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

11R1. Adaptive Meshing with Boundary Elements. Topics in Engineering, Vol 41**.** - JC Miranda-Valenzuela *(ITESM Campus Toluca, Mexico)* and KH Muci-Kuchler *(Univ of Detroit Mercy, Detroit MI 48219)*. WIT Press, Southampton, UK. 2002. 293 pp. ISBN 1-85312-888-0. $169.00.

Reviewed by J Trevelyan (Sch of Eng, Univ of Durham, Durham, DH1 3LE, UK).

There has been considerable literature over the last 20 years surrounding adaptive methods of mesh refinement, or solution improvement, in the finite element method. Publications relating to the use of these methods in the boundary element method (BEM) have followed. The field is now sufficiently mature for the production of a textbook that might summarize the developments, and that might provide a useful starting point for a BEM researcher who is hoping to make use of these techniques. This book serves the purpose well.

The book is not solely about adaptive methods. The first five chapters, indeed, make little reference to adaptivity, but instead present a background to the BEM upon which the later chapters can build in their presentation of the adaptive techniques. There are different levels on which the BEM can be described, ranging from the intuitive to the pure mathematical. This book takes the mathematical approach. It is not for the mathematically faint-hearted, especially as more than the usual amount of space has been devoted to details of the tangent derivative formulations in which the authors have worked and which form the basis for the adaptive error indicators described towards the end of the book. On this point, though, the authors must have recognized that the market for the book is a relatively small set of researchers who have the mathematical skills already to prepare a BEM code, and who probably have prepared codes of their own already in which adaptivity might be implemented. It is because of the limited market, also, that I suspect the publishers have set a quite challenging price of $169 for a work running to 287 pages.

The book is generally well written and very readable. Many chapters include introductory sections containing very concise and well-presented literature reviews that read like a chronological story of developments. These sections provide a useful perspective to the field.

Chapter 6 is particularly useful, in which the authors present an overview of adaptive meshing and error estimation. The chapter would be a useful resource for a graduate student taking his/her first steps in preparation for implementing some adaptivity in a BEM code. The accumulation of ideas is presented in a logical, clear, and accessible way.

This reviewer has two criticisms: firstly, not enough use is made of examples. Those that are presented are generally clear and serve their purpose of illustrating the methods, but more examples would have aided clarity in places. Most examples illustrate the methods based around the Hermite elements favored by the authors, whereas more examples of conventional Lagrangian elements would have made the book a more general work. Secondly, the book has focused very heavily on the error estimation. Without question, error estimation is a key constituent of a successful adaptive scheme, but little space is given to the remeshing strategies that might be employed. In particular, little attention is given to p-adaptive schemes, or hp combinations.

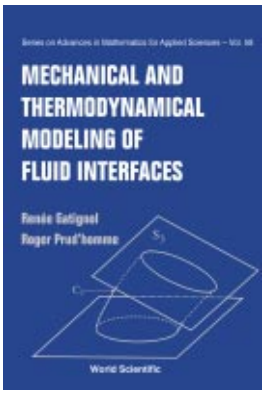
In spite of these criticisms, and its cost this reviewer would recommend *Adaptive Meshing with Boundary Elements* as an introduction to adaptive methods for the BEM, and one that is justified now that these techniques are maturing.

11R2. Mechanical and Thermodynamical Modeling of Fluid Interfaces. Advances in Mathematics for Applied Sciences Series, Vol 58**.** - R Gatignol and R Prud'homme *(Lab de Modelisation en Mecanique, Univ Pierre et Marie Curie & CNRS, France)***.** World Sci Publ, Singapore. 2001. 248 pp. ISBN 981-02-4305-7. $58.00**.**

Reviewed by SA Sherif (Dept of Mech Eng, Univ of Florida, 228 MEB, PO Box 116300, Gainesville FL 32611-6300).

This book falls into the category of reference books. It deals with an advanced subject area that is beyond the scope of most traditional undergraduate courses in Mechanical or Chemical Engineering. The subject of fluid interfaces is extremely important, but equally complex to understand, and hence the publication of such a book should add good value to the reference shelf of researchers in this field.

The book comprises seven chapters. Chapter 1 provides a fundamental analysis of interface and interfacial layers in a thermo-mechanical context. The chapter serves as a nice introduction to readers who would like to get a slow start on the subject and not jump too quickly into the heart of the subject matter. Chapter 2 deals with surface quantities which belong to either a transition layer in which large gradients of densities are present, or a zero-thickness surface. Chapter 3 deals with interfacial balance laws for species, mass, momentum, and energy, as well as interfacial entropy production laws.



In Chapter 4, the constitutive relations are derived for two-dimensional interfaces employing linear irreversible thermodynamical relations. Of special interest in this chapter is the coverage of problems related to evaporation and condensation. Chapter 5 introduces the reader to classical three-dimensional constitutive relations. Topics covered include premixed flames with high activation energy as well as shock waves and relaxation zones behind shock waves. Here the gaseous shock wave is treated as an interface. Chapter 6 discusses the application of second gradient theory to interfacial media. Main topics covered in this chapter include the internal capillarity problem in a variety of application areas. Finally, Chapter 7 discusses typical problems involving surface tension and other surface properties. Of particular interest in the chapter is the discussion pertaining to the growth of a bubble, vapor recoil, and diffusive interfaces. The book concludes with three appendices, one dealing with tensor notation, the second dealing with geometry of interfaces and interfacial layers in orthogonal curvilinear coordinates, and the third covering the topic of kinematics of the interface.

In general, *Mechanical and Thermodynamical Modeling of Fluid Interfaces* is well written and should be relatively reader friendly to the scientifically literate individual. The addition of numerical examples on how to apply the different methods could provide additional value to the book and perhaps make the book more useable in the graduate textbook market. Nevertheless, the book serves its stated purpose in its current form in being a solid reference in the area of fluid interfaces.

11N3. Computational Fluid and Solid Mechanics. Proc of 1st Conf, Cambridge MA, June 2001**.** - Edited by KJ Bathe *(MIT MA)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 1768 pp. ISBN 0-08-043944-6. $204.00. Also available on CD-ROM, ISBN 0-08-043956-X, $68.00 and 2-Vol set and CD-ROM, ISBN 0-08-043964-0, $224.50.

This proceedings includes conference papers that sought to reach a new level of mathematical modeling and numerical solution and to provide an exciting research environment for the next generation in computational mechanics.

11N4. Computational Fluid Dynamics: Principles and Applications. - Edited by J Blazek *(ASTOM Power Ltd, Aerodynamics of Turbomachinery, Baden-Daettwil, CH-5401, Switzerland)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 460 pp. ISBN 0-08-043009-0. $125.00.

The objective of this book is to provide a solid foundation for understanding the numerical methods employed in today's computational fluid dynamics (CFD) and to raise awareness of modern CFD codes through hands-on experience. The accompanying CD-ROM contains the sources of 1D and 2D Euler solvers as well as grid generators.

11N5. Computational Mechanics: New Frontiers for the New Millennium. Proc of 1st Asian Pacific Congress, Sydney, Australia, Nov 2001**.** - Edited by S Valliappan and N Khalili *(Dept of Civil and Env Eng, Univ of New South Wales, Sydney, NSW 2052, Australia)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 1868 pp. ISBN 0-08-043981-0. $330.00.

The papers in this proceedings cover such new frontiers as micromechanics, contact mechanics, environmental geomechanics, chemo-thermo-mechanics, inverse techniques, homogenization, meshless methods, smart materials/smart structures and graphic visualization, besides the general topics related to the application of finite element and boundary element methods in structural mechanics, fluid mechanics, geomechanics, and biomechanics.

11N6. Multiscale Modeling of Materials-2000. From 2000 MRS Fall Meeting, Boston**.** - Edited by LP Kubin *(LEM, CNRS-ONERA)*, RL Selinger *(Catholic Univ of Am)*, JL Bassani *(Univ of Penn)*, K Cho *(Stanford Univ)*. Mat Res Soc, Warrendale PA. 2001. 254 pp. ISBN 1-55899-563-3. $91.00.

Multiscale modeling of materials has emerged as a powerful tool with application to metals, semiconductors, polymers, and biochemical systems. Together with rapid advances in computing power, these new methods represent an important step toward the goal of linking atomic-scale processes—modeled with interatomic potentials, tight-binding and *ab initio* methods—to simulations of macroscopic phenomena. This volume's 38 papers discuss state-of-the-art methodologies for linking disparate length and time scales and for understanding and predicting the behavior of complex materials systems. It is organized around several major themes representing current challenges in multiscale simulation and modeling. Topics include length-scale and time-scale problems, applications to microstructure evolution, plastic deformation and fracture, multiscale modeling schemes, length scales, and size effects.

11N7. Practical Guide to Boundary Element Methods with the Software Libarary BEMLIB. - C Pozrikidis *(Univ of California at San Diego, La Jolla CA 92093)*. Chapman and Hall/CRC, Boca Raton FL. 2002. 440 pp. ISBN 1-58488-323-5. $99.95.

This dual-purpose text provides a concise introduction to the theory and implementation of BEMs while simultaneously offering hands-on experience based on the software library *BEMLIB*.

BEMLIB contains four directories comprising a collection of FORTRAN 77 programs and codes on Green's functions and boundary element methods for Laplace, Helmholtz, and Stokes flow problems. The software is freely available from the Internet site: http://bemlib.ucsd.edu

The first seven chapters of this book discuss the theoretical foundation and practical implementation of the BEM. The material includes both classical topics and recent developments, such as methods for solving inhomogeneous, nonlinear, and time-dependent equations. The last five chapters comprise the *BEMLIB* user guide, which discusses the mathematical formulation of the problems considered, outlines the numerical methods, and describes the structure of the boundary element codes.

Boundary Element Method, Volume 1: Applications in Thermo-Fluids and Acoustics. - LC Wrobel *(Brunel Univ, UK)*. Wiley, W Sussex, UK. 2002. 451 pp. ISBN 0-471-72039-9. $160.00. (Under review)

Boundary Element Method, Volume 2: Applications in Solids and Structures. - MH Aliabadi *(Queen Mary, Univ of London, London, UK)*. Wiley, W Sussex, UK. 2002. 580 pp. ISBN 0-470-84298-9. $175.00. (Under review)

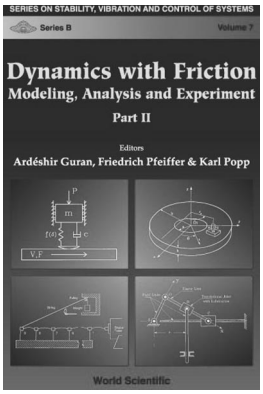
II. DYNAMICS & VIBRATION

11R8. Dynamics with Friction: Modeling, Analysis and Experiment, Part II. Stability, Vibration, and Control of Systems, Series B, Vol 7. - Edited by A Guran *(Inst for Structronics, Canada)*, F Pfeiffer *(Inst of Mech, Tech Univ, Munich, Germany)*, K Popp *(Inst of Mech, Univ of Hannover, Germany)*. World Sci Publ, Singapore. 2001. 313 pp. ISBN 981-02-2954-2. $77.00.

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

This book is very timely because of the revival in recent years of contact mechanics, ie, mechanical systems with friction associated with new computer resources and applications such as robotics, human artificial joints, virtual reality, animation, and crashworthiness.

The book is important because most of nature, machines, and structures involve dynamical friction. The Preface alone is worth the price of the book. Along with an excellent summary of the importance of friction in nearly everything (''forces are nearly always applied by means of frictional contacts''), a pragmatic case is made for the role of friction in an almost unlimited number of applications. The Preface also contains a statement by Leonardo da Vinci that should be motivating to all those associated with mechanics in any way, ''Mechanics is the noblest and above all others the most useful, seeing that by means of it, all animated bodies which have movement perform all their actions.''



The book emphasizes a number of examples of contact mechanics. While many engineering applications require that we minimize friction, ''everyday life is... impossible without friction.'' The nine chapters (papers given by a dozen different authors) add to the engineering and mathematical ability to model friction in more realistic ways.

Most of these applications fall under the categories: dry sliding contacts, discs, kinematic chains, periodic structures, beams, linear viscoelastic media, and rectangular plates. There are also chapters on friction modeling and dynamic computation and on the use of passive and semi-active dry friction to accomplish damping.

The approaches vary widely in complexity, usually culminating in experimental cases with graphic results. The book has excellent figures including some in color. Every one of the figures of the various detailed models analyzed (for example, a flexible link with a slider joint) is especially well done. There are hundreds of references, but they are included at the end of each chapter instead of being assimilated into one place. There is a very brief index and an author index.

Excellent technical features are the wide range of simple to complex models, stability versus instability studies, well-presented results, and mathematical approaches that traverse from the simple to the complex.

This reviewer recommends *Dynamics with Friction: Modeling, Analysis and Experiment, Part II* as primarily a reference book intended for those in the contact mechanics field, professors, material scientists, mathematicians, physicists, and libraries. The authors succeed in their goals of augmenting Part I with a good collection of papers for modeling, analyzing, and experimenting on the effects of friction on a number of dynamical systems.

11R9. Engineering Analysis in Applied Mechanics. - JW Brewer *(Univ of California, Davis CA)*. Taylor & Francis Publ, New York NY. 2002. 472 pp. ISBN 1-56032-932-7. $75.00.

Reviewed by T Krzyzynski (Dept of Mech Eng, Koszalin Univ of Tech, Raclawicka 15-17, Koszalin, 75-620, Poland).

This is a book which constitutes a comprehensive course of application of mathematical methods in engineering analysis in solid mechanics, dynamics, and thermodynamics. The author, who deals with mathematics as a language of technology, addresses his book to students of mechanical engineering.

This book consists of six chapters, two appendices, answers to selected exercises, and a subject index. Each chapter ends with review questions, exercises, and references to the subject considered, and is illustrated by good-quality figures. Four chapters and one appendix contain a section called *Computer Assignments*, which presents an illustration on how to solve problems by means of computer programs like MATLAB.

In Chapter 1 (Theory of Equations), fundamentals of equations derived and solved in mechanical sciences are briefly discussed. The emphasis of this chapter is on the existence and uniqueness of the solutions of algebraic equations.

