* Springer-Verlag, New York. 2001. 688 pp. ISBN 0-387-95149-0. $89.95.

This book develops a unified mathematical framework for treating a wide variety of diffusion-related periodic phenomena in such areas as heat transfer, electrical conduction, and light scattering. Deriving and using Green functions in one and higher dimensions to provide a unified approach, the author develops the properties of diffusion-wave fields first for the well-studied case of thermal-wave fields and then applies the methods to nonthermal fields. The presentation, largely in the form of case studies directly applicable in a wide range of experimental methodologies, is intended for graduate students, professional scientists and engineers working in fields that involve diffusion waves, including thermal-wave, photothermal and photoacoustic spectroscopies, non-destructive evaluation, semiconductor and electronic device carrier plasma-wave characterization, and biomedical laser tissue diffuse photon density-wave diagnostics. The treatment requires no more mathematical background than a course in advanced calculus and mathematical analysis. Problems at the ends of each chapter complement the main text and some serve to extend the material to current research.

9N51. The John Zink Combustion Handbook. - Edited by CE Baukal Jr *(John Zink Co, Tulsa OK).* CRC Press LLC, Boca Raton FL. 2001. 750 pp. ISBN 0-8493-2337-1. $149.95.

Written for engineers, researchers, designers, operators, technologists, and regulators involved in all aspects of combustion, particularly in its use in the process industries, this handbook offers both a general reference on combustion and a detailed reference on industrial combustion for the chemical, hydrocarbon, petrochemical, power generation, and thermal oxidation industries.

This book contains 21 chapters in two parts. The first part deals with the basic theory of combustion, heat transfer, fluid flow, etc, and covers Chapters 1 through 13. While these topics have been covered in many combustion textbooks, this book treats them from the context of the process and power generation industries. The second part of the book deals with specific equipment design issues and applications in the process and power generation industries.

9N52. Proceedings of the 2001 National Heat Transfer Conference. Held June 2001, Anaheim CA. - ASME, New York. 2001. CD-ROM. ISBN 0-7918-3527-8. ASME Book No I1495CD. $350.00. (ASME members &280.00).

This is a compilation on a single CD-ROM of 219 full-length, peer-reviewed technical papers presented on the following topics: aerospace heat transfer, nuclear engineering; materials processing; boiling and condensation; control and design; conduction; computational heat transfer, bio heat transfer; environmental renewable energy; low temperature heat transfer; combustion; solid-liquid phase change; convection; properties and measurement; electronics cooling; heat exchangers/heat transfer equipment; microscale heat transfer; multiphase heat transfer; porous media; and radiation.

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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. (Under review)

Fundamentals of Thermal-Fluid Sciences. - YA Cengel and RH Turner (*Dept of Mech Eng, Univ of Nevada, Reno NV*). McGraw-Hill, New York. 2001. 1047 pp. CD-ROM included. ISBN 0-07-239054-9. $93.95. (Under review)

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. (Under review)

VII. EARTH SCIENCES

9R53. General Circulation Model Development: Past, Present, and Future. International Geophysics Series, Vol 70. - Edited by DA Randall *(Dept of Atmos Sci, Colorado State Univ, Ft Collins CO).* Academic Press, San Diego CA. 2000. 803 pp. ISBN 0-12-578010-9. $99.00.

Reviewed by J Zehnder (Dept of Geography, Arizona State Univ, PO Box 870104, Tempe AZ 85287).

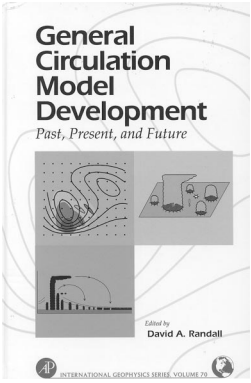
This book is a collection of papers prepared for a symposium honoring Prof Akio Arakawa upon his retirement. The symposium was held in January 1998 on the campus of the University of California-Los Angeles, where Arakawa spent the majority of his career on the faculty of the Department of Atmospheric Sciences. Arakawa received a BSc in physics from Tokyo University in 1950 and a DSc from the same in 1961. He gained practical experience as a research meteorologist with the Japan Meteorological Agency and at UCLA working with Prof Yale Mintz.

