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. [DOI: 10.1115/1.1566391]

I. FOUNDATIONS & BASIC METHODS

5R1. Computational Aerodynamics and Fluid Dynamics: An Introduction. - J-J Chattot *(Dept of Mech and Aeronaut Eng, Univ of California, 1 Shields Ave, Davis CA 95616).* Springer-Verlag, Berlin. 2002. 186 pp. ISBN 3-540-43494-1. $54.95.

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

In this book, the author has documented his lecture notes on computational fluid dynamics (CFD) which he has developed over the past 20 years to form this textbook. This textbook is intended for senior undergraduate and first-year graduate students who will be developing or using codes in the numerical simulation of fluid flows or other physical phenomena governed by partial differential equations. The book is organized into 11 chapters. The fundamental numerical methods discussed in this book are based on the finite difference method as a method of discretization on Cartesian mesh systems, in the physical domain, or in the computational domain after coordinate transformation. The author has discussed the finite volume method for discretization for arbitrary mesh systems including unstructured meshes.

The fundamental theory and techniques are presented in Chapter 2, which include the Taylor expansion and the complex mode analysis. Further, the accuracy and stability analyses for these methods are also discussed.

The ordinary differential equations (ODEs) and their integration are given in Chapter 3. The general discussions of PDEs are given in Chapter 4, which include the discussions on the type and classifications of PDEs and the concepts of characteristic surfaces, computational relations, and the jump conditions associated with conservation laws. The connection between the physical phenomena of wave propagation, diffusion and equilibrium, and their mathematical counterparts are discussed well.

Chapters 5–7 discuss the linear model equations of hyperbolic, parabolic, and elliptic, respectively. Classical schemes such as centered scheme, upwind scheme, the Lax scheme, the Lax-Wendroff scheme, etc, are reviewed and discussed in terms of accuracy and stability. Practical aspects of the implementation of the selected schemes are presented.

Chapter 8 gives a specific discussion on the finite difference scheme for a convection-diffusion equation which includes the FTCS method, the Box and modified Box method, and a mixed type scheme.

Chapter 9 presents an excellent discussion on the method of Murman and Cole with a model problem of the 2D steady compressible flow past a body.

The author moves to the discussion of nonlinearities in Chapter 10. The explicit and implicit mixed-type schemes are given. Finally, the application to a system of equations for gasdynamics is discussed.

The most significant aspect of this book is that the author presents two appendices that include the problems and solutions, respectively.

In summary, *Computational Aerodynamics and Fluid Dynamics: An Introduction* is a very well-written book. This reviewer recommends it highly for advanced undergraduate and first-year graduate classes. In addition, engineers and scientists interested in numerical simulation of fluid flow and plasma flow should find this an excellent self-study textbook.

5R2. Continuum Mechanics. - I-Shih Liu *(Inst de Matematica, Univ Federal do Rio de Janeiro, CP 68530, Rio de Janeiro, 21945-970, Brazil).* Springer-Verlag, Berlin. 2002. 297 pp. ISBN 3-540-43019-9. $54.95.

Reviewed by E DeSantiago (Dept of Civil and Architec Eng, Illinois Inst of Tech, 3201 S Dearborn St, Rm 213, Chicago IL 60616-3793).

This book is intended primarily as a textbook for graduate students and advanced undergraduate students in theoretical physics, applied mathematics, and engineering sciences. The text can also serve as a reference book for students and researchers in the fields of applied and structural mechanics. The text begins with a general discussion of kinematics in Chapter 1 and the basic balance laws in Chapter 2. Chapter 2 also includes formulations for the balance laws in which jump conditions exist due to singularities in the continuum fields. Chapter 3 contains a very general and thorough discussion of constitutive theories in which the principles of material objectivity and material symmetry are presented. Chapter 4 continues the discussion on constitutive formulations and particular emphasis is placed on deriving a reduced set of variables for these formulations using basic principles.