Chapter 2 (Theory of the Extreme Values of Functions) deals with mathematical theory of maxima and minima of algebraic functions. The attention is focused on mathematical and engineering significance of the terms: necessary and sufficient conditions of existence of function extrema.

Chapter 3 (Calculus of Variations), stating a natural extension of Chapter 2, is devoted to fundamentals of the subject in its title and presents applications in engineering economics, mechanical design, and automatic control.

Chapter 4 (Extremum Principles of Thermodynamics) covers applications of extremum principles in thermodynamics. A mental model of thermodynamics is introduced to illustrate concepts presented. In this chapter, besides the physics of thermodynamics and the mathematical structure of thermodynamics, one can study problems like Legendre transforms, thermodynamics of engines and thermodynamic stability.

Chapter 5 (Stationarity and Extremum Principles of Solid Mechanics) is dedicated to applications of extremum principles in problems encountered in solid mechanics. A reader becomes familiar with the principle of virtual work of rigid and deformable bodies, and questions like stability of static equilibrium, complementary energy, and energy methods.

Chapter 6 (Equations of Motion and the Stationarity Principles of Lagrange and Hamilton) is focused on deriving the differential equations of motion of by using either Lagrange's or Hamilton's equations. The attention is restricted to the idealization of modeling dynamical systems as rigid bodies. This completes the considerations presented in Chapter 5, where the system internal energy is taken into account as an elastic strain.

Appendix A (Matrix Algebra and the Linear Independence of Vectors) and Appendix B (Review of Elementary Real Analysis) provide a quick reference and background material for problems discussed in the text.

The structure of each of the parts of the book makes it possible to study the problems considered not only in an effective, but also pleasurable way. In the opinion of this reviewer *Engineering Analysis in Applied Mechanics* is a very useful book for both students and lecturers. It can serve as resource for engineers and scientists and is also recommended for their libraries.

11R10. Generating Families in the Restricted Three-Body Problem, II: Quantitative Study of Bifurcations. Lecture Notes in Physics, Vol m65**. -** M Henon *(CNRS, Observatoire de la Cote d'Azur, BP 4229, Nice, 06304 Cedex 4, France)*. Springer-Verlag, Berlin. 2001. 301 pp. ISBN 3-540-41733-8. $44.00.

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

This monograph belongs to a series called the Lecture Notes in Physics whose editorial policy states, ''...reports new developments in physical research and teaching - quickly, informally, and at a high level. The type of material considered for publication in the monograph series includes monographs presenting original research or new angles in a classical field. The timeliness of a manuscript is more important than its form, which may be preliminary or tentative. Manuscripts should be reasonably self contained.'' This monograph satisfies all these requirements, except for the last one. The current work starts with Chapter 11; the first ten appear in the first monograph volume with the same name. Furthermore, the ''introductory'' chapter in the current volume refers to definitions, figures, and results from the early chapters that are not reproduced in this volume. In addition, similar references appear throughout this work. Consequently, one would not be able to initiate a study of this subject using this second volume alone.

This work is an extension of the earlier monograph, by the author, in this same series. In that volume, the study of generating families in the restricted three-body problem was initiated and treated qualitatively. There, generating families are defined as the limits of families of periodic orbits for the case where the mass ratio approached 0. The main problem is in determining the junctions between the branches at a bifurcation orbit, where two or more families of generating orbits intersect. This monograph focuses on that problem.

The first chapter (Ch 11) sets up the definitions (often times referring to Chs 1–10) and the governing equations. In addition, a general method of approach is presented by the numbers, that is referred to by the same numbers in later chapters. Chapters 12–14 present the application of this approach to the total and partial bifurcations of Type 1. Chapter 15 presents a geometric approach to solving the problem that is interesting, but runs into problems with increasing numbers of arcs. Chapter 16 generalizes the results of Chapter 15, overcoming the numbers problem, and verifies results obtained from Chapters 12–14. Chapters 17–23 apply the method of Chapters 12–14 to total and partial bifurcations of Type 2. These are significantly more complicated and have additional phenomena called total and partial Transitions, requiring more details to sort out. Essentially, this monograph carries us through the details of the search for all possible combinations and permutations of possible junctions for Type 1 and Type 2 bifurcations.

Generating Families in the Restricted Three-Body Problem, II: Quantitative Study of Bifurcations is generally well written and in a logical order. Occasionally, there is lack of justification for some results. It would seem that there could be more figures in the book to support some of the statements and equations that are used and to help interpret some of the results. It is clear that the objective here is to get results, not interpret them. Finally, an analysis of Type 3 bifurcations is suggested as being much more complicated, introducing a dozen or so new types of arcs, and is not pursued in this volume. This reviewer would suggest that this volume should not be purchased without the first one. Further, the subject is very limited, but interesting, and requires a great deal of patience to follow all the possible paths to determine the solutions. While some of the techniques may be applied to general dynamical systems, most are reserved for this particular problem.

11R11. Mechanical Behavior of Engineering Materials, Volume 2: Dynamic Loading and Intelligent Material Systems. - YM Haddad *(Mech Eng, Univ of Ottawa, Canada)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2000. 484 pp. ISBN 0-7923-6355-8. $225.00.

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

The book under review is the second volume of the two-volume monograph *Mechanical Behavior of Engineering Materials*. This volume is devoted to the evaluation of the engineering materials properties under dynamic loading. However, due to the wide scope of topics covered and its popular presentation, this book is not a monograph, it can be classified as a tutorial on dynamic behavior of engineering

materials. In each chapter, a review of well-known results in particular aspects of dynamic loading is given, which paves the way for a person inexperienced in the field for perceiving the current state of the art in the development of mechanics of materials. Having read this book, a reader will be ready to embark on in-depth study of the subject.

The second volume begins with Chapter 9. The previous eight chapters, devoted to static and quasi-static loading of linear and nonlinear elastic, viscoelastic, and elastic-plastic continuum media, are contained in Volume 1 (an interested reader is referred to the review of Volume 1 by J-C Roegiers published in *AMR*, July 2002, p B61). Chapter 9 introduces the subject of the response of metallic materials to dynamic loading both under high and low rates. Behavior of the materials within the plastic range, with due account for plastic instability and localization effects, is reviewed in Chapter 10. Chapter 11 presents brief information concerning elastic bulk and plane wave propagation in unbounded and semi-infinite elastic media, as well as surface waves. It is worth noting that aspects of dynamic behavior of rods and plates are discussed rather weakly and superficially. Dynamic plastic behavior of engineering materials, as well as plastic shock wave propagation, are presented in Chapter 12. Linear viscoelastic properties of materials under dynamic loading are discussed in Chapter 13, and linear and nonlinear viscoelastic wave propagation is considered in Chapter 14. The dynamic behavior of fiber-reinforced composite materials is presented in Chapter 16. Chapter 17 gives an introduction into the concept of intelligence in engineering materials, as well as a review of different models, control algorithms, and analyses developed by various researchers. Pattern recognition and classification methodology for the characterization of material response states is discussed in the last chapter, 18.

Each chapter ends with a list of main references, as well as the references for further reading, but this reviewer should note that only a few of them, excluding those of the author, were published during the last 10 years. Chapters 10, 11, 14, and 15 contain problems for student self-checking. Volume 2 concludes with a subject index and cumulative subject index.

This reviewer can recommend *Mechanical Behavior of Engineering Materials, Volume 2* only for undergraduate students of civil engineering and mechanical engineering departments as an introductory course in dynamic behavior of engineering materials.

11N12. Noise and Vibration from High-Speed Trains. - Edited by VV Krylov. Thomas Telford Ltd, London. 2001. 435 pp. ISBN 0-7277-2963-2. $160.00.

This book looks at the generation of noise and vibration from a variety of sources across different railway systems.

11N13. Spaceflight Mechanics 2001, Volume 108, Parts I and II: Advances in the Astronautical Sciences. Proc of AAS/AIAA Space Flight Mechanics Meeting, Feb 2001, Santa Barbara CA. - Edited by LA D'Amario *(Jet Propulsion Lab, Pasadena CA 91109)*, LL Sackett *(Charles Stark Draper Lab)*, DJ Scheeres *(Univ of Michigan)*, BG Williams *(Jet Propulsion Lab, Pasadena CA 91109)*. Am Astronaut Soc, San Diego. 2001. 2174 pp. ISBN 0-87703-487-7. $330.00.

This is a two-part volume. Papers not available for publication are listed on the divider pages of each section of the volume. A chronological index and an author index are appended to Part II. Part I focuses on the following topics: Mars missions 1, Attitude control, Orbital debris, Mars missions 2, Attitude dynamics, Atmospheric flight and modeling, Missions to small bodies 1, Attitude control and determination 1, Navigation, Missions to small bodies 2, interplanetary missions, Satellite clusters and formation flying, Earth and lunar missions, and Attitude control and determinations 2. Part II covers Orbit determination, Tether systems 1, Control systems, Multi-body dynamics and libration points, Low thrust missions, Satellite constellations, Special topics in astrodynamics, Tether systems 2, Guidance and control, Orbit dynamics and design, and the Plenary lecture, ''In Quest of Better Attitudes,'' by Malcolm D Shuster.

11N14. Waves in Ocean Engineering. Book 5 in the Elsevier Ocean Engineering Book Series. - Edited by MJ Tucker *(Taunton, Somerset, UK)* and EG Pitt *(Pulborough, W Sussex, UK)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 550 pp. ISBN 0-08-043566-1. $134.00.

This work covers the whole field of wave studies of interest to applied oceanographers and ocean engineers. It has considerable relevance to coastal engineering. The book is split into 12 sections, the first of which is devoted to the practical applications of wave studies and to the history of wave research. The rest of the book covers the measurement of waves, including remote sensing, the analysis and interpretation of wave data; estimating the properties of the extreme *Design Wave*, as well as the generality of waves for fatigue calculations; waves in finite depth, wave generation by wind, and wave forecasting models; nonlinear effects, and errors and uncertainties in wave data.

Dynamical Contact Problems with Friction: Models, Methods, Experiments and Applications. Lecture Notes in Applied Mechanics, Vol 3. - W Sextro *(Inst of Mech, Univ of Hannover, Applestr 11, Hannover, 30167, Germany)*. Springer-Verlag, Berlin. 2002. 159 pp. ISBN 3-540-43023-7. $79.95. (Under review)

III. AUTOMATIC CONTROL

11R15. Functional Adaptive Control: An Intelligent Systems Approach. - SG Fabri *(Dept of Elec Power and Control Eng, Univ of Malta, Msida, MSD 06, Malta)* and V Kadirkamanathan *(Dept of Autom Control and Syst Eng, Univ of Sheffield, Sheffield, S1 3JD, UK)*. Springer-Verlag London Ltd, Surrey, UK. 2001. 266 pp. ISBN 1-85233-438-X. $99.00.

Reviewed by PJ Eagle (Exp and Comput Mech, DaimlerChrysler Corp, CIMS 483-05-10, 800 Chrysler Dr, Auburn Hill MI 48326-2757).

This book is a monograph devoted to methods for analyzing nonlinear control problems using techniques to confront uncertainty in the plant and environment. The stated aim of the text is to present new results in intelligent control associated with adapting to functionally uncertain, nonlinear, continuous time systems. The authors honestly state that the book arose out of the first author's doctoral research. This fact is clear in the both the content and presentation as the reader sees the limitations of this text. The writing style is not oriented toward pedagogy and does not contain practice problems. As such, it would not be a good choice as an undergraduate text. Unfortunately, every example contained in the text is contrived as a purely numerical simulation without clear linkage to actual practice. While the claim is made that simulations are included which confirm ''that these novel designs are truly effective for dealing with the stringent conditions usually associated with intelligent control,'' it is possible that none of this work has been evaluated with physical systems or real data. Upper-level graduate students pursuing research topics in control systems might be better served by reviewing the various peer-reviewed publications that are related to this topic area.

The book consists of ten chapters presenting some of the author's research and some background literature review. There is an extensive list of nomenclature, symbols, and figures supported by a complete table of contents and index. The references are carefully and accurately indicated throughout the text. The book was well reviewed for typesetting irregularities and typographic errors. There is an abundance of figures that provides complete results and, in some cases, input data for the simulations used throughout.

The book contains a clearly presented review of the main issues and techniques in adaptive control. The painstaking referencing system used to support this review is impressive. The literature review is typical of a doctoral dissertation as well as the authors' observations about their own contributions to the field. It will not be convincing to most readers that carefully formulated simulations shown that Gaussian radial basis functions are ''a practical and feasible solution for effecting adaptive control of a wide variety of physical systems'' or that the problem of transient performance improvement for functional adaptive control has been ''tackled by deriving a novel neural network adaptation law.'' The author's claims would be most convincing if peer-reviewed journals accepted the backbone of this work and if some physical systems were used to test the results. Many well-documented aircraft examples exist in the same references cited in this text could be used to provide the necessary data. In fact, the authors indicate that ''the combination of complexity coupled with strict performance specifications is not uncom-

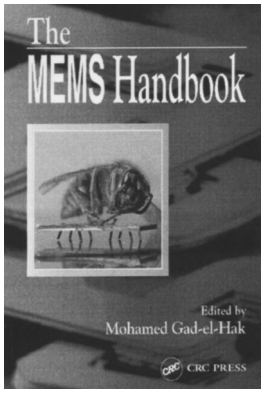
mon in modern aircraft.'' The reader is not convinced that this statement is made with any first-hand knowledge.

In summary, this reviewer would have difficulty in recommending *Functional Adaptive Control: An Intelligent Systems Approach* to students or libraries seeking adaptive control system reference texts. This book is neither a complete nor a practical resource. Researchers seeking guidance in these areas would be better served by the original references.

11R16. MEMS Handbook. - Edited by M Gad-el-Hak *(Dept of Aerospace and Mech Eng, Univ of Notre Dame, Notre Dame IN 46556)*. CRC Press LLC, Boca Raton FL. 2002. 1368 pp. ISBN 0-8493-0077-0. $149.95.

Reviewed by WE Seemann (Dept of Mech and Process Eng, Univ of Kaiserslautern, PO 3049, Kaiserslautern, 67653, Germany).