Arakawa's research has led to landmark contributions in the development of general circulation models (GCMs) and to the understanding of the atmosphere in general. He provided early and significant contributions to numerical methods which allow for finite difference solutions of the Navier-Stokes equations on a rotating sphere (the so-called *primitive equations*) and to the parameterization of moist processes and cloud formation. Each of these seminal contributions helped shaped areas of research that have led to the current state of the art GCMs.

The book consists of 23 papers that span a wide range of topics from historical perspectives, discussions of the current state of global scale atmospheric modeling, and theoretical aspects of the subject. Arakawa himself contributed three of the articles: his personal recollections of early model development at UCLA, a discussion of the origin of cumulus parameterizations, and his views on the future development of GCMs. The remainder of the contributions are provided by recognized researchers, many of whom are former students and collaborators. Arakawa's contributions to the field, through his ideas, research, and mentoring of future scientists are well illustrated in this volume.

The historical perspectives are provided in the first three chapters in an article by Arakawa, one on the history of GCMs by Paul Lewis, and a discussion of Phillip's early work by John Lewis. Discussions of early work on data assimilation by Halem *et al* (Ch 5) and on the development of cumulus paramterization by Wayne Schubert (Ch 6) round out the historical perspectives.

A fair amount of the text is devoted to technical details of GCMs. Mesinger provides a review of finite difference techniques, which Arakawa helped pioneer, in Chapter 13. Randall *et al* describes an alternative to the finite difference and spectral models, the geodesic grid, in Chapter 17. A wide range of physical processes such as boundary layer (Moeng and Stevens, Ch 19), clouds and moisture (Moorthi, Ch 9; Kruger, Ch 20) radiative transfer (Sommerville, Ch 21) are discussed. An overview of ocean models is provided by McWilliams (Ch 14) and the formidable task of coupling oceanic and atmospheric GCMs is described by Mechoso *et al* in Chapter 18.



The more theoretical perspectives are provided by Kerry Emanuel (Ch 8) in a discussion of *Quasi-Equilibrium Thinking*, which includes the statistical equilibrium representation of cumulus convection developed by Schubert and Arakawa. Problem solving with GCMs and aspects of chaotic dynamics are described by Ghil and Robertson (Ch 10), and Donald Johnson reviews the energetics of the equilibrium climate state in Chapter 22. Aspects of operational long-term weather and climate forecasts at the European Center for Medium Range Weather Forecasts (Hollingsworth, Ch 11) and the Japan Meteorological Agency (Tokioka, Ch 12) are also presented. The final chapter of the book is devoted to Arakawa's discussion of the future development of GCMs, focusing on the vertical and horizontal discretization problems and issues related to the parameterization of the boundary layer, stratiform, and cumulus clouds.

General Circulation Model Development: Past, Present, and Future is of great value to researchers active in the development and use of GCMs and to anyone interested in the history of GCM development. There is also discussion of the use of GMCs to study global warming, in which both sides of the heated debate are elucidated. The reference list at the end of each chapter is quite comprehensive and serves as a starting point for anyone interested further detail. The book would also serve as a text for a graduate course on modeling of the earth's general circulation and is a valuable addition to any individual's or library's collection.

9R54. Mathematics of Multidimensional Seismic Imaging, Migration, and Inversion. Interdisciplinary Applied Mathematics, Vol 13. - N Bleistein *(Center for Wave Phenomena, Colorado Sch of Mines, Golden CO 80401-1887),* JK Cohen *(Deceased),* and JW Stockwell Jr *(Center for Wave Phenomena, Colorado Sch of Mines, Golden CO 80401-1887).* Springer-Verlag, New York. 2001. 510 pp. ISBN 0-387-95061-3. $79.95.

Reviewed by JG Berryman (Geophys and Global Security Div, LLNL, 7000 East Ave, Mail Stop L-200, Livermore CA 94550).

This group at the Colorado School of Mines has a unique perspective on reflection seismology, as it has been developed for and practiced by the exploration community within the oil industry during the last 25 years. This reviewer thinks that nowhere else in academia are applied mathematicians and geophysicists working so fruitfully in such close proximity, sharing students and joint research seminars, as at CSM.