Chapter 5 introduces entropy principles and the resulting Clausius-Duhem inequality. Discussions on the restrictions placed on constitutive formulations by entropy principles and the role entropy production plays in the stability of equilibrium solutions is also included in this chapter. Chapter 6 emphasizes the application of previously derived principles to isotropic elastic solids. In this chapter the problems of biaxial stretching, pure shear of a square block, and the finite deformation of spherical shells are solved and presented. Chapter 7 introduces the concept of utilizing Lagrange multipliers for exploiting the entropy principle for a viscous heat-conducting fluid. Chapter 8 includes a brief lecture on the relatively new approach for formulating the basic equations termed rational extended thermodynamics. In this approach, the momentum flux and the energy flux are also taken as basic field quantities in addition to the densities of mass, momentum, and energy leading to simpler constitutive relations but at the cost of more complex basic fields. Finally, the text concludes with an appendix in which a short introduction to linear algebra and tensor calculus is included.

The objective of the author is to present the theory of continuum mechanics from a rational framework that emphasizes basic principles. The strength of the book lies in the presentation of a very general and rational the framework for constitutive formulations and the role thermodynamics plays in these formulations. The discussions on kinematics and force (stress) concepts, on the other hand, are not as thorough as those found in other text on the same subject matter. With the exception of Chapter 6, very few applications to physical problems are presented. Instead the author includes exercises and figures that emphasize the derivation and application of basic principles and theories to further the understanding of the material. It is clear from the presentation of the material that more emphasis was placed on constitutive formulations and thermodynamics than was the case for mechanical concepts.

In summary, *Continuum Mechanics* is recommended more as a reference book for students and researchers in applied mechanics and structural mechanics who are interested in a more thorough treatment of con-

stitutive formulations and the role thermodynamics plays in these formulations. The text is also recommended as a textbook for studentsin the fields of theoretical physics and applied mathematics for which a more rational framework of continuum mechanics is required.

5N3. Computational Structures Technology. - Edited by BHV Topping and Z Bittnar. Saxe-Coburg Publ, Edinburgh. 2002. 434 pp. ISBN 1-874672-16-4. $155.00.

This volume includes the 16 invited lectures presented at the Sixth International Conference on Computational Structures Technology held in Prague, Czech Republic in September 2002. Topics covered include fluid-structure and fluid-solid interaction, linear and nonlinear finite element techniques, materials and fracture mechanics modeling, damage mechanics, analysis and design of composites and laminates, dynamic analysis, new techniques for structural mechanics, damage assessment techniques, and optimization in structural analysis and design.

5N4. Engineering Computational Technology. - Edited by BHV Topping and Z Bittnar. Saxe-Coburg Publ, Edinburgh. 2002. 315 pp. ISBN 1-874672-17-2. $135.00.

This volume includes the 12 invited lectures presented at the Third International Conference on Engineering Computational Technology held in Prague, Czech Republic in September 2002.

5N5. Finite Element Method for Elliptic Problems. Classics in Applied Mathematics, Vol 40. - PG Ciarlet *(Lab d'Analyze Numerique, Univ Pierre et Marie Curie, Paris, France).* SIAM, Philadelphia. 2002. 530 pp. Softcover. ISBN 0-89871-514-8. $55.00.

This SIAM softcover edition is an unabridged republication of the work first published by North-Holland, Amsterdam, New York, Oxford, 1978.

5N6. Handbook of Nanoscience, Engineering, and Technology. - Edited by WA Goddard III, DW Brenner, SE Lyshevski, GJ Iafrate. CRC Press LLC, Boca Raton FL. 2003. 824 pp. ISBN 0-8493-1200-0. $149.95.

This handbook features:

- Comprehensive information and references for nanoscale structures, devices, systems, molecular technology, and nanoelectromechanical theory
- Discussions on current challenges, advanced research results, and potential breakthroughs in the field
- NEMS applications in areas such as medicine, information technology, the environment, energy systems, national security, and transportation
- More than 200 defining terms and almost 500 illustrations

It also includes a chapter, *Mechanics of Carbon Nanotubes,* (by Dong Qian, Gregory J. Wagner, Wing Kam Liu, Min-Feng Yu, and Rodney S. Ruoff) which was originally published as an AMR review article (Appl Mech Rev, **55** (6), Nov, 495-533).