The *MEMS Handbook* is a collection of 36 chapters, each subdivided in several sections and covering a special subject or topic, and almost each is written by one or more different authors. As every of the 54 contributors has his own field of knowledge and expertise, this book is a good collection of subjects within the area of microelectromechanical-systems (MEMS).



The book is divided into four parts. Part I covers the background and fundamentals of MEMS, including flow phenomena, physics of thin films, bubble/drop transport, control theory, and soft computing. The second part deals with the design and fabrication of MEMS. Aspects covered in this part are materials and material properties for MEMS, fabrication of MEMS, the LIGA technique, X-ray-based fabrication up to very advanced techniques like the solid free form technique for MEMS. In Part III applications of MEMS are presented. Inertial sensors, pressure sensors, sensors and actuators for flow control, miniature mechanisms, microrobotics, heat pipes, and micro droplet generators serve as examples for applications and fabrication of MEMS. In most of these chapters on applications of MEMS, the fabrication processes already shown in Part II are revisited once more. The last and smallest part covers future applications and trends towards nanoelectromechanical systems (NEMS).

This short overview on the contents of the book shows that it may serve as a reference for many different important aspects in MEMS. On the other hand, all the chapters are written independently like separate articles, and therefore, the book may also serve as a textbook for the reader having already some background in the MEMS area. To get a reference on a special problem, the reader will have to consult the subject index, and normally, there will be more than one chapter to which references are found. This is in accordance with this reviewer's feeling that different topics are covered more than once in several chapters. A handbook having been written by only one author would have the advantages that the structure of the book could be better, overlapping of the chapters could be avoided, and the sections would not differ both in style as well as depth and length. However, one should keep in mind that it is difficult for a single author to deal with all the topics covered in this book in such a detailed and fundamental form. On the other hand, the book gives the opportunity for many authors to present latest or ongoing work. This is underlined by the large number of standard and very actual references given at the end of each chapter. Some chapters or topics could have been omitted. Examples are the chapters on control theory or neural networks because these topics are not especially related to MEMS, but can be assumed to be known to the reader. In addition, a few chapters do not deal very much with MEMS, for example, the chapter on vacuum pumps.

In this reviewer's opinion, it can be felt that the editor's background is in fluid dynamics. Therefore, problems of MEMS occurring in the field of fluid dynamics and its applications are a little bit overemphasized in relation to other topics and applications.

Despite the criticism, this reviewer thinks that the *MEMS Handbook* is worth much more than the price it costs. Therefore, everyone working in the field of or trying to become acquainted with MEMS should purchase the book. For those new to the field, it is a good introduction into the topic, as all the chapters are written in the style of a textbook. There are several applications and examples of MEMS underlined by many figures of good quality. For those who are almost an expert, the handbook is a very good reference, both for the topic of fluid dynamics at large Knudsen numbers, as well as for design and fabrication of MEMS. Especially, the chapters on MEMS fabrication, LIGA technique, and related chapters serve as a very good basis because they report much data about different etching techniques, composition, and ingredients of sacrificial layers and etchants. There are many examples of topics and fabrication processes, such as chemical vapor deposition (CVD) and low-pressure chemical vapor deposition (LPCVD), deep reactive ion etching (DRIE), isotropic and anisotropic etching, lithography, and molding, to name only a few.

11N17. Control of Nonlinear Distributed Parameter Systems. - Edited by G Chen *(Texas A&M Univ, College Station TX)*, I Lasiecka *(Univ of Virginia, Charlottesville VA)*, J Zhou *(Texas A&M Univ, College Station TX)*. Marcel Dekker, New York. 2001. 376 pp. ISBN 0-8247-0564-5. $150.00.

This book contains 16 state-of-the-art reviews and encompasses an extensive breadth of interdisciplinary concerns. It also investigates control laws, stability and optimization systems, and feedback syntheses for systems defined by partial differential equations; chronicles advances in *smart* materials, developing, methodology for nonlinear distributed parameter systems (DPS), and dynamical systems; illuminates the effects of chaotic behavior on linear wave equations; articulates the theory and method for attaining dual control of nonconvex DPS; explains how to achieve bilinear control for semilinear parabolic equations; and details modeling, synthesis, and simulation techniques for static buckling and optimal control of beams, rods, and nonlinear infinite dimensional systems.

11N18. Sensor Based Intelligent Robots. Proc of Int Workshop, Dagstuhl Castle, Germany, Oct 2000**.** - Edited by GD Hager *(Johns Hopkins Univ, Baltimore MD)*, HI Christensen *(Royal Inst of Tech, Stockholm, Sweden)*, H Bunke *(Univ of Bern, Switzerland)*, R Klein *(Univ of Bonn, Germany)*. Springer-Verlag, New York. 2002. 383 pp. Softcover. ISBN 3-540-43399-6. $62.00.

This book constitutes the refereed post-proceedings of selected revised papers from the international workshop. The 20 revised full papers were carefully reviewed and improved for inclusion in this book. Addressing a broad variety of aspects of the highly interdisciplinary field of robotics, the book presents three topical sections on sensing, robotics, and intelligence.

IV. MECHANICS OF SOLIDS

11R19. Cosserat Theories: Shells, Rods and Points. Solid Mechanics and its Applications, Vol 79**.** - MB Rubin *(Fac of Mech Eng, Technion-Israel Inst of Tech, Haifa, Israel)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2000. 480 pp. ISBN 0-7923-6489-9. $205.00.

Reviewed by AH Cardon (Dept of Mech of Mat and Construct, Free Univ Brussels, Pleinlaan 2, Brussels, B1050, Belgium).

This book by Rubin on Cosserat theories is an excellent textbook on the subject with more specific applications to shells, rods, and even points. The book is published as part of the famous series on Solid Mechanics and its Applications, edited by GML Gladwell. This work can be of great help for research engineers and scientists who have to design one- or two-dimensional structural components and who want to understand the basic aspects of those elements out of the one- and two-dimensional analysis without the return to a complete three-dimensional theory.

This book is not of easy access, but the systematic presentation makes it easy to follow and very interesting as further reference work on aspects that were not read in detail during a first lecture.

A short general introduction to the Cosserat model includes an overview not only of the early developments (1893, 1909, 1961, 1972), but also of the more recent applications to many physical problems from electromagnetic effects, over turbulence, microcrack growth, composite materials, plasticity, special behavior of granular media, size effects in rocks to micromechanics of inclusions, and failure of welds. This is followed by an outline of the book showing very clearly the structure of the approach from the basis to the numerical solutions.

In order to have a good basis, Chapter 2 gives an introduction to the basic tensor operations in curvilinear coordinates completed by an Appendix (A) on tensor operations and a short Appendix (B) on specific coordinate systems, polar and spherical.

Chapter 3 reviews the basic equations for the motion of a three-dimensional continuum starting with the balance laws. Further on, anisotropic and isotropic nonlinear elastic materials are discussed followed by a small strain theory and the problem of small deformations superimposed on a large deformation. After some examples, vibrations are analyzed, and in fine a short description is given of the dissipation inequality and the material damping.

The following three chapters (4, 5, and 6) have a similar structure related to the Cosserat theory of Shells (Ch 4), Rods (Ch 5) and Points (Ch 6). In those chapters after description of the Cosserat model, the balance laws are derived from the 3-dimensional theory and by the direct approach. The anistropic nonlinear behavior is followed by a small strain theory, some applications for bending and torsion, vibrations, membranes (Ch 4), strings (Ch 5), the linear theory, the dissipation inequality, and the material damping.

Chapter 7 considers the Cosserat approach to numerical solution procedures in continuum mechanics in general, followed by numerical solution for the Cosserat shell, and the numerical solutions of string, rods, and two- and three-dimensional problems using the theory of the Cosserat point.

After the two appendices, the author introduces some 248 exercises on all the chapters in order for the reader to arrive at a good understanding of the content of the book.

The book is completed by an extensive reference list of some 150 titles and a very good index. The presentation of the book is excellent, and the few figures are of good quality. The stated aims of the author are succeeded by the content and the structure of the book. *Cosserat Theories: Shells, Rods and Points* has to be present in the libraries of all civil and mechanical engineering departments as well as in all departments of theoretical and applied solid mechanics. Researchers working on beams, rods, plates, shells, and nonlinear structural mechanics in general will find important support in this reference book.

11R20. Mechanical Evaluation Strategies for Plastics Materials. - DR Moore *(ICI Tech, Witton Res Center, UK)* and S Turner *(Queen Mary and Westfield Col, Univ of London, UK)*. Woodhead Publ Ltd, Cambridge, UK. 2001. 328 pp. ISBN 1-85573-379-X. $195.00.

Reviewed by KL Murty (Dept of Nucl Eng and Mat Sci and Eng, N Carolina State Univ, PO Box 7909, Raleigh NC 27695-7909).

The authors of this book on the evaluation of mechanical and fracture properties of plastics apparently had extensive experience on the subject during their association with ICI's research department. As per the Preface by an unspecified person, the book ''contains strategies for experimental approaches to stiffness, strength and toughness testing'' of plastic materials. The presentation style of the book is quite different from the norm, and many short numbered sections comprise each of the chapters, apparently not to deviate from the main thrust of the chapter. The supplements following the sections of the chapter were to cover the respective details referring back to the numbered sections. This reviewer's initial impression after reading the first chapter was that it is refreshingly new; however, when it came to real subject matters in the second chapter onwards, the arrangement was found to be rather annoying and perhaps not very useful, and unserving. Lack of headings for sections in the chapter makes it difficult to follow the subject matter, and one has to refer to the numbered sections and supplements to match and follow the descriptions.

Following a detailed introduction (Ch 1) of 33 pages, the authors deal with the general aspects of modulus, ductility, and stiffness, as well as toughness in the second chapter while these subjects are covered (along with the definitions, again) in the subsequent chapters. Modulus is covered in more than four chapters. The determination from constant deformation rate tests (Ch 4), sinusoidal excitation tests (Ch 5), and step-function excitation tests (Ch 6) are followed by anisotropy in Chapter 7. Chapter 6 on Step-Function Excitation Tests is essentially creep and relaxation testing, and the nomenclature used by the authors is confusing. Larsen-Miller parameter (p 191) is the only parameter covered in these chapters with no mention of others such as Monkman-Grant, Sherby-Dorn, etc. Chapter 7 on anisotropic modulus and stiffness contains enough details but very few examples are included.

The subsequent chapters, from 8 onward, deal with the strength, ductility, and toughness—again, one full chapter is devoted to the so-called general principles wherein simple fundamental aspects are described. The sequence covered in the chapter is in the reverse order of the title with toughness followed by ductility and strength. The experimental evaluations of these parameters under constant loading are covered in Chapter 9, which also included good detail on Considere's construction for determination of necking strain, tensile strength, etc, as well as K_c tests and data. The correlation between the ductility and toughness is nicely illustrated. The chapter entitled strength and ductility from step-function and cyclic excitations are essentially creep, fatigue, and fatigue crack-growth albeit very basic aspects are dealt with. Section S10.11, on Environmental stress cracking, contains a brief discussion on stress corrosion cracking of plastics, with Figs. S10.11/1 and S10.11/2 illustrating examples of the *static fatigue* (although the authors did not use this word). Section S10.15 is an excellent example of the engineering design of a water storage tank using creep and fatigue data. The ductility under impact loading was the subject matter of the last and final chapter that contained good illustrating examples. The sections in Chapter 11 cover some interesting practical examples such as the optimum coating thickness for avoiding brittle fracture, effect of thickness for impact resistance of flexed plate, etc.

The authors' emphasis throughout the book is on the rationale for data generation, selection of appropriate test methods, and statistical significance of the generated data sets. Although *Mechanical Evaluation Strategies for Plastics Materials* is enjoyable to read with some interesting aspects covered in each of the chapters, it is not clear which audience will benefit besides the practicing plastics engineer with particular interest and/or responsibility for mechanical property testing of plastics.

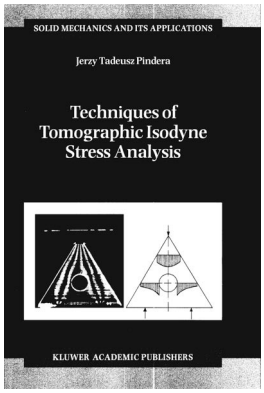
11R21. Techniques of Tomographic Isodyne Stress Analysis. Solid Mechanics and its Applications, Vol 75**. -** JT Pindera *(Dept of Civil Eng, Univ of Waterloo, Waterloo, ON, Canada)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2000. 286 pp. ISBN 0-7923-6388-4. $134.00.

Reviewed by AM Vinogradov (Dept of Mech Eng, Montana State Univ, Roberts Hall, Bozeman MT 59717).

This is an interesting, very specialized, and somewhat unusual book. It focuses on the method of isodyne stress analysis, using optical measurements. The author states that the ''book is written as a technical guide for tomographic isodyne experiments and as a reference monograph.''

The book consists of five parts. Part 1, Review of Basic Motions: Reality, Models and Theories, is of a very general nature. It

presents the author's philosophical views in regard to the society and technology interaction, including discussions of general technological trends, modern technological requirements, and interrelations between theoretical and experimental approaches in science and engineering. The stated purpose of such considerations is to define the frame of reference for the presentation of the main subject.



Part 2, Review: Basic Stress-Strain Relations, Basic Materials Relations, provides an overview of material characterization techniques based on the theories of linear elasticity and linear viscoelasticity. Further, the author outlines the basic requirements of these constitutive theories in terms of adequate experimental determination of material responses under various stress-strain conditions that depend parametrically on time and temperature.

It is only starting with Part 3, Outline of the Theories of Analytical and Optical Isodynes, when the author concentrates on the main subject, ie, the tomographic isodyne stress analysis. Part 3 provides a theoretical foundation for nondestructive stress measurements using optical techniques. The author demonstrates that the method of isodyne stress measurements satisfies the required standards of accuracy and reliability in regard to the obtained empirical information.

Part 4, Isodyne Experimentation–Theories and Techniques, contains a discussion of the experimental procedures required for the implementation of the isodyne stress analysis. In this regard, the author provides a general overview of the basic principles and experimental techniques underlying the optical isodyne methodology. Of particular interest is the list of various materials and the respective requirements that would warrant the application of the method. The author also presents some guidelines for sample preparation and accuracy considerations in regard to data collection.

Part 5, Case Studies, contains a number of examples illustrating the isodyne method of stress measurements under various loading conditions, including two-dimensional stress analysis of plates and the stress analysis of beams under the action of concentrated loads. The use of the isodyne methodology for dynamic applications is briefly discussed.

Each part of the book includes a reasonably extensive bibliography. However, from the entire list of references, it is obvious that the author relies primarily on his own work, providing very limited citations of the work by other researchers in the field. This fact creates an impression of certain subjectivity. A more broad coverage of the subject matter in the context of historical developments in the field would have been a welcome addition.

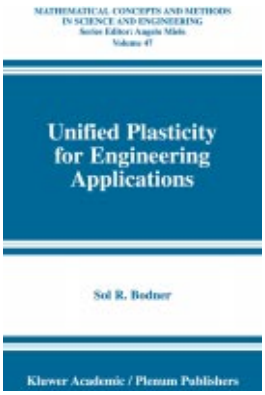
In general, the book is well written. The philosophical undertones make the reading interesting and somewhat entertaining. The quality of the figures, tables, and other illustrations is excellent. It is obvious that the author is one of the top experts in the field.

Techniques of Tomographic Isodyne Stress Analysis will be of interest to researchers and engineers working in various areas of the stress analysis of structures and components, as well as those interested in nondestructive material evaluation techniques. The book is recommended for library and individual collections.

11R22. Unified Plasticity for Engineering Applications. Mathematical Concepts and Methods in Science and Engineering, Vol 47**.** - SR Bodner *(Technion-Israel Inst of Tech, Haifa, Israel)*. Kluwer Acad/Plenum, New York. 2002. 115 pp. ISBN 0-306-46744-5. $75.00.

Reviewed by S Kaliszky (Dept of Struct Mech, Tech Univ, Muegyetem rkp 3, Kmf 35, Budapest, H-1521, Hungary).

Constitutive equations of plasticity which usually do not include a yield condition and do not separate the elastic and inelastic strains during the overall material response are considered unified. This monograph presents a unified plasticity theory based on the material models elaborated by Rodner and Partom during the past 30 years. The theory does not require yield criterion or loading and unloading conditions. Considering small strains, the elastic and inelastic strain rates are supposed to be additive and generally non-zero at all stages of loading and unloading. The equations describing the theory are reasonably simple, have a firm physical basis, and represent the principal macroscopic properties of inelastic materials such as strain rate sensitivity, temperature dependence, stress saturation under imposed loading, isotropic and directional hardening for monothonic and reverse loadings, primary and secondary creep, thermal recovery of hardening, and stress relaxation. The comparisons of the model to a number of experimental results show good agreement. In addition to the theory, methods based on conventional uniaxial stress tests, which can be used to the determination of the parameters and material constants appearing in the constitutive equations, are also proposed, and a list of these parameters for different metals and metallic alloys are presented.



There are a number of subjects in dynamic plasticity such as wave propagation in structures due to impact, overall structural response due to high intensity rapidly applied pressure, and ballistic penetration where inelastic deformation, strain rate sensitivity, hardening, and temperature effects have a dominant role. The proposed material model takes all these material characteristics and effects in a set of equations into consideration, and therefore, can form a firm and efficient basis to the investigation of dynamic plasticity problems and other specific applications such as, eg, gas turbine engines and power generation plants. To promote the application, a number of finite element programs listed in the book have been developed that implement the proposed constitutive equation as a material model.

The monograph is confined to the detailed and very precise discussion of the Bodner-Partom unified plasticity model and to the comparison to its results of several experiments and to a number of exercises by various authors. It was not the intention of the author to present a comprehensive description and criticism of other unified material models. The illustration of industrial applications of the proposed constitutive equation by showing a few examples is also not included in the book.

The presentation of the book is excellent. The text is well written, the treatment and derivation of the theories are clear, and the figures and diagrams are of good quality. The monograph is an important and valuable contribution to material sciences and theory of plasticity. *Unified Plasticity for Engineering Applications* is highly suggested to researchers, PhD and postdoctoral students working in these fields, and to engineers dealing with the design and control of special structural and industrial problems at which the high intensity dynamic loads, the inelastic and viscous material properties, and the high temperature effects have a dominant role.

11R23. Variational Inequality Approach to Free Boundary Problems with Applications in Mould Filling. ISNM, Vol 136**.** - J Steinbach *(Gartnerstr 8, Augsburg, 86153, Germany)*. Birkhauser Verlag AG, Basel, Switzerland. 2002. 294 pp. ISBN 3-7643-6582-X. $149.00.

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

The purpose of this monograph is to study the evolutionary variational inequality approach to a moving free boundary problem with respect to both the mathematical analysis and to the numerical treatment. The author is successful in his aim to provide a detailed systematic treatment of the conceptual, mathematical, and numerical aspects of the approach, including the problems of existence, uniqueness, regularity, and time evolution of solutions, the numerical (finite element and finite volume) approximations of the problem, and practical applications of the approach.

The book is primarily addressed to applied mathematicians working in the field of nonlinear differential equations as well as to scientists from the application areas of engineering and physics. The layout is pleasant, the figures are original, and a well-done subject index is available. The lists of symbols and figures are included in the book as well.

The book is logically divided into three major parts: mathematical analysis (Chs 2 and 3), numerical treatment (Chs 4 and 5), and the applications of the approach to the numerical analysis of the injection and compression moulding process (Ch 6). The short history of the problem, its place in the general theory of nonlinear differential equations, as well as the general outline of the following chapters are given in the Introduction.

In Chapter 2, *Derivation of the Evolutionary Variational Inequality Approach*, an evolutionary variational inequality is derived as a fixed domain formulation for a general moving free boundary problem. The relation to another fixed domain formulation (weak formulation) is discussed, and the formulations are compared.

In Chapter 3, *Properties of the Variational Inequality Solution*, the analytical aspects of the evolutionary variational inequality formulation and properties of the solution of the problem are studied. The existence of a unique solution for the problem as a continuous mapping to the Sobolev space is proved. The regularity of the solution with respect to time as well as the spatial regularity is studied on the basis of the investigation of the associated penalty problem.

Chapter 4, *Finite Volume Approximations for Elliptic Variational Inequalities*, provides a systematic treatment of the finite volume method for the numerical solution of interior and boundary obstacle problems of elliptic type with mixed boundary conditions in two and three dimensions. A study of the finite volume approximation, which includes the solvability, stability, error analysis, and maximum principle, is performed. The comparison with the piecewise linear finite element approximation is carried out. The results of the numerical analysis of the finite volume schemes applied to elliptic variational inequalities, described in this chapter, present basic tools for the numerical analysis of the evolutionary inequalities, given in the next chapter.

In Chapter 5, *Numerical Analysis of the Evolutionary Variational Inequalities*, the finite element and finite volume schemes applied to the solution of the evolutionary variational inequalities with mixed boundary conditions are studied. The solvability and stability of discrete problems, maximum principle, error estimation, and different penalization methods of the approximations are considered.

In Chapter 6, *Injection and Compression Moulding as Application Problems*, the mathematical models of the injection and compression molding process based both on the generalized Hele-Shaw flow (which includes non-isothermal and possible non-Newtonian effects) and on three-dimensional non-Newtonian Navier-Stokes equations without the Hele-Shaw simplifications are presented. The numerical implementations of the models (finite volume and finite elements) are discussed in this chapter. The influence of geometrical and operating conditions of the injection-compression molding process on the flow front movement, pressure distribution, and the appearance of air traps in molding is studied numerically on the basis of the evolutionary variational inequality approach.

The big merit of the book is that it gives a systematic, detailed, and comprehensive treatment of the evolutionary variational inequality approach to a degenerate moving free boundary problem, including mathematical, numerical, and application aspects. This approach is very efficient and can be useful in solving many problems of considerable importance for practical applications. The book is well structured, and all the concepts, ideas and solutions are presented taking into account the history of the problem and the state-of-the-art of corresponding areas of applied mathematics and engineering.

In general, *Variational Inequality Approach to Free Boundary Problems* is highly recommended to libraries and to specialists working in the areas of nonlinear differential equations and their applications to engineering and physical problems.

11N24. Advanced Polymer Composites and Polymers in the Civil Infrastructure. - LC Hollaway *(Composite Struct Res Unit, Dept of Civil Eng, Univ of Surrey, Guildford, GU2 5XH, UK)* and PR Head *(Maunsell, Maunsell House, 160, Croydon Rd, Beckenham, BR3 4DE, UK)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 326 pp. ISBN 0-08-043661-7. $115.50.

In recent years, the fabrication technologies for the production of advanced polymer composites have been revolutionized by sophisticated manufacturing techniques. These methods have enabled polymer composite materials to produce good quality laminates with minimal voids and accurate fiber alignment.

This book provides a background to the understanding and use of advanced polymer composites in the civil infrastructure; examples have been provided to illustrate the use and versatility of the material. Furthermore, the book discusses the current fabrication techniques, design methods, and formula for the design of structural composite systems. It also discusses the fundamentals of geosynthetics used in geotechnical engineering.

11N25. Applications of Automation Technology in Fatigue and Fracture Testing and Analysis, 4th Volume. (STP 1411)**.** - Edited by PC McKeighan *(Southwest Res Inst, San Antonio TX)*, AA Braun *(MTS Systems Corp)*, AM Nicholson *(Instron Corp)*, RD Lohr *(Instron Ltd)*. ASTM, W Conshohocken PA. 2002. 257 pp. ISBN 0-8031-2890-8. $90.00.

Fourteen peer-reviewed papers examine the range of the latest computer applications in the modern test lab. Topics include latest applications of computer hardware and software in the mechanical testing laboratory; specific fatigue and fracture test system implementations, especially as related to more challenging applications, such as high frequency or thermomechanical fatigue testing; how fatigue or fracture data are applied in the design process to yield safer structures with longer service lives; strategies for coping with greater amounts of recorded data; and challenges faced in full-scale testing, either from a control or end-level editing viewpoint.

11N26. Cam Design and Manufacturing Handbook. - RL Norton. ASME, New York. 2001. 640 pp. ISBN 0-8311-3122-5. $89.95.

The use of computers for engineering design and in the numerical control for manufacturing has dramatically changed the cam design and manufacturing process. This handbook brings together up-to-date cam design technology, correct design and manufacturing procedures, and recent cam research results in this one volume.

Beginning at an introductory level and progressing to more advanced topics, the handbook provides information needed to properly design, model, analyze, specify, and manufacture cam-follower systems. In addition, it is accompanied by a 90-day trial demonstration copy of the Professional Version of Dynacam for Windows V. 7.0. Written by the author, this program solves the equations described in the book and allows, in its fully-licensed version, the design, dynamic modeling, analysis, and generation of follower center, cam surface, and cutter coordinate data for any cam. It also defines conjugate cams for any application. Also included are 90-day trial demonstration copies of programs Fourbar, Sixbar, and Slider for the design of cam-follower linkages.

11N27. Centrifugal Processing. Proc of 4th Int Workshop on Materials Processing at High Gravity, Clarkson Univ, May/June 2000**.** - Edited by LL Regel and WR Wilcox *(Clarkson Univ, Potsdam NY)*. Kluwer Acad Publ, Norwell MA. 2001. 378 pp. ISBN 0-306-46654-6. $150.00.

Seventy-three attendees from 16 countries covered topics that extended beyond materials processing, thus the name: *Centrifugal Processing*.

Centrifugal processing includes the traditional bench-scale centrifuges, as well as all rotating systems utilizing the centrifugal and Coriolis forces to provide unique performance. Several theoretical studies dealt with the influence of rotation on fluid convection on surfaces and in pipes, tubes, and porous media. These have applications to integrated-circuit chip manufacturing, alloy casting, oil production, crystal growth, and the operation of rotating machinery.

11N28. Coated Textiles: Principles and Ap-

plications. - AK Sen *(Defense Mat and Stores, Res and Dev Est, Kanpur, India)*. CRC Press LLC, Boca Raton FL. 2001. 245 pp. ISBN 1-58716-023-4. $149.95.

Intensive research and development in coated-fabric materials and processes has led to new and improved products for a wide range of consumer, industrial, medical, and military applications. This book provides an up-to-date presentation of this technology and its applications.

From coating materials and substrates to coating methods, physical properties, and testing techniques, the author presents detailed examinations of the chemistry, processing, properties, and applications of coated fabrics. He explores the full range of applications, including foul-weather clothing; architectural, automotive, and other non-apparel uses; and high-tech applications, such as chemical protective clothing, thermochromic fabrics, camouflage nets, and metal coated fabrics.

11N29. Computational Methods in Contact Mechanics V. Proc of 5th Int Conf, Seville, Spain, June 2001**.** - Edited by J Dominguez *(Univ of Seville, Spain)* and CA Brebbia *(Wessex Inst of Tech, Southampton, UK)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech Publ, Billerica MA. 328 pp. ISBN 1-853-12872-4. $178.00.

Placing particular emphasis on the application of advanced theories, the 30 papers included cover mechanical, numerical, and mathematical models and a range of applications. The papers are organized into the following sections: Multibody contact; Fracture fatigue and wear; Extrusion and forming processes; Composite materials; Soil structure interaction; and Computational methods.

11N30. Creep, Shrinkage, and Durability Mechanics of Concrete and Other Quasi-Brittle Materials. - Edited by F-J Ulm *(MIT, Cambridge MA)*, ZP Bazant *(Dept of Civil Eng, Northwestern Univ, Evanston IL)*, FH Wittman *(Inst for Build Mat, Swiss Fed Inst of Tech, Zurich, Switzerland)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 832 pp. ISBN 0-08-044002-9. $181.50.

The increasing need for evaluation of the durability performance of concrete structures has led recently to the development of advanced material models and numerical approaches founded on applied mechanics and computational mechanics. This is the unifying theme of the papers presented at the Conference (CONCREEP-6@MIT). The papers are subdivided into four parts: I) Micromechanisms and micromechanics of creep and shrinkage; II) Creep, shrinkage, and fracture couplings; III) Durability mechanics of concrete structures; and IV) From new concrete materials to the design of high performance structures.

11N31. Fatigue and Fracture Mechanics, 31st Volume. (STP 1389)**.** - Edited by GF Halford and JP Gallagher. ASTM, W Conshohocken PA. 2001. 560 pp. ISBN 0-8031-2868-1. $295.00.

This collection of 29 peer-reviewed papers are divided into the following five sections:

Swedlow Memorial Lecture—addresses undergraduate educational needs in the area of fatigue and fracture.

Keynote Tributes to George Irwin—summarizes some of the most important contributions of George R Irwin, the father of modern fracture mechanics.

Cyclic Stress-Strain and Fatigue Resistance—provides experimental or analytical insight into approaches for the evaluation of the cyclic durability resistance of engineering materials.

Elastic-Plastic Fracture Mechanics—examines methods of how to apply this technology to low-strength structural materials used in most civil, oceanographic, power plant, and automotive applications.

Crack Analyses and Application to Structural Integrity—investigates advances in crack analyses, fatigue crack growth behavior, and structural applications.

11N32. Fatigue and Fracture Mechanics, 32nd Volume. (STP 1406)**.** - Edited by R Chona. ASTM, W Conshohocken PA. 2001. 400 pp. ISBN 0-8031-2888-6. $240.00.

Twenty-three peer-reviewed papers detail the latest advances in all aspects of fatigue and fracture mechanics, related technologies, and innovative applications. Topics covered include: new analytical approaches to applications for tried and true methods; life assessment issues facing critical engineering components and structures; fracture behavior under dynamic loading; and failure mechanics in ceramics and composites.

11N33. Finite Element Analysis in Geotechnical Engineering: Application. - DM Potts and L Zdravkovic. Thomas Telford Ltd, London. 2001. 427 pp. ISBN 0-7277-2783-4. $137.00.

This book provides an insight into the use of finite element methods in geotechnical contexts. The aim is to arm the reader with sufficient knowledge that they might make good judgments as to the credibility of the numerical results they may obtain, or review in the future. Through concentrating on case studies, it provides a holistic impression of the subject. It uses practical examples to illustrate the restrictions, pitfalls, advantages, and disadvantages of such numerical analyses.

11N34. Fracture Mechanics Testing Methods for Polymers, Adhesives and Composites. Series on Structural Integrity, Vol 28**.** - Edited by DR Moore *(Business Res Assoc, ICI plc, UK)*, A Pavan *(Dipartimento di Chimica, Industriale e Ingegneria Chimica, Politecnico di Milano, Milan, Italy)*, JG Williams *(Dept of Mech Eng, Imperial Col, London, UK)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 376 pp. ISBN 0-08-043689-7. $134.00.

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

With the establishment of the Technical Committee 4, two major areas were identified as appropriate for the activity: A need for standard, fracture-mechanics-based test methods to be designed for polymers and composites, and a need to explore the use of such data in the design of plastic parts.

11N35. Fracture Resistance Testing of Monolithic and Composite Brittle Materials. (STP 1409)**.** - Edited by JA Salem *(NASA Glenn Res Center at Lewis Field)*, GD Quinn *(Natl Inst for Standards and Tech)*, MG Jenkins *(Univ of Washington)*. ASTM, W Conshohocken PA. 2002. 237 pp. ISBN 0-8031-2880-0. $105.00.

This book features 14 peer-reviewed papers that summarize the latest methods for the measurement of fracture toughness, slow crack growth, and biaxial strength. It also identifies new areas for fracture toughness test methods development and standardization. Papers are divided into the following five sections:

Plenary Session—discusses 30 years of progress in fracture mechanics of brittle materials.

Implications for Design and Testing—focuses on the analysis of plates for biaxial strength testing and the transition in measured fracture toughness from a value associated with the properties of a single grain to the polycrystalline value.

Fracture Toughness Standardization—examines three techniques in the new fracture toughness standard, ASTM C 1421 Standard Test Methods for Determination of Fracture Toughness of Advanced Ceramics at Ambient Temperatures. These techniques show convergence when good metrology is employed. In addition to standardized techniques, this section discusses the single edged V-notched beam method that is on a fast track for standardization in Europe.

Crack Growth Resistance—covers testing of functionally graded materials, elevated temperature R-curve testing, and the study of a toughening mechanism. Although most researchers applied classical mechanical techniques for the measurement of fracture toughness or crack growth resistance, both theoretical and fractographic methods were also presented.

Unique Materials and Environmental Effects—examines elevated temperature fracture toughness testing of particulate reinforced ceramic composites, thermal and environmental effects on the fracture toughness of titanium carbonitrides for machining, and environmental interactions that lead to rate effects in *dynamic fatigue* (ie, stress corrosion) testing.

11N36. FRP Composites in Civil Engineering. Proc of Int Conf, Hong Kong, Dec 2001**.** - Edited by Jin-Guang Teng *(Dept of Civil and Struct Eng, Hong Kong Polytech Univ, Hung Hom, Kowloon, Hong Kong, China)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 1776 pp. 2-Vol set. ISBN 0-08-043945-4. $245.00.

This two-volume proceedings includes keynote and invited papers from the conference.

11N37. Fundamentals of Nanoindentation and Nanotribology II. Proc of 2000 MRS Fall Meeting, Boston**.** - Edited by SP Baker *(Cornell Univ, Ithaca NY)*, RF Cook *(Univ of Minnesota)*, SG Corcoran *(Virginia Tech)*, NR Moody *(Sandia Natl Lab, Albuquerque NM)*. Mat Res Soc, Warrendale PA. 2001. 290 pp. ISBN 1-55899-559-5. $74.00.

This proceedings highlights the maturation in the field of nanoindentation and nanotribology. The emphasis of the 43 papers in this volume is on the use of indentation techniques to solve materials problems and understand materials behavior. Presentations demonstrating extensions of nanoindentation methods include viscoelastic contacts, hard coatings on soft substrates, 3D finite element models, dissipated energy-based analyses, the use of loading and unloading slopes, measurement of residual stresses, and direct comparison of indentation-derived properties with those from bulk tests. Topics covered include modeling and simulations; scanning probe methods; new methods; deformation and deformation mechanisms; adhesion; nanoindentation and nanotribology; and limits of strength in indentation.

11N38. High Performance Structures and Composites. Proc of 1st Int Conf, Seville, Spain, March, 2002**.** - Edited by CA Brebbia *(Wessex Inst of Tech, Southampton, UK)* and WP de Wilde *(Vrije Univ, Brussels, Belgium)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech Publ, Billerica MA. 2002. 672 pp. ISBN 1-853-12904-6. $338.00.

This volume focuses on the application of computational methods to the modeling, control, and management of such structures and materials. Particular emphasis is placed on intelligent smart structures. This includes a range of topics relating to the design, optimization, manufacturing, and experiments within these areas.

11N39. Introduction to Structural Analysis and Design. - SD Rajan. Wiley, New York. 2001. 720 pp. ISBN 0-471-31997-X. $112.95.

This comprehensive book provides a fundamental understanding of the principles of structural analysis and structural design. The discussion of structural analysis and structural design including optimum design are strongly linked through and abundance of analysis and design examples. The book includes a CD-Rom to enhance the understanding of the engineering principles as well as the learning of the use of computer-based tools.

11N40. Load and Global Response of Ships. Book 4 in the Elsevier Ocean Engineering Book

Series**.** - JJ Jensen *(Dept of Naval and Offshore Eng, Tech Univ of Denmark, Lyngby, DK-2800 KGS, Denmark)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 348 pp. ISBN 0-08-043953-5. $125.00.

This book gives an introductory background to naval architecture statistics and strength of materials. Each subject is treated in detail, starting from the first principle. The aim of this title was to derive and present the necessary theoretical framework for predicting the extreme loads and the corresponding hull girder stresses that a ship may be subjected to during its operational lifetime. Although some account is given to reliability analysis, the present treatment has to be supplemented with methods for detailed stress evaluation and for structural strength assessment before a complete structural reliability analysis can be carried out.

The classification societies have issued rules and regulations for a proper structural analysis of a ship and selection of the scantlings. Previously, those rules rather explicitly gave formulas for thickness of the hull plantings, the size of the stiffeners, etc. Such empirical rules must necessarily be rather conservative in order to apply to a large variety of ships.

With the advent of powerful computers, the rules have changed. Today, the naval architect can perform the structural analysis using mainly rational methods based on first principles. The classification society may then specify proper safety factors against local global failure modes, taking into account the consequences of failure and the analysis procedure used. A cruder method of analysis then necessitates a larger safety factor. Therefore, the effort made by the experienced naval architect to perform a detailed structural analysis will be returned not just by a rational structural arrangement, but also often in lower weight of the ship and thus a higher payload throughout the operational lifetime of the ship.

This analysis has attempted to make explicit one way in which designers limit the design space by creating rules to which they expect users to adhere.

It is also an attempt to encourage designers to reconsider the *rules of use* that they have used in their designs, so as to reconceptualize potential usage. This can help design behavior where rule use is not blindly followed.

By making these rules visible, it is possible to expose the limitations of current technology and development design solutions that do not restrict use to the *normal* case of action. Rules are useful to designers because they are simplifications of activity. Rules encode the normal case, and these are simplistic representations of work that re, in many cases, accurate enough for the purpose of design. However, encoding behavior in rules has dangers in that they do not encompass the whole range of behaviors that can be performed. Using examples, this title shows that being able to break rules means that people are able to engage in a richer more flexible set of actions than when they are constrained to a limited range.

11N41. Long Term Durability of Structural Materials. Proc of Workshop, Oct 2000**.** - Edited by PJM Monteiro *(Univ of California, Berkeley CA 94720)*, KP Chong *(Natl Sci Found, 4201 Wilson Blvd, Arlington VA 22230)*, J Larsen-Basse, K Komvopolous *(Univ of California, Berkeley CA 94720)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 312 pp. ISBN 0-08-043890-3. $115.50.

This book includes papers by engineers and scientists who have received grants from the initiative NSF 98-42. They share their results on the study of long-term durability of materials and structures.

The major objective was to develop new methods for accelerated short-term laboratory or in-situ tests which allow accurate, reliable predictions of the long-term performance of materials, machines, and structures.

11N42. Structural Engineering, Mechanics and Computation. Proc of Int Conf, April 2001, Cape Town**.** - Edited by A Zingoni *(Dept of Civil Eng, Univ of Cape Town, Rondebosch 7701, Cape Town, S Africa)*. Elsevier Sci Ltd, Kidlington, UK. 2001. 1712 pp. 2-Vol set. ISBN 0-08-043948-9. $238.00.

This two-volume proceedings contains over 170 papers written by authors from about 40 countries worldwide.

The contributions include six Keynote Papers and 12 Special Invited Papers. There is a healthy balance between papers of a theoretical nature, concerned with various aspects of structural mechanics and computational issues, and those of a more practical nature, addressing issues of design, safety and construction.

11N43. Structure and Mechanical Properties of Nanophase Materials: Theory and Computer Simulation vs Experiment. From the 2000 MRS Fall Meeting, Boston**.** - Edited by D Farkas *(VPI, Blacksburg VA 24061)*, H Kung *(Los Alamos Natl Lab, Los Alamos NM 87545)*, M Mayo *(Penn State, University Park PA 16802)*, H Van Swygenhoven *(Paul Scherrer Inst)*, J Weertman *(Northwestern Univ, Evanston IL 60201)*. Mat Res Soc, Warrendale PA. 2001. 314 pp. ISBN 1-55899-544-7. $85.00.

This volume brings together experimentalists, computer modelers, and theorists to advance the present state of understanding on strength- and ductility-limiting factors in nanostructured materials; clarify issues pertinent to the production and engineering of superior nanostructured materials; and stimulate discussion of potential applications. Emphasis of the 44 papers in this volume if placed on 1) the guidance that computer modeling can give in designing experiments as well as to their interpretation, and 2) the guidance suggested by experiments and characterization of actual nanocrystalline samples in setting up the initial structure of a computer model and the development of new potentials. Nanostructured materials of interest include metals, ceramics and composites in bulk form, thin films, and layered structures. Topics include mechanical properties and deformation behavior; mechanical properties and deformation behavior, softening at very small grain sizes; ceramic materials; and clusters and other nanostructures.

11N44. Structures 2001. Proc of 2001 Structures Congress, May 2001, Washington, DC**.** - Edited by Peter C Chang. ASCE, Reston VA. 2001. CD-ROM. ISBN 0-7844-0558-1. $125.00.

These proceedings contain papers presented at the congress. Papers are listed by session, and sessions were grouped by theme. The themes are aging and historic structures, bridges, seismic, blast/fire, wind/structural control, materials, and research topics. The goal of the congress is to provide a forum for the dissemination of recent developments in structural engineering research and practice.

Analysis of Composite Structures. - C Decolon *(Dept of Mech, Conservatoire Natl des Arts et Metiers, France)*. Hermes Sci Publ, Paris. Distributed in USA by Taylor & Francis Publ, New York NY. 2002. 336 pp. ISBN 1-56032-982-3. $135.00. (Under review)

Numerical Assessments of Cracks in Elastic-Plastic Materials. Lecture Notes in Applied Mechanics, Vol 4**.** - Huang Yuan *(MTU Aero Engines GmbH, Munchen, 80995, Germany)*. Springer-Verlag, Berlin. 2002. 311 pp. ISBN 3-540-43336-8. $89.95. (Under review)

Theory of Composites. Cambridge Monographs on Applied and Computational Mathematics**.** - Edited by GW Milton *(Dept of Math, Univ of Utah, Salt Lake City UT)*. Cambridge UP, Cambridge, UK. 2002. 719 pp. ISBN 0-521-78125-6. $80.00. (Under review)

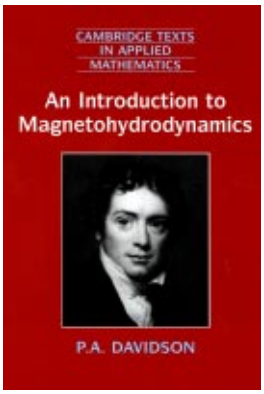
V. MECHANICS OF FLUIDS

11R45. Introduction to Magnetohydrodynamics. Cambridge Text in Applied Mathematics**.** - PA Davidson *(Univ of Cambridge, UK)*. Cambridge UP, Cambridge, UK. 2001. 431 pp. (Softcover). ISBN 0-521-79487-0. $110.00.

Reviewed by K Piechor (Inst of Fund Tech Res, Polish Acad of Sci, ul Swietokrzyska 21, Warsaw, 00-049, Poland).

The reviewed book is a typical textbook on MHD for students in physics, applied mathematics, and engineering. The reader is assumed to be familiar with the classical electrodynamics and quite advanced calculus like surface and curvilinear integrals, Stokes and Gauss theorems.

The book is divided into two parts: Part A, where the fundamentals of MHD are covered, and Part B in which some applications of MHD in engineering and metallurgy are discussed. The division is not very rigorous, so many applications are at least mentioned in Part A, and Part B is not free from theoretical considerations.



Part A, after an introductory Section 1, includes a very brief presentation of the governing equations of electrodynamics (Section 2) and those of fluid mechanics with some discussion of turbulence (Section 3). The main problems of MHD are discussed in Sections 5–7. Roughly speaking, the material of these sections is divided according to the value of the magnetic Reynolds number. Section 5 is devoted to low magnetic Reynolds number. Here the suppression of motion, generation of it, and boundary layers are discussed. The case of moderate magnetic Reynolds number is discussed in Section 6. The last section of Part A, Section 7, contains material on the turbulence at low and high magnetic Reynolds number. Part B, as it was said yet, is written from the point of view of metallurgical application of MHD. Here the magnetic stirring (Section 8), magnetic damping of flows in liquid metals (Section 9), and vacuum-arc remelting (Section 10) are discussed. The role of MHD in production of (mainly) aluminum and the effect of instabilities in reduction cells are presented in Section 11.

Some metallurgical processes, where a high-frequency coil is used, are discussed in the last section, 12.

This textbook is written from an interesting viewpoint. Namely, instead of starting from presenting the physical and mathematical problems, equations, and their solutions in an ''abstract'' form and next looking for possible applications of these results—what is typical for many other textbooks on this subject—the author starts from presenting first natural phenomena or industrial problems, then explains their magnetohydrodynamical nature, and finally he formulates the mathematical formulation (equations). This philosophy causes that almost each section is preceded by (sometimes-long) presentation of the astrophysical or industrial questions. For an impatient reader, who wants to quickly have the equations, the long introductions can be boring and dull. However, in this reviewer's opinion, a reader omitting these parts of the book loses very much!

The author cares greatly about the student. The language of this book is simple, vivid, yet fully scientific. It is a real pleasure to read it. The most important statements and equations are framed. Many well-thought-out figures help readers to understand the discussed topic. A suitable suggested reading and exercises follow each section.

In this reviewer's opinion, *Introduction to Magnetohydrodynamics* is worth recommending, not only to students, but also to everyone who is interested in MHD, particularly to theoreticians who, as a rule, know almost nothing about metallurgical applications of MHD.

11R46. Large Eddy Simulation for Incompressible Flows: An Introduction. Scientific Computation Series**.** - P Sagaut *(DSNA/ETRI, ONERA, 29 av Div Leclerc, Chatillon, 92320, France)*. Springer-Verlag, New York. 2001. 319 pp. ISBN 3-540-67890-5. $59.95.

Reviewed by Yu-Tai Lee (David Taylor Model Basin, 9500 MacArther Blvd, W Bethesda MD 20817).

Although the emergence of the large eddy simulation (LES) began in the sixties, real practical industrial applications did not grow until recently. This recent growth in adapting LES in industrial applications results from the advancement of the parallel computing power, demand of flowfield information pertaining to detailed turbulence structure, and development of broadened finite-difference solution methods in physical space. This book emerges out of this steady growth and is a leading endeavor in presenting the subject area exclusively and methodically.

The author has done a remarkable job in collecting and categorizing various ongoing modeling techniques into a systematical presentation as given in the book. Following the introduction of the concept of resolved and modeled energy spectra in solutions from Reynolds Averaged Numerical Simulation (RANS), unsteady RANS, and LES, the author presents existing mathematical filters for homogeneous and inhomogeneous turbulence and their applications to the Navier Stokes equations. He then proceeds to describe the isotropic and anisotropic subgrid scale models with the functional and structural modeling. The functional modeling models the *action* of the subgrid terms, and the structural modeling models the subgrid stress terms directly. Practical implementation issues such as boundary conditions, filter usage, error examination, and validation are discussed in the later part of the book. Several brief computational examples with simple geometrical configurations and in an order of increasing complexity are given in the last chapter to demonstrate solution differences between LES and RANS.

This book has a good source of references for further detailed investigation and a good subject index section. However, it would certainly enhance readers' understanding if more pictorial presentations had been used, particularly in areas of introducing various modeling concepts and mathematical interpretation. Comparison of computational CPU requirements among RANS, Very Large Eddy Simulation, LES, and Direct Numerical Simulation should be addressed for readers' benefit. In addition, an example in Chapter 11 with more detailed description of the relationship between modeling techniques mentioned in the earlier chapters and its solution would be helpful. How to extract information from LES results is also essential in a practical application and should be addressed in the book.

Turbulence is still one of the most difficult topics in fluid mechanics. Most practical industrial applications with even modest complexity of geometrical configurations require numerical simulations with various levels of complex turbulence modelings. The author takes on a tremendous difficult task of dealing with LES exclusively and did well in conveying the concept of LES.

This book will serve as a good reference book for graduate students and researchers pursuing LES. *Large Eddy Simulation for Incompressible Flows: An Introduction* provides a good summary description of all topics even though the mathematical presentation of the subject used is a bit overwhelming as an introduction book.

11N47. Cavitation of Hydraulic Machinery. - Edited by SC Li *(Univ of Warwick, UK)*. Imperial Col Press, London. 2001. 492 pp. ISBN 1-86094-257-1. $125.00.

This volume deals with cavitation and its effects in turbines and pumps. After introducing cavitation and its relation with hydraulic machines, the invited contributors from throughout the world review relevant cavitation subjects from fundamental phenomena to various problems and solution measures in hydraulic machines.

11N48. Coastal Dynamics 2001. Proc of 4th Conf, June 2001, Lund, Sweden**.** - Edited by H Hanson. ASCE, Reston VA. 2001. 1104 pp. Softcover. ISBN 0-7844-0566-2. $99.00.

This collection of 109 conference papers details the state of the art in the physical aspects of coastal and inlet environments. It provides the latest research to the newest engineering applications.

Topics include effects of coastal structures, wave properties in shallow water, nearshore sediment transport, wave-current interaction, planform modeling, breaking waves, inlet morphodynamics, long waves, suspended sediments, nearshore wave modeling, morphodynamic modeling, inlet hydrodynamics, inlet sediment transport, rip currents, ripples and bedforms, nearshore circulation, micro-scale processes, regional studies, nearshore bars, shoreline and transport modeling, longterm morphodynamics, swash hydrodynamics, beach nourishment, swash and graded sediments, cross-shore response, monitoring, intertidal processes, and rhythmic features.

11N49. Coastal Engineering V: Computer Modelling of Seas and Coastal Regions. Proc of 5th Int Conf, Rhodes, Greece, Sept 2001**.** - Edited by CA Brebbia *(Wessex Inst of Tech, Southampton, UK)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech Publ, Billerica MA. 2001. 344 pp. ISBN 1-85312-879-1. $194.00.

Computer models, in combination with remote sensing and experimental sampling techniques, now provide an efficient tool for the analysis of coastal systems. Featuring state-of-the-art research, this book contains papers presented at the conference. The contributions come from scientists from many different countries and span a multitude of topics and techniques in such areas as estuarine problems, shallow water models, siltation and dredging, tidal simulation, wave studies, pollutant transport and dispersion, and coastal erosion.

11N50. High Speed Jet Flows. - Edited by PJ Morris, DK McLaughlin *(Penn State Univ, State College PA)*, G Raman *(Illinois Inst of Tech, Chicago IL)*. Taylor & Francis Publ, New York NY. 2002. 416 pp. ISBN 1-56032-765-0. $110.00.

A consolidated source of information on the flow physics and acoustics of high-speed jets, this book includes a review of state-of-the-art technology. Topics include flow physics and distinguishing features of high-speed jets; stability in high-speed jets; control of high-speed jets; and aerospace applications of high-speed jet research.

11N51. New Results in Numerical and Experimental Fluid Mechanics III. From 12th STAB/DGLR Symp, Stuttgart, Nov 2000**.** - Edited by S Wagner, U Rist *(Inst fur Aeordynamik und Gasdynamik, Univ Stuttgart, Pfaffenwaldring 21, Stuttgart, D-70569, Germany)*, HJ Heinemann *(DLR, Bunsenstr 10, Gottingen, D-37073, Germany)*, R Hilbig *(Technology Programmes "Flight Physics," DaimlerChrysler Aerospace Airbus, Hunefeldstr 1-5, Bremen, D-28199, Germany)*. Springer-Verlag, Berlin. 2002. 433 pp. ISBN 3-540-42696-5. $219.99.

Fifty papers from the symposium are included in this volume divided into the following sections: High aspect-ratio wings; Low aspect-ratio wings; Hypersonic flows; Fluid-structure-coupling; Fundamentals of fluid flow; Transition and fluidmechanical modeling; Mathematical fundamentals/numerical simulation; Bluff bodies; Turbomachinery; Airframe noise; Laminar flow control; and Measuring techniques.

11N52. Proceedings of the 2002 ASME Fluids Engineering Division Summer Meeting. Held in July 2002, Montreal**.** - ASME, New York. 2002. 397 Papers. ISBN 0-7918-3600-2. ASME Book No I569CD. $450.00. (ASME members $360.00)**.**

This is a compilation of 397 full-length, peer-reviewed technical papers presented at the following fora and symposia:

Forums: High speed jet flows; fluid measurements and instrumentation; fluid machinery; cavitation and multiphase flow; turbulent flows; open forum on multiphase flows: work in progress; advances in free surface and interface fluid dynamics; CFD applications in large facilities; CFD applications at DoE/DoD National Laboratories; CFD applications in automotive flows; vehicular flows; supersonic flows in shock waves; unsteady flows; fluidics; advances in fluids engineering education; 3D flows; environmental flows; flow instabilities and control; fluid mechanics in mixing phenomena II: fundamentals and industrial applications; and wavelet application in fluid mechanics.

Symposia: Flows in manufacturing processes; experimental and numerical flow visualization and laser anemometry; erosion processes; fluid-structure interaction and flow-induced noise in industrial applications; numerical methods for multiphase flows; numerical developments in CFD; finite element applications in fluid dynamics; CFD applications for aerospace; non-invasive measurement in multiphase flows; control and stability of multiphase flows; advances in numerical modeling of aerodynamics and hydrodynamics in turbomachinery; fluid power; fluid flow in micro systems, measurements, analysis, and applications; measurement and modeling of large-scale turbulent structures; marine propulsion and renewable energy (wind and hydro); plus general papers in fluids engineering.

These proceedings on CD-Rom have been created using Adobe Acrobat Reader 5.0 with search and include full and fielded searching, color graphics, readme files, and technical support information.

11N53. Rheology and Fluid Mechanics of Nonlinear Materials-2001. Proc of ASME Int Congress, Nov 2001, New York**.** - Edited by DA Siginer and SI Bakhtiyarov. ASME, New York. 2001. 264 pp. ISBN 0-7918-3568-5. ASME Book No I00536. $130.00. (ASME members $65.00).

The 24 full-length, peer-reviewed technical papers collected in this volume report on results concerning issues related to various aspects of the rheological and flow properties of nonlinear materials, and in particular, advanced materials of the 21st century. Transport processes of importance to various areas of industry are included as well as constitutive theories and various aspects of their behavior. Other issues of fundamental and industrial importance ranging from drag reduction and the modeling of biofluids to the all-important topic of lubrication with viscoelastic fluids are also addressed.

Capillary Surfaces: Shape, Stability, Dynamics, in Particular Under Weightlessness. Tracts in Modern Physics, Vol 178**.** - D Langbein *(Univ Bremen, Am Fallturm, Bremen, 28359, Germany).* Springer-Verlag, Berlin. 2002. 364 pp. ISBN 3-540-41815-6. $219.00. (Under review)

Hydraulics of Stepped Chutes and Spillways. - H Chanson *(Dept of Civil Eng, Univ of Queensland, Brisbane, Australia).* Balkema Publ, Rotterdam, Netherlands. 2002. 384 pp. ISBN 90-5809-352-2. $105.00. (Under review)

Lectures on Fluid Dynamics: A Particle Theorist's View of Supersymmetric, Non-Abelian, Noncommutative Fluid Mechanics and d-Branes. CRM Series in Mathematical Physics**.** - R Jackiw *(Center for Theor Phys, MIT, Cambridge MA 02139).* Springer-Verlag, New York. 2002. 114 pp. ISBN 0-387-95422-8. $49.95. (Under review)

VI. HEAT TRANSFER

11R54. Microgravity Combustion: Fire in Free Fall. - Edited by HD Ross *(NASA Glenn Res Center, Cleveland OH).* Academic Press, San Diego. 2001. 575 pp. ISBN 0-12-598190-2. $124.95.

Reviewed by SR Gollahalli (Lesch Centennial Chair, Director, Sch of Aerospace and Mech Eng, Univ of Oklahoma, Norman OK 73019-0601).

This book is a compilation of eight chapters contributed by 16 authors, who have done extensive research on various combustion issues in normal and microgravity environments. This reviewer also had the privilege of reviewing the first book on Microgravity Combustion, *Combustion Experiments in Zero Gravity Laboratory*, edited by Thomas Cochran (AIAA Progress in Aeronautics and Astronautics, Vol. 73, 1981), for *AMR* (Vol. 35, No. 4, p B586, 1982). During the last two decades, substantial advances have occurred in microgravity testing facilities, diagnostics, and computational capabilities. They have enabled several researchers in USA and abroad to conduct in depth studies on the effects of buoyancy on various scientific phenomena in the fields of physics, fluid mechanics, materials, bioengineering, and combustion. This book is a survey and review of the progress on the effects of gravity through 1999 on several combustion phenomena.

Although, according to the editor, no requirements on organization or content were imposed on authors, it is nice to see most of the chapters follow a somewhat similar and consistent format. They begin with a list of nomenclature, a short abstract, a brief introduction to the topic covered, a detailed review of the research studies on the topic, concluding remarks, and an extensive list of references. Although the title of the book suggests that the material deals with only microgravity combustion, most of the authors have covered the same combustion phenomena in normal gravity to provide baseline information for comparison with microgravity phenomena. Thus, even the readers that are new to a combustion topic, but interested in normal gravity as well as microgravity effects, find the book useful. Of course, as expected, the authors have drawn much of the material from their own research even though they discuss it in the light of other studies in the literature.

The first chapter, written by the editor Howard Ross, presents an overview of the fundamentals of the gravity effects, issues of scaling buoyancy effects, experimental methods available for minimizing gravity influence, and an example of candle flame characteristics affected by gravity. The second chapter on premixed flames by Paul Rooney begins with a discussion of the salient time scales significant in microgravity combustion and deals with buoyancy effects on flammability limits, flame instabilities, stretched and curved flames, cool flames, and turbulent flames. This author also presents a list of topics recommended for future research. Gerard Faeth's third chapter covers laminar and turbulent diffusion flames, limiting the presentation to only gas flames. After briefly discussing the significance of non-dimensional numbers relevant to quantify the effects of gravity, the author discusses microgravity combustion experimental facilities and presents extensive experimental data on the flame shapes, flame structure measurements and predictions, and soot processes. The second half of this chapter is devoted to turbulent diffusion flames, including laminar flamelet concepts, flame vortex interactions, and transition to turbulence.

Microgravity droplet combustion is the topic of the fourth chapter by Mun Young Choi and Frederick Dryer. After an introduction to the literature on low gravity studies including the classical experiments of Kumagai, the authors present classical theories of droplet combustion, recent advances in theoretical analysis, experimental methods for microgravity studies, and extensive experimental and numerical results on n-heptane, methanol, and multicomponent droplet combustion including its disruptive behavior. This chapter also covers other pertinent topics such as droplet arrays, pressure effects, and convective combustion effects. The fifth chapter, by James Tien and his coauthors, is devoted to flame spread and smolder wave propagation and includes a section on the overview of flame spread over solid surfaces, relevant time scales, theoretical models of flame spread over thin solids, ignition of solids in opposed and concurrent flows, flame spread over liquid pools, and smoldering wave propagation. Richard Yetter and Frederick Dryer discuss the classification and regimes of metal particle combustion with a focus on microgravity research studies in Chapter 6 and conclude it with recommendations for future studies. Chapter 7, by Richard Axelbaum and John Moore, deals with combustion applications for material synthesis. Condensed-phase combustion, self-propagating high-temperature combustion, the gas-phase combustion synthesis processes, and the important reaction parameters that govern them are discussed. The applications of these processes and influence of gravity for the production of powders, fullerenes, and nanotubes are covered. Robert Friedman and Howard Ross present the applications of combustion technology to fire safety issues in human-crew space missions including lunar and Martian missions.

The book's editing, printing, and quality of illustrations are impressive. The cover design showing the candle flame is an appropriate reflection of the contents of the book. The table of contents and subject index are organized well. This book contains not only the basic material required for a

beginning researcher in microgravity combustion, but also includes a valuable collection of recent data and references useful for experienced researchers as well. *Microgravity Combustion: Fire in Free Fall* is recommended as a valuable reference source for research libraries and higher educational institutions.

11N55. Advanced Computational Methods in Heat Transfer VII. Proc of 7th Int Conf, Halkidiki, Greece, April 2002**.** - Edited by B Sunden *(Lund Inst of Tech, Sweden)* and CA Brebbia *(Wessex Inst of Tech, Southampton, UK)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech Publ, Billerica MA. 2002. 532 pp. ISBN 1-8531-2906-2. $285.00.

Containing edited versions of the papers presented at the conference, this book reflects the extensive research presently being carried out in the field. The book presents new approaches to the numerical solutions of heat transfer problems. Methods discussed include all well-established and efficient numerical techniques like finite differences, finite volume, finite elements, and boundary elements. Special attention is also paid to complex thermal problems from engineering practice. The contents are organized into nine sections, as follows: Diffusion-convection; Conduction including nonlinear problems; Natural and forced convection; Phase change; Metal casting, Welding, forging, and other processes; Heat and mass transfer; Advances in computational methods; Heat exchangers; and Modeling and experiments in heat transfer. An author index is also included.

11N56. Advances in Chemical Propulsion: Science to Technology. Environmental and Energy Engineering Series**.** - Edited by GD Roy *(Office of Naval Res, Arlington VA)*. CRC Press LLC, Boca Raton FL. 2001. 552 pp. ISBN 0-8493-1171-3. $129.95.

This book reports on the progress achieved by the team of scientists and engineers participating in the Office of Naval Research Propulsion Program. Its chapters, each written by the scientists who performed the research, cover all aspects of the combustion process, from chemical synthesis to reaction pathways of the fuel, from combustor performance to the reduction of emissions, from the sooting problem to thrust vectoring, and from diagnostics to control. They discuss the relevant issues, describe the approach used and the results obtained, and show how the findings can be extended to practical applications. The work offers a comprehensive survey of the field, from pre-to post-combustion. It suggests directions for new research efforts and reflects the state-of-the-art technologies and issues that have a direct impact on combustion systems, both present and future.

11N57. Proceedings of Turbo Expo 2002. Sponsored by ASME, June 2002, Amsterdam**.** - ASME, New York. 2002. CD-ROM. ISBN 0-7918-3601-0. ASME Book No I570CD. $595.00. (ASME members $476.00)**.**

This proceedings on CD-Rom is a compilation of 621 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.

Created using Adobe Acrobat Reader 5.0 with search, this CD allows users to view, search, download, and print information electronically generated and produced in PDF format. It includes full and fielded searching, color graphics, readme files, and technical support information.

Dynamics of Regenerative Heat Transfer. Series in Computational and Physical Processes in Mechanics and Thermal Sciences**.** - AJ Willmott *(Dept of Comput Sci, Univ of York, UK)*. Taylor & Francis Publ, New York NY. 2002. 298 pp. ISBN 1-56032-369-8. $99.00. (Under review)

Radiation Heat Transfer: A Statistical Approach. - JR Mahan *(Dept of Mech Eng, VPI, Blacksburg VA)*. Wiley, New York. 2002. 482 pp. CD-Rom included. ISBN 0-471-21270-9. $120.00. (Under review)

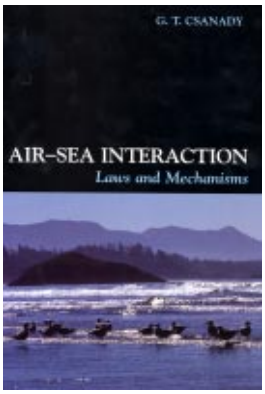
VII. EARTH SCIENCES

11R58. Air-Sea Interaction: Laws and Mechanisms. - GT Csanady *(Old Dominion Univ, Norfolk VA)*. Cambridge UP, Cambridge, UK. 2001. 239 pp. (Softcover). ISBN 0-521-79680-6. $95.00.

Reviewed by JL Lumley (Dept of Mech and Aerospace Eng, Cornell Univ, 256 Upson Hall, Ithaca NY 14853-2801).

This book would make a wonderful text for a graduate-level course in air-sea interaction. The style is accessible and friendly, the descriptions very clear, and the figures excellent. Unfortunately, the index is a little sketchy, but it is not a serious problem.

Csanady covers the transfer laws of the air-sea interface, wind waves and the mechanisms of air-sea transfer, mixed layers in contact, hot towers, and the ocean's warm water sphere.



The transfer laws are treated by Monin-Obukhov similarity theory, and the presentation of wind waves covers the classical work on equilibrium spectra. Turbulence generation by wave breaking is much less well understood, but is clearly presented with good diagrams. The discussion of air-side and water-side gas, heat and vapor flux is excellent. The discussion of air-side and water-side mixed layers and deep convection (hot towers and chimneys) is very clear; in addition to classical material on mixed layers that is easier to deal with analytically, there are wonderful diagrams of the real world—cloud structure, upwelling, thermocline depth, thunderstorms, squall lines, hurricanes, pycnostads (well-mixed boluses of seawater). The warm water sphere discusses the relatively shallow pool of warm water that lies on the surface of the ocean that makes it possible to live in Norway, but not at the corresponding southern latitude, and that is responsible for hurricanes and monsoons. Each chapter begins with a quite general introduction, placing the phenomenon in a global context.

Although, of course, this book will be of most interest to people in meteorology, oceanography and environmental engineering, it also serves as an eye-opening introduction to the complex effects of buoyancy for mechanical engineers who are accustomed to dealing with shear and nothing else. *Air-Sea Interaction: Laws and Mechanisms* would make a nice addition to the bookshelf of any physical scientist, and should certainly be purchased by libraries of research universities.

This reviewer finds it a little distressing that, at $95, the book is worth nearly $0.40 per page, just under seven times the cost of a photocopy.

11R59. Computational Methods in Environmental Fluid Mechanics. - O Kolditz *(Center for Appl Geosci, Univ of Tubingen, Sigwartstr 10, Tubingen, D-72076, Germany)*. Springer-Verlag, Berlin. 2002. 378 pp. ISBN 3-540-42895-X. $54.95.

Reviewed by LA Glenn (Computational Phys Group, Geophys Div, MS L-200, LLNL, 7000 East Ave, Livermore CA 94550-9900).

This is intended to be a graduate-level textbook for students in civil and environmental engineering. It is organized into four parts: Continuum Mechanics, Numerical Methods, Software Engineering, and Selected Topics.

The first part considers the general balance equations of mass, momentum, and energy; averaging concepts for turbulence; a discussion of porous media; and the mathematical and physical classification of the partial differential equations (PDEs) governing fluid flow and related transport processes. The second part deals with basic concepts for solving PDEs; concepts of approximation theory; and a description of finite difference, finite element, and finite volume methods, with application to diffusion, advection, and transport processes. This material spans roughly half of the book and, while reasonably well organized, really covers no new ground that is not readily available in numerous other standard texts on fluid mechanics. In fact, the roughly 100 pages focusing on numerical methods affords only quite skimpy treatment of many important topics that would be required before a student could reasonably be expected to apply these methods to actual problems.

In Parts 3 and 4, by contrast, this book breaks new ground. The author believes that object-oriented programing methods are important tools for modeling complex systems, and Part 3 is an introduction to these methods and their application to coupled processes in subsurface systems (geomechanics, single and multiphase

flows, heat and mass transport, and chemical and biological processes). Unfortunately, Part 3 covers only 40 pages so that, here again, one gets only the most meager treatment of the subject. This reviewer found himself wishing that Parts 1 and 2 had been dispensed with and this part extended accordingly.

The last part of the book is divided into four chapters, each of which is a fairly self-contained segment dealing with problems of particular interest to the author: nonlinear flow in fractured media, heat transport in fractured porous media, density dependent flow in porous media, and multiphase flow in deformable porous media. On each topic, there is a nice introduction to its relevance in environmental fluid mechanics, a description of the governing equations and approximations, an outline of the numerical scheme employed for solution, comparison of solution results with experimental data, and a bibliography giving relevant papers and background material.

Computational Methods in Environmental Fluid Mechanics is well illustrated throughout, and the text and mathematical derivations are clear and relatively easy to follow. One complaint, a minor one to be sure, is that the index is arranged rather poorly so that some topics are hard to locate. Although it may serve as a useful reference, the use of this book as a graduate text in computational fluid mechanics is problematical since many important practical issues arising in the application of the numerical methods are either ignored or given only very skimpy treatment.

11R60. Macroscale Models of Flow Through Highly Heterogeneous Porous Media. Theory and Applications of Transport in Porous Media, Vol 16**.** - M Panfilov *(Oil and Gas Res Inst, Russian Acad of Sci, Moscow, Russia)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2000. 363 pp. ISBN 0-7923-6176-8. $148.00.

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

This book is a scholarly presentation of work done by the author at the Russian Academy of Science, in the Oil and Gas Research Institute of Moscow. The goals of the book are to show some new results in the field of modeling transport through highly heterogeneous media, based on the homogenization theory and to illustrate the homogenization method as a powerful tool to deduce new models in continuum mechanics.

The book is divided into five chapters including One Phase Darcy's Flow in Double Porosity Media, Chemical or Heat Convection-Diffusion Transport Through Highly Heterogeneous Porous Media, Dispersion Tensor in Anisotropic Network Media, Stream Configuration Method, and Two-Phase Flow in Pseudo-Cavity Media. The porous medium consists of two types of rocks with contrasting permeabilities. Each chapter is preceded by a review of the previously published literature on the subject. Chapter 1 lists 163 references that address methods of averaging in previous work. Chapter 2 has 59 references, Chapter 3 refers to the Chapter 1 list, Chapter 4 has 60 references, and Chapter 5, 7 references. This scholarly review in itself makes the book valuable. It includes the modification of homogenization techniques, classification of flows, deduction of new effective models of flow, definition of the macroscale parameters and function, description of dynamic or non-equilibrium effects, solution of the cell problems, reduction of the two-phase cell problems to the saturation independent ones, development of some effective tools to compute the effective functions in disordered highly heterogeneous media, computational analysis of the derived models, and applications to some problems of the oil industry.

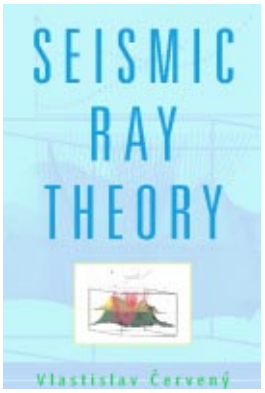
This reviewer believes that *Macroscale Models of Flow Through Highly Heterogeneous Porous Media* should be of interest to civil, environmental, hydraulic, and petroleum engineers as well as scientists and engineers in reservoir characterization, chemical engineering, and geophysics. It deserves to be shelved in technical libraries.

11R61. Seismic Ray Theory. - V Cerveny *(Charles Univ, Praha, Czech Republic)*. Cambridge UP, Cambridge, UK. 2001. 713 pp. ISBN 0-521-36671-2. $95.00.

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

Vlastislav Cerveny has been a leader in the area of seismic ray theory for about 40 years. He has received various international awards for his work and has co-authored two previous books on aspects of the same topic. The present book appears to be designed to serve as a fairly comprehensive reference book on ray theory, with the main applications being elastodynamics and seismology. In the Introduction, the author clarifies what will and will not be covered in the text. The book aims to cover high-frequency asymptotic methods, and in particular, the emphasis is almost entirely on the zeroth-order terms in the well-known high-frequency expansion. Other approaches, such as variational methods and computational methods that give direct numerical solutions of the elastodynamic equations, are specifically excluded from consideration.

One distinction which is commonly made between the *kinematic* and the *dynamic* parts of the seismic ray method is made here early on and is used to organize the material discussed. The kinematics of ray theory consists of finding the seismic ray paths, wavefronts, and the corresponding traveltimes. The dynamics of ray theory consists of finding the amplitudes of the displacements along the ray paths, and also of computing in some cases synthetic seismograms and even ground motion diagrams associated with the rays. Some of these computations can be elementary in media composed of homogeneous layers of elastic material, but the book seeks to describe and solve the harder problems of 3D heterogeneous elastic media. In such media, it is generally difficult to separate compressional and shear modes in a simple way, and it is, at least in part, this complication that drives many of the choices made about what to present in the book.



Following the brief introductory chapter, the book is organized into five topics, with a single chapter devoted to each topic. These topics are 1) the equations of elastodynamics, 2) seismic rays and traveltimes, 3) dynamic ray tracing and paraxial ray methods, 4) ray amplitudes, and 5) ray-based synthetic seismograms. Two chapters are thus devoted to kinematics and three to dynamics. The book ends with a short appendix on Fourier transforms.

The level of exposition—starting in Chapter 2 and remaining quite consistent throughout—makes extensive use of matrix and tensor notation. This level is appropriate for mathematically well-prepared undergraduates and graduate students in engineering, applied mathematics, physics, and seismology. For use as an advanced textbook in a graduate-level course, it would probably require supplementation with handouts of some of the most recent work that is not covered in depth here.

To get a feeling for how the book might be used, this reviewer looked for various topics, some standard and some more recent, in the subject index and also directly in the text. This reviewer found Zoppritz equations discussed briefly, but no mention of Haskell matrices. Caustics, weak elastic anisotropy, random media, and parabolic equations are all briefly mentioned, while a more extensive discussion of Gaussian beams is presented. Eikonal equations solvers based on finite difference approximations are mentioned, as are fast marching methods, but the connection between fast marching and level set methods is not discussed. Of these two topics, neither *fast marching* nor *level sets* is listed in the subject index.

As might be expected, the strongest contributions of the book are in areas of the

author's own research publications. These topics include perturbation methods for traveltimes, synthetic body wave seismograms, Gaussian beams, and ray tracing methods for laterally varying layered media. For his own research, this reviewer thought the long section (5.4) on ray amplitudes in elastic anisotropic structures seemed especially comprehensive and should provide a valuable resource in future work.

This reviewer recommends that libraries covering wave propagation of all types, and especially those related to seismic waves and geophysical imaging, should have a copy of *Seismic Ray Theory* available for their patrons. Students and individual researchers doing computations involving seismic waves will probably also want to have a personal copy for frequent use, both because of the exposition in those sections where details are stressed and because of the many pointers to the literature where expansion can be found on issues raised, but not discussed at length in the text. There is also an extensive bibliography (having more than 800 references) to the literature. This bibliography is not truly comprehensive, but presumably no single book could be comprehensive in covering a topic as broad and heavily studied as this one. The present reference listing will nevertheless be very useful to many researchers.

11N62. Modeling of Inelastic Behavior of RC Structures Under Seismic Loads. - Edited by P Benson Shing and Tada-aki Tanabe. ASCE, Reston VA. 2001. 632 pp. Softcover. ISBN 0-7844-0553-0. $59.00.

This collection of technical papers presents the latest ideas and findings on the inelastic behavior of reinforced concrete structures from the analysis and design standpoints. These papers include the state-of-the-art concrete material models and analysis methods that can be used to simulate and understand the inelastic behavior of reinforced concrete structures, and design issues that can improve the seismic performance of these structures. Topics include modeling of concrete behavior; modeling of RC structures (finite element approach and macro-element approach); and experimental studies, analysis, and design issues.

IX. BIOENGINEERING

11R63. Biological Micro- and Nanotribology: Nature's Solutions. NanoScience and Technology Series**. -** *M Scherge (IAVF Antriebstechnik AG, Im Schlehert 32, Karlsruhe, 76187, Germany) and SS Gorb (Biologische Mikrotribologie Gruppe, MPI fur Entwicklungsbiologie, Spemannstr 35, Tubingen, 72076, Germany).* Springer-Verlag, New York. 2001. 304 pp. ISBN 3-540-41188-7. $74.95.

Reviewed by JL Lewis (Orthopaedic Surgery and Mech Eng, Univ of Minnesota, 420 Delaware St, SE, Box 289, Minneapolis MN 55455).

This book describes the methods, questions, and knowledge base of tribology and adhesion phenomena that occurs in nature. This is a reference book intended for those interested in beginning research in this field. The book is organized into four sections, beginning with an overview of engineering tribology. The second section provides the core of the text, with examples of lubrication, adhesion, anti-adhesion, and friction in natural biological systems. This includes discussion of cartilage lubrication, friction of fish and snake skin, adhesion in mollusks and crustaceans, and anti-adhesives in plants. The third section describes test equipment used in this field, mainly tools of surface science, such as microtribometers, nanoindenters, spectrometers, and various microscopes. The fourth section describes three case studies of biotribology, all of these dealing with some aspect of the contact pads of insects.

This is really a pioneering work for introducing a fascinating topic. Nature has devised ingenious solutions to sticking, sliding, and wear. There is certainly much to be learned that may lead to useful technological solutions, in the spirit of biomimetics. However, because of its pioneering nature, the book leaves much work to be done. As the authors point out, ''Even selected examples show the present state of knowledge is very poor.'' The description of the field in section two is more an anatomy description, rather than a description of tribological mechanisms in nature, most of which are apparently poorly understood. There is heavy emphasis on adhesion mechanisms, which would not normally be thought of as tribology. The review of tribology in section one is necessarily cursory, but one would need to have a good background in tribology to follow it in much detail, and if one had that background, section one would probably not be needed. The book is well prepared, with clear figures, although there are some slips in editing. For example, cartilage tissue composition is briefly described and the reader referred to a figure of synovial membrane for illustration. Overall, however, the book is pleasing to read, and the figures are clear. There is an extensive bibliography, which would be especially useful for new researchers in this field.

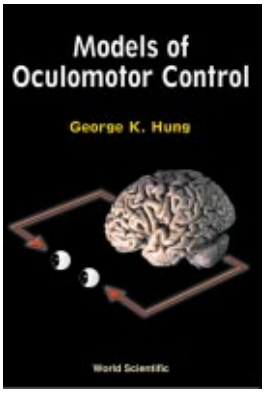
Although there are many limitations to this book, it does achieve its intended goal. This is a good source for someone wanting to begin or explore research potentials in this field. After reading *Biological Micro- and Nanotribology: Nature's Solutions*, one has a sense of the questions, methods, and literature in the field. It would be a useful purchase for individuals and reference libraries.

11R64. Models of Oculomotor Control. - GK Hung *(Rutgers Univ, Piscataway NJ).* World Sci Publ, Singapore. 2001. 127 pp. ISBN 981-02-4568-8. $32.00.

Reviewed by RL Huston (Dept of Mech, Indust, and Nucl Eng, Univ of Cincinnati, PO Box 210072, Cincinnati OH 45221-0072).

This is a brief monograph intended to bridge a knowledge and communications gap between biomedical engineers and vision scientists for oculomotor control (eye/vision control). In writing the book, the author has two stated objectives: 1) To provide biomedical engineers with a means for applying engineering control principles to oculomotor systems and 2) to provide vision scientists with an understanding of control theory and how it can model physiological phenomena. Among expected readers are bioengineers, biophysicists, mathematicians, neurologists, ophthalmologists, optometrists, and psychologists.

The book has three main sections spanning approximately 125 pages. The first is an introduction describing eye anatomy, measurement terms, measurement techniques, and control concepts. The second section, devoted to static analysis techniques, discusses accommodation systems, vergence systems, analysis methods, and proximal models. The third section, dynamic analysis techniques, considers root locus analysis, dual-mode dynamic characteristics, myopia models, error development models, and interactive dynamic models. The book concludes with a bibliography having 175 entries.



The concepts are illustrated with figures throughout as well as with numerous equations.

Although the book intends to provide an understanding of concepts and phenomena across disciplines, it nevertheless assumes considerable sophistication and prior knowledge of its readers. The book reads more like a review article than a tutorial. The subjects discussed in any given section are carefully cited and referred to the extensive bibliography.

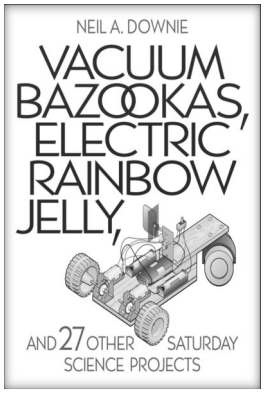
This reviewer believes that the utility of *Models of Oculomotor Control* is most likely to be that of a reference for researchers and scholars who are planning to work in human vision systems.

X. GENERAL & MISCELLANEOUS

11R65. Vacuum Bazookas, Electric Rainbow Jelly and 27 Other Saturday Science Projects. - NA Downie *(Air Prod and Chem, Blasingstoke, UK).* Princeton UP, Princeton. 2001. 253 pp. Softcover. ISBN 0-691-00986-4. $18.95.

Reviewed by A Nachman (4808 45th Street NW, Washington DC 20016).

The book in question is intended (by the author) to motivate (or further motivate) youngsters to pursue science/technology. He does this by describing 29 projects (each description between 5 and 10 pages with quite nice figures) of various levels of difficulty (which he himself rates) that can be done at home. The author commendably provides reasonably clear instructions for making and then employing the devices in each case and further provides some little historical context for the device or the principle the device illustrates. He also provides some ''Science and Math'' narrative (in a few cases involving calculus which would not be communicable to youngsters) and a narrative called ''The Surprising Parts'' which confronts the subtleties of the phenomena within each project. It is these sections that elevate this book above the ''Mr. Wizard'' or ''Mr. Nye the Science Guy'' level.



This reviewer believes that some of these projects (about 1/2) are indeed of interest to the ASME community either as a teaching aid (even for undergraduates) or for self-amusement. Interestingly neither of the two projects mentioned in the title rate highly with this reviewer. The *Jell-O* project involves mobility of certain colored gels under an electric field (the relative differences serves to spread them into a rainbow within a petri dish) while the *Bazooka* project, though indeed mechanical, is not very interesting (a T-shaped tube driven by a vacuum cleaner which can shoot ping-pong balls).

More interesting are projects which demonstrate some (possibly) counterintuitive phenomena. These include a pole which is vibrated by a small electric motor (many projects require a small electric motor) and which has one or more washers which can thereby be made to slide ''up'' the pole as well as almost stand still. The title of Hovering Rings for this project is quite apt. The explanation in terms of nodes and traveling waves on the pole (and of course friction between the washers and the pole) is well written. A related project shows that a pendulum can be kept in the vertical (plumb bob end closest to the ceiling) position by the expedient of suitably vibrating the other end with a small electric motor. Those who have been exposed to serious nonlinear oscillations material would not be surprised, but undergraduates might be, and this is a demonstration that could be undertaken in a classroom. Once again the explanation is sound.

There is a project (Fishy Boat) which, while not so easy to make (it requires having a model boat and being willing to ''modify'' it as instructed), is really interesting. It argues that the single oar Venetian gondola method for boat propulsion has some merit in that the back-and-forth motion is well matched by the workings of a steam engine and a real case could be made for using it to navigate weed infested swamps, since it has no propeller to get tangled and is quiet. The next project argues that one could replace the rudder in a ship with a rotating cylinder (Rotarudder) and exploit the Magnus effect. Not a new idea, but still the accompanying narrative is very good and sending undergraduates from an introductory fluids course to read these few pages will be rewarding to them.

There is a project for guiding a mobile toy car using a light beam (a warm-up exercise for laser-guided bombs!), and this is actually an excellent project for an introductory class in control theory—this reviewer regards this as the best project in this book—and another for cracking nuts using a snapped string (cracks the shell without crushing the meat). The discussion on the forces generated by such a suitably deployed string is just the sort of thing an undergraduate engineering student needs to read. The nonmechanical projects are also fun to read. This reviewer especially liked the toothless gearwheels made from magnets and the homemade amplifier.

While this reviewer thinks every person who teaches general science (and especially physics) in any grade up to 12 should obtain *Vacuum Bazookas, Electric Rainbow Jelly and 27 Other Saturday Science Projects*, he cannot make the same recommendation to the *AMR* reader. He can only say that this book is entertaining and edifying and is not expensive, so if the *AMR* reader has the slightest inclination toward books such as this one, then the impulse to buy should not be stifled.

Author Index for November 2002

The codes after each name give the sequence numbers of the items in the Book Reviews section (R = Review, N = Note). Books listed by title only or as "under review" are not included in this index.

Erratum

The three references listed below were missing from the *AMR* Book Review (#7R12, *AMR* **55**(4) July 2002, pp. B65·B66) of the book *Vibration of Strongly Nonlinear Discontinuous Systems* (by VI Babitsky and VL Krupenin). We apologize to the reviewer, J Angeles, and to the reader for this omission.

REFERENCES

[1] Flügge-Lotz I (1968), *Discontinuous and Optimal Control*, McGraw-Hill Book Co., McGraw-Hill Series in Modern Applied Mathematics, New York.
[2] Pfeiffer F and Glocker Ch (1996), *Multi-body Dynamics with Unilateral Contacts*, Wiley-Interscience, New York.
[3] Strang G (1988), *Linear Algebra, Third Edition*, Harcourt Brace Jovanovich College Publishers, Ft Worth.