This book was written by three of the most mathematically- and computationally-inclined members of this group. The intended audience is other applied mathematicians, and/or mathematically-inclined geophysicists. The described work is concerned with sound waves propagating in the earth and how to use proven, practical methods on field data to invert for (or image) geological structures underground or beneath the ocean.

The method of choice is integral equations that can be written as Fourier integral operators or pseudodifferential operators. As is explained very carefully in Chapter 2, the reason for this choice of method is the very practical desire to have a stable inverse for the integral operator used for forward modeling. Fredholm integral equations may or may not have stable inverses in general. But the stability of Fourier transforms, and of their inverse transforms, are very well understood both analytically and numerically. Meanwhile, the previously mentioned extensions, pseudodifferential operators and Fourier integral operators, share many of these stability characteristics. Nevertheless, some regularization methods are often required to deal with issues associated with finite bandwidth field data, but these issues too are largely well understood now.

Having chosen a theoretical framework, the remainder of the book explores a wide range of applications in both 2D and 3D acoustic imaging. High-frequencies, and therefore large wavenumbers, are often assumed, and this leads to eikonal equation solvers and ray theory for finite aperture imagers. In the present applications, the seismic field array determines the pertinent aperture of the imaging system. Asymptotic analysis and stationary phase methods play an important role throughout the book.

These explorations culminate in Chapter 7 where the authors present a general theory of data mapping. For those interested in this topic, this chapter alone justifies the price of the book. The topics covered include perennial issues such as velocity analysis, wave-equation datuming, and data regularization, as well as some discussion of less common ideas such as ''uncoverting'' of mode-converted waves.

Five Appendices cover topics both more and less mathematical than those treated in the main text. Distribution theory, Fourier transforms of causal functions, and a long (53 pages) appendix introducing ray theory are the main contributions here.

The principal limitations of the book are listed in its Preface. The authors see this book as one at an *introductory* level and, therefore, do not treat the more advanced topics of elastic wave propagation, anisotropy, mode conversion, elimination of multiple reflections, wavelet deconvolution, and quite a few other topics (including seismic crosswell tomography) that might have required a different formulation from the one preferred here. Nevertheless, the book should not be viewed as introductory in the general sense. The authors assume a fairly high level of understanding by the reader of wave propagation, Fourier transforms, and ray theory (the Appendices help with these topics to some extent). As a textbook for graduate-level studies, this presentation is very appropriate. But this reviewer would not recommend it to undergraduates unless they have very exceptional preparation.

In addition to its potential use as a textbook, the book will be especially useful 1) to researchers in applied mathematics who want to gain a foothold in this very important area of geophysical imaging and 2) to working geophysicists who need to gain a better understanding of the math behind the data processing they routinely do so they can make further improvements. The book has good subject and author indices, as well as professional quality figures throughout.

CSM has also developed the Seismic Unix (SU) package of data processing routines that is freely available for download at http://www.cwp.mines.edu/cwpeodes. The combination of the book and the codes will go a long way to helping both mathematicians and geophysicists catch up to the level of understanding summarized in this very useful volume.

This reviewer recommends that libraries covering wave propagation of all types, and especially those related to geophysical imaging, should have a copy of this book (*Mathematics of Multidimensional Seismic Imaging, Migration, and Inversion*) available to their patrons. Students and individual researchers may want to have a personal copy because of the very clear exposition and the extensive set of references to recent literature in this continually expanding area of active and topical research.

9N55. Continuum Mechanics and Applications in Geophysics and the Environment. - Edited by B Straughan *(Dept of Math Sci, Univ of Durham, Durham, DH1 3LE, UK)*, R Greve, H Ehrentraut, and Y Wang *(Fachbereich Machanik, Technische Univ, Hochschulstr 1, Darmstadt, 64289, Germany).* Springer-Verlag, Berlin. 2001. 393 pp. ISBN 3-540-41660-9. $79.95.

This topical volume of 19 individually-authored papers reviews applications of continuum mechanics to systems in geophysics and the environment. Part of the text is devoted to numerical simulations and modeling. The topics covered include soil mechanics and porous media, glacier and ice dynamics, climatology and lake physics, climate change as well as numerical algorithms.

9N56. Wind Stress over the Ocean. - Edited by ISF Jones *(Univ of Sydney, Sydney, Australia)* and Y Toba *(Tohoku Univ, Tohoku, Japan)*. Cambridge UP, New York. 2001. 336 pp. ISBN 0-521-66243-5. $80.00.