5N7. Inverse Boundary Spectral Problems. Monographs and Surveys in Pure and Applied Mathematics, Volume 123. - A Katchalov *(Steklov Math Inst, St Petersburg, Russia),* Y Kurylev *(Dept of Math Sci, Loughborough Univ, UK),* M Lassas *(Rolf Nevanlinna Inst, Univ of Helsinki, Finland).* Chapman and Hall/CRC, Boca Raton FL. 2001. 290 pp. ISBN 1-58488-005-8. $94.95.

This book develops a rigorous theory for solving several types of inverse problems. The authors approach inverse problems in a coordinate invariant way, that is, by applying ideas drawn from differential geometry. To solve them, they apply methods of Riemannian geometry, modern control theory, and the theory of localized wave packets, also known as Gaussian beams. The treatment includes the relevant background of each of these areas. Although the theory of inverse boundary spectral problems has been in development for at least 10 years, the literature has been scattered throughout various journals. This self-contained monograph summarizes the relevant concepts and the techniques useful for dealing with them.

5N8. Lanczos Algorithms for Large Symmetric Eigenvalue Computations, Vol I: Theory. - JK Cullum *(Dept of Comput and Computational Sci Div, Los Alamos Natl Lab)* and RA Willoughby *(Deceased).* SIAM, Philadelphia. 2002. 271 pp. Softcover. ISBN 0-89871-523-7. $42.00.

This edition is a softcover, unabridged republication of the work first published by Birkhauser Boston in 1985.

Foundations and Applications of Mechanics, Volume I: Continuum Mechanics. - CS Jog *(Dept of Mech Eng, Indian Inst of Sci, Bangalore, 560 012, India).* Narosa Publ, New Delhi, India. Distributed in USA by CRC Press LLC, Boca Raton FL. 2002. 254 pp. ISBN 0-8493-2414-9. $89.95. (Under review)

Physics of Strength and Fracture Control: Adaptation of Engineering Materials and Structures. - AA Komarovsky *(Lab of Phys of Strength, Sci and Eng Center for Non-Traditional Technologies (SALUTA), Kiev, Ukraine).* CRC Press LLC, Boca Raton FL. 2003. 639 pp. ISBN 0-8493-1151-9. $179.95. (Under review)

II. DYNAMICS & VIBRATION

5R9. Introduction to Structural Dynamics and Aeroelasticity. - DH Hodges and GA Pierce *(Sch of Aerospace Eng, Georgia Inst of Tech, Atlanta GA).* Cambridge UP, Cambridge, UK. 2002. 170 pp. ISBN 0-521-80698-4. $55.00.

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

This textbook would be excellent for its targeted audience—''to provide an introduction to the field of structural dynamics and aeroelasticity (SD & A),...a semester-length, senior-level, undergraduate course or a first-year graduate course in which the emphasis is placed on conventional aircraft.'' There is sufficient material for a separate course on aeroelasticity alone. The figures are excellent.

This reviewer really likes the quote from da Vinci as the subheading of Chapter 2, ''O students, study mathematics, and do not build without foundations.'' The book then proceeds with the subject at hand using differential equations, partial differential equations, various principles such as orthogonality, separation of variables, Lagrange's equations (with an eight-page appendix on this very important subject), various energy concepts, virtual work, and a number of approximate solution techniques. These are indeed, along with good modeling techniques, the ''foundations'' of SD & A!

Intentionally absent are the popular, but less enlightening digital techniques. There are, however, several problems on which the student is asked to use either Excel®, MATLAB®, or Mathematica® as the means to solve the problem. And the concept of stiffness and mass matrices is utilized in the excellent treatment of approximate solution techniques. Some instructors might consider this absence (see above) a shortcoming of the book, but exposure to digital modeling usually occurs in other courses, and this type of material can be easily supplemented. (See for example the chapter on elastic and aeroelastic instabilities in *An Analysis of Aircraft Structures, An Introduction,* by Bruce K. Donaldson, 1993.) The references and the index are limited (1.5 and 3.5 pages, respectively).

Most of the models in the structural dynamic chapter are uniform string models and uniform beam models, as they should be for an introductory course.

There are numerous aeroelastic models scattered throughout Chapters 3 and 4 that make up the material on this topic. They include a rigid wing section mounted on: a torsional elastic support, a flexible sting, and two struts, and the ''typical section'' mounted on pitch and plunge springs. In addition, there is a flapped, 2D wing section, a uniform, unswept cantilevered lifting surface, and a swept wing. Chapter 2 on Structural Dynamics, Chapter 3 on Static Aeroelasticity, and Chapter 4 on Aeroelastic Flutter, each end with an ample number of thoughtful problems (55 of them) for assignment to students. Answers are given below the problems for a number of them. An adequate number of examples are strategically placed throughout the text.

This reviewer would have liked to see references to some of the current web sites on aeroelasticity where there are videos and simulations that are quite helpful. Two locations, for the Auburn and Texas A & M sites, are http://www.eng.auburn.edu/~drmac/ae605hp.html and http://aerounix.tamu.edu/aeroel/.

Introduction to Structural Dynamics and Aeroelasticity is highly recommended for individuals and libraries. The field was in dire need for an up-to-date, error-free book that addresses the fundamentals and treats the very important problems of divergence, aileron reversal, dynamic response, and flutter and related problems. That need is fulfilled in this book.

5R10. Meanest Foundations and Nobler Superstructures: Hooke, Newton and the "Compounding of the Celestiall Motions of the Planetts." Boston Studies in the Philosophy of Science, Vol 229. - O Gal *(Ben-Gurion Univ of the Negev, Beer-Sheva, Israel).* Kluwer Acad Publ, Dordrecht, Netherlands. 2002. 239 pp. ISBN 1-4020-0732-9. $69.00.

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

This book explores the idea that Robert Hooke (of Hooke's law fame) initiated the

idea that celestial motions are the result of a tangential motion and an attractive motion toward a central body. The idea of choice at the time seemed to favor that the natural motion was in a circle (or closed path) and that the additional force was the ''centrifugal force,'' the force that tended to pull the object away from its circle. It is suggested, that Hooke's correspondence with Sir Isaac Newton led Newton to change his way of thinking and thus subsequently led to his developing the correct model of celestial motions. Although this is the overall premise of the book, and it is primarily written to support this premise, there are many more philosophical ideas that are examined. The development of various supporting arguments for this premise is extremely interesting.

It starts out with an Introduction in which all the correspondence between Hooke and Newton (in the time frame of 1679–80) is presented. It gives a little background on the two scientists and their relationships, both working and social, between the two. The generally accepted idea that Hooke was a ''mechanic'' as opposed to a scientist is questioned. This introduction is followed by three historical chapters, with two philosophical ''interludes'' between them. Chapter 1 then describes in more detail Hooke's development of his ''Programme'' and then introduces the meaning of ''inflection,''—signifying the gradual curving of a rectilinear trajectory. This chapter is followed by the first ''interlude'' that explores some ideas regarding science and technology and the ''spectator theory of knowledge.'' Chapter 2 is titled, Power, and deals with Hooke's theories of vibration and springs. However, this is all presented in the context of Hooke's Program. This chapter is followed by another ''interlude'' that looks at additional philosophical ideas and opinions regarding such things as the concepts of ''Knowledge of'' and ''Knowledge that.'' All this leads to the final chapter, Newton's Synthesis. Here, the author brings his case together and tries to answer the question ''Could the road to the Principia, then, be properly described as a realization of *Hooke's Programme*?''

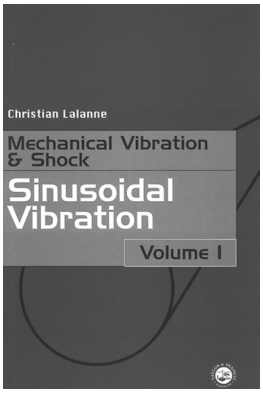
Meanest Foundations and Nobler Superstructures: Hooke, Newton and the ''Compounding of the Celestiall Motions of the Planetts'' is well written and well documented. There are 12 pages of notes and over 150 cited references, many including reprints of original documents by Hooke and Newton. There are several figures reproduced from these documents in the text. There is an extensive index that indicates the locations of both subjects and authors in the text. This work is number 229 in the Boston Series in the Philosophy of Science. This reviewer mentions this fact to indicate exactly what kind of book this is; it is trying to put in perspective the influence of Hooke on Newton.

5R11. Sinusoidal Vibration. Mechanical Vibration and Shock Series, Vol I. - C Lalanne *(French Atomic Energy Authority, France). Hermes Sci Publ, Paris. Distributed in USA by Taylor & Francis Publ, New York NY. 2002. 312 pp. ISBN 1-56032-985-8. $150.00.*

Reviewed by AW Leissa (Dept of Mech Eng, Colorado State Univ, Fort Collins, CO 80523).

This book is Volume I of a five volume series entitled *Mechanical Vibration and Shock.* The subsequent four volumes are: II, *Mechanical Shock*; III, *Random Vibration*; IV, *Fatigue Damage*; V, *Specification Development.* As explained in a Foreword, the series is intended for engineers and technicians working in design teams, and for testing laboratories.

With the above users in mind, the narrowness of scope and the inaccuracy of explanations in the present book are tolerable. This book is limited to single-degree-of-freedom systems having linear springs and viscous damping. Excitations are entirely deterministic, without considering random input. Continuous systems (rods, beams, plates, etc) are not taken up.



The inaccuracies are clearly evident in Chapter 1 (Basic Mechanics), where the ordinary differential equation for the one-dof system is derived (from Newtons Second Law—not D'Alembert's Principle, as mentioned there). Free body diagrams are never drawn. Instead, equations evolve through discussion (including the well-known formulas for springs in parallel and in series). The linear spring stiffness is (unusually) defined as $k=-\Delta F/\Delta z$, and an incorrect picture (Fig. 1.4) is shown to explain it. Some lengthy discussion of material behavior transpires, with improper terminology used in places (eg, ''deformation velocity,'' instead of ''strain rate,'' which is dimensionally different, and ''longitudinal deflection'' instead of ''strain''). In spite of such carping criticisms, Chapter 1 does have considerable useful and interesting general information in it. One only hopes that readers lacking *fundamental* background in the subject will obtain it elsewhere, and not rely too heavily upon the explanations here.

The next four chapters present solutions in great detail for displacement, velocity and acceleration of single-dof vibrating masses subjected to various types of applied forces or base excitation, including impulse or step functions. For the latter, Laplace transforms are introduced. All of these solutions are found also in textbooks, although typically not presented in such detail.

This reviewer found Chapter 6 to be interesting. It is entitled ''Non-Viscous Damping.'' It explains that in reality the various types of nonviscous damping (dry friction, aerodynamic, velocity powers, hysteretic, etc) can *usually* be represented by equivalent viscous damping. This is because, in practice, ''damping is fortunately rather weak, so that the motion can be approached using a sinusoid.'' Another important statement is that attempting to solve the nonlinear equations of nonviscous damping ''leads to--calculations complex in a way seldom justified by the result obtained.'' This is at the beginning of the chapter. The rest of it derives the well-known equivalent viscous damping coefficients by evaluating energy dissipated in a cycle of motion, and looks at hysteresis loops.

The final two chapters examine the response of the simple system to *swept* sine excitation. By this, it is meant that in the sin Ωt forcing function, the excitation frequency (Ω) is itself a function of time (t). The swept sine excitation is often used in laboratory tests. Three types of frequency variation are considered: linear, logarithmic (actually exponential), and hyperbolic. Extensive numerical examples are presented and discussed.

The book has an outstanding bibliography of almost 200 listings, with emphasis placed on papers, reports, and books dealing with vibration damping and testing. It covers the field very well and is an excellent source from which a good reference library could be developed.

Sinusoidal Vibration is recommended for technical libraries and also for readers who want to *supplement* their understanding of damped vibrations. But, as mentioned earlier, it should be used only after a good fundamental understanding is obtained elsewhere.

5N12. Advances in Stability Theory at the End of the 20th Century. - Edited by AA Martynyuk *(Inst of Mech, Kiev, Ukraine).* Taylor & Francis Publ, New York NY. 2002. 304 pp. ISBN 0-415-26962-8. $104.00.

This volume presents surveys and research papers on aspects of the modern theory of stability and some applications. The contributing authors are experienced in this area of applied mathematics and applied engineering.

The volume consists of four sections presenting the following directions in the development of stability theory: progress in stability theory by first approximation; contemporary developments in Lyapunov's idea of direct method; stability of solutions to periodic differential systems; and selected applications. An introduction to the Series, Preface, and Overview lead into the following four sections: Progress in stability theory by the first approximation; Contemporary development of Lyapunov's ideas of direct method; Stability of solutions; and Selected applications.

5N13. Classical and Celestial Mechanics: The Recife Lectures. - Edited by H Cabral *(Fed Univ Pernambuco, Recife, Brazil)* and F Diacu *(Pacific Inst for the Math Sci, Univ of Victoria).* Princeton UP, Princeton. 2002. 408 pp. ISBN 0-691-05022-8. $49.50.

This work brings together a number of lectures given between 1993 and 1999 as part of a special series hosted by the Federal University of Pernambuco, in which internationally established researchers came to Recife, Brazil, to lecture on classical or celestial mechanics. Nine of the lectures have been assembled in this book in order to make them available to mathematicians and students worldwide.

The topics covered include central configurations and relative equilibria for the N-body problem; singularities of the N-body problem; the two-body problem; normal forms of Hamiltonian systems and stability of equilibria; applications to celestial mechanics of Poincare's compactification; the motion of the moon; geometrical methods in mechanics; momentum maps and geometric phases; holonomy for gyrostats; microswimming; and bifurcation from families of periodic solutions.

5N14. Sound-Flow Interactions. Lecture Notes in Physics Series. - Edited by Y Auregan *(Univ du Maine, Le Mans, France),* A Maurel *(ESPCI, Paris, France),* V Pagneaux *(Univ du Maine, Le Mans, France),* J-F Pinton *(Ecole Normale Superieure de Lyon, France).* Springer-Verlag, New York. 2002. 286 pp. ISBN 3-540-43332-5. $57.00.

The coupling between acoustic waves and fluid flow motion is basically nonlinear, with the result that flow and sound modify themselves reciprocally with respect to properties of generation and propagation. As a result, this problem is investigated by many different communities, including applied mathematics, acoustics, and fluid mechanics. This book is the result of an international workshop to discuss the foundation of sound-flow interactions, to share expertise and methodologies, and to promote cross-fertilization between the different disciplines involved. It consists essentially of a set of pedagogical lectures and is meant to serve not only as a compact source of reference for the experienced researcher, but also as an advanced textbook for postgraduate students, and nonspecialists wishing to familiarize themselves in depth, at a research level, with this subject.

Aeroacoustic Measurements. - Edited by TJ Mueller *(Dept of Aero and Mech Eng, Univ of Notre Dame, 112 Hessert Center, Notre Dame IN 46556-5684).* Springer-Verlag, Berlin. 2002. 313 pp. ISBN 3-540-41757-5. $99.00. (Under review)

Mechanics of Solids and Shells: Theories and Approximations. - G Wempner *(Georgia Inst of Tech, Atlanta GA)* and D Talaslidis *(Aristotle Univ, Thessaloniki, Greece).* CRC Press LLC, Boca Raton FL. 2003. 529 pp. ISBN 0-8493-9654-9. $119.95. (Under review)

III. AUTOMATIC CONTROL

5R15. Dynamics of Controlled Mechanical Systems with Delayed Feedback. - H Hu and Z Wang *(Inst of Vib Eng Res, Nanjing Univ of Aeronaut and Astronaut, Nanjing, 210016, PR China).* Springer-Verlag, Berlin. 2002. 294 pp. ISBN 3-540-43733-9. $89.95.

Reviewed by DB Schaechter (Lockheed Martin, Bldg 201, Org L9-24, 3251 Hanover St, Palo Alto CA 94304-1191).

Hu and Wang have compiled an engineering monograph that can be used as a reference for the subject title. Their text is suited for upper division control engineers, graduate students, and control engineering professionals, and presupposes knowledge of control systems, differential and difference equations, analysis, frequency response methods, and linear and nonlinear stability criteria. The text is divided into eight chapters dealing with modeling, fundamentals, stability analyses, periodic motions, chaotic systems, and control of delayed dynamic systems. It consists of good quality figures, a decent index, no problem sets, no appendices, several pages of references, and interesting highly analytical (theorem-proof) technical material solidified occasionally with seemingly contrived examples. Readability suffers slightly in places from lack of grammatical editing.

In the text, the authors present a formalized treatment of systems (both linear and nonlinear) containing delays (both single and multiple) and address both the stability and performance aspects of such systems. They present a refreshingly systematic and analytical approach to the subject matter, much more than just the e^{-sT} unity gain, linear phase impact of a constant time delay and its manifestations in linear systems. These techniques include, linear stability theory, Lyapunov stability, approximation techniques for short time delays, stability regions, delay independent stability, generalized Sturm stability, perturbation methods, and periodic behavior. A noticeable omission, perhaps by choice, is treatment at any length of Laplace transforms and how they might be applied to analyzing and designing controllers for such systems.

There is a wealth of relevant and detailed information pertaining to systems which encompass time delays, however, the sequence of chapters seems to be somewhat non-intuitive, at times, with occasional meandering away from the chapter topic. For example, Chapter 1, which deals with the modeling of delay dynamic systems, rapidly delves in unwarranted detail into genetic algorithm approaches for characterizing and identifying such systems. This chapter, in turn, is followed by an excellent chapter entitled Fundamentals of Delay Differential Equations, with content that one might expect pedagogically to serve as introductory material for the entire text. The remainder of the text then penetrates the core material of the book, how one characterizes, recognizes, analyzes, approximates, and controls systems in which single or multiple finite time delays play a significant role in the overall system response.

All in all, *Dynamics of Controlled Mechanical Systems with Delayed Feedback* would add depth and breadth to any engineering library and would prove beneficial to control engineers who would like to probe more deeply into some of the more subtle ramifications of the presence of time delays in mechanical systems.

5R16. Modeling, Identification and Control of Robots. - W Khalil *(Ecole Centrale de Nantes, France)* and E Dombre *(Robotics Dept LIRMM, UMR CNRS, France).* Hermes Sci Publ, Paris. Distributed in USA by Taylor & Francis Publ, New York NY. 2002. 480 pp. ISBN 1-56032-983-1. $149.00.

Reviewed by ML Nagurka (Dept of Mech and Indust Eng, Marquette Univ, PO Box 1881, Milwaukee WI 53201-1881).

This book is a revised and augmented edition of the French version, *Modélisation, Identification et Commande Des Robots,* published by Hermés in 1999, whose first edition was published in 1988. The authors consider this book to be the third edition, as it has been substantially modified and updated. The book contains 15 chapters, 11 appendices, and an extensive list of references. It unfolds as follows.

Chapter 1 is an introduction to the terminology and presents general information and definitions of core concepts, such as kinematic chains, types of joints, configuration versus task space, redundancy, singular configurations, architectures of robot manipulators, and robot characteristics.

Chapter 2, Transformation matrix between vectors, frames and screws, sets out the basic mathematical tools used in robot modeling, including homogeneous and differential transformations as well as screws, twists, and wrenches.

Geometric representations of simple open chain robots are developed in Chapter 3, Direct geometric model of serial robots. A variation of the Denavit-Hartenberg notation, called the Khalil-Kleinfinger notation, is introduced to describe robot geometry. The authors claim that their notation also handles the description of complex chains with tree structures or closed loops.

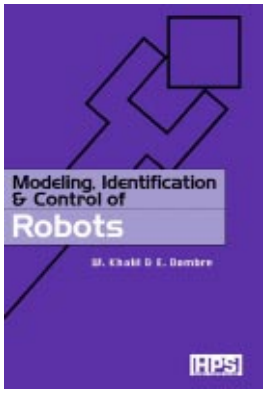
In Chapter 4, Inverse geometric model of serial robots, three approaches are presented: the Paul method, which can be used for most industrial robots; the Pieper method, which deals with six degree-of-freedom robots having three prismatic joints or a spherical joint; and the Raghavan-Roth method, which is suitable for six degree-of-freedom robots with general geometry.

After developing efficient methods for calculating the Jacobian matrix, Chapter 5, Direct kinematic model of serial robots, presents several analysis-oriented issues, including robot workspace, determination of the degrees-of-freedom, velocity and force ellipsoids, and twist-wrench duality. The kinematic model can also be used to find a numerical solution to the inverse geometric problem. This is the topic of Chapter 6, Inverse kinematic model of serial robots,

where solution techniques are provided for regular, singular, and redundant robot configurations.

Chapter 7, Geometric and kinematic models of complex chain robots, examines models of complex chain robots with tree and closed chain structures. The problem of solving the constraint equations of closed loop robots is treated using geometric constraint equations and kinematic constraint equations.

Parallel structured robots are the subjects of Chapter 8, Introduction to geometric and kinematic modeling of parallel robots, where their architectures and features are presented.



Chapters 9 and 10 tackle issues of dynamic modeling. Simple open chains are considered in Chapter 9, Dynamic modeling of serial robots, and complex kinematic chains in Chapter 10, Dynamics of robots with complex structure. Both Lagrangian and Newton-Euler formulations are developed to obtain the robot equations of motion. The determination of the minimum inertial parameters, also referred to as base inertial parameters, is carried out using a direct symbolic method and by a numerical method, based on a QR decomposition. The number of operations of the inverse dynamic model is minimized by using the base parameters and customized symbolic programing techniques. The chapters discuss on-line implementation issues and give different methods for the direct dynamic model computation, including a method that avoids inverting the inertia matrix.

Chapters 11 and 12 focus on identification of geometric and dynamic parameters, respectively. In Chapter 11, Geometric calibration of robots, various calibration methods are offered, including those that require information from external sensors and those that are autonomous. A short subsection introduces the active field of research into parallel robot calibration. In Chapter 12, Identification of the dynamic parameters, several methods (all linear in the dynamic parameters) for identification of dynamic models and energy models are introduced.

Chapter 13 covers Trajectory generation. Beginning with point-to-point trajectories in the joint space and in the task space, the chapter, then examines the problem of adding intermediate points. The topic of trajectory generation on a continuous path is also treated briefly.

Robot control issues are addressed in the last two chapters. Chapter 14, Motion control, covers PID control, computed torque control, passive control and adaptive control, whereas Chapter 15, Compliant motion control, explores passive control, impedance control, hybrid force-position control, and hybrid external control.

The chapters are followed by 11 appendices (over 50 pages) that provide details of mathematical methods and examples of computations (eg, solutions of inverse robot equations, computations of parameters, control laws, stability analyses), a bibliography of more than 400 references, and ends with an index.

It is difficult to compete in the field of robot texts and reference books. Several books cover comparable topics, including the influential *Introduction to Robotics: Mechanics and Control*, by J Craig (2nd edition, Addison-Wesley, 1989), the extensive and more applied *Introduction to Robotics*, by P McKerrow (Addison-Wesley, 1991), as well as the more current *Robot Analysis: The Mechanics of Serial and Parallel Manipulators*, by L-W Tsai (Wiley, 1999). In this reviewer's opinion, the book *Modeling, Identification and Control of Robots* is a welcome addition to these books.

The book is primarily a mathematical treatise that unfolds logically and covers a wide range of accepted topics in robotics. It is less of a reference for those seeking information about robotic applications. Given its analytical rigor it may be beyond a technician-level book and more suitable for one with sufficient mathematical skills and savvy. The book contains a wealth of information and would be appropriate as an upper-level undergraduate or graduate text for engineering courses.

In closing, this is a comprehensive, well-written, and pleasing book that contains a broad range of material related to robot modeling, identification, and control. The layout is logical, the writing style smooth, and the figures, although more might be warranted, are clear, black-and-white, schematic-type drawings. The book could be strengthened by the inclusion of more example problems, as well as discussion and material of a more applied nature. Its attention to implementation issues, such as the computational burden in carrying out robotic related calculations, is commendable. It has the rigor and completeness to make it appropriate as a textbook for an advanced engineering course, as well as for anyone seeking information in the field. The book is clearly a contribution and is recommended.

5N17. Responsive Systems for Active Vibration Control. - Edited byA Preumont *(Univ Libre de Bruxelles, Belgium).* Kluwer Acad Publ, Norwell MA. 2002. 396 pp. (Softcover: ISBN 1-4020-0898-8, $55.00). ISBN 1-4020-0897-X. $147.00.

Chapters