Parameterization of the wind stress—drag—over the ocean is central to many facets of air-sea interaction, which in turn is vital for models of weather prediction and climate modeling. This book brings together 30 leading experts in air-sea interaction, under the auspices of the Scientific Committee on Oceanic Research. The contributed chapters offer a reexamination of the physical processes that transfer momentum between the atmosphere and the ocean. In addition to covering established fundamentals, the book also explores active areas of research and controversy for researchers and graduate students in physical oceanography, meteorology, fluid dynamics, and coastal engineering.

Seismic Isolation for Earthquake Resistant Structures. Advances in Earthquake Engineering. - P Komodromos *(Dept of Civil and Env Eng, Intelligent Eng Syst Lab, MIT, Cambridge MA 02139)*. WIT Press Southampton, UK. 2000. 201 pp. ISBN 1-85312-803-1. $122.00. (Under review)

VIII. ENERGY & ENVIRONMENT

9N57. Proceedings of the 2001 ASME Wind Energy Symposium. January 2001, Reno NV. - ASME, New York. 2001. 440 pp. ISBN 1-56347-476-X. ASME Book No I00488. $160.00. (ASME members $80.00).

This is a collection of 42 technical papers presented at the symposium. Topics discussed include materials, manufacturing and structural design; aerodynamics and performance; laboratory and field testing; estimating structural design loads, simulations, and computational modeling; and controls, systems dynamics, and structural.

IX. BIOENGINEERING

9N58. 2000 22nd International Conference: A New Millennium in Clinical Care and Motion Analysis Technology. - IEEE, New York. 2001. 240 pp. ISBN 0-7803-6469-4. $92.00.

Topics covered include multi-center motion analysis concepts, challenges and changes; motion analysis in the clinical environment; the foot and ankle: planter aperture, motion, modeling, and clinical applications; and upper extremity: motor coordination, kinematics, and assistive devices.

9N59. Computational Modeling in Biological Fluid Dynamics. IMA Volumes in Mathematics and its Applications, Vol 124. - Edited by LJ Fauci *(Dept of Math, Tulane Univ, New Orleans LA 70118)* and S Gueron *(Dept of Math, Technion-Israel Inst of Tech, Haifa, 32000, Israel)*. Springer-Verlag, New York, 2001. 238 pp. ISBN 0-387-95233-0. $69.95.

A unifying theme in biological fluid dynamics is the interaction of elastic boundaries with a surrounding fluid. These moving boundary problems, coupled with the equations of incompressible, viscous fluid dynamics, pose formidable challenges to the computational scientist. In this volume, a variety of computational methods are presented, both in general terms and within the context of applications including ciliary beating, blood flow, and insect flight.

This volume contains 11 invited and refereed papers based upon presentations given in the IMA workshop on the subject during January 1999.

X. GENERAL & MISCELLANEOUS

9N60. ASME Engineer's Data Book. - C Matthews. ASME, New York. 2001. 268 pp. ISBN 0-7918-0155-1. ASME Book No 801551. $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. It includes essential mathematics; units; engineering design processes and principles; basic mechanical design; motion; mechanics of materials; material failure; thermodynamics; fluid mechanics; fluid equipment; vessel codes and standards; 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.

9N61. ASTM International Directory of Testing Laboratories, 2001 Edition. - ASTM, W Conshohocken PA. 2001. 380 pp. Softcover. ISBN 0-8031-2742-2. $69.00.

Updated annually to reflect new capabilities and equipment, this directory includes a listing of over 1,000 laboratories, most located in the US, 45 in Canada, and 90 located throughout the world. Detailed indexes list labs by location, name, specialty, equipment, testing capabilities, applications, and specific tests performed.

Features include 17 fields of testing; eight classifications of laboratory services; 12 major categories; 58 subcategories of materials and products; three indexes: subject, test performed, alphabetical; laboratory accreditation(s); specific tests performed (listed by issuing agency and designation number); and geographical segmentation of listings by country, state, and city.

Note: The laboratories included are not certified or endorsed by ASTM; they are paid listings compiled as a service to ASTM members and customers.

Author Index for September 2001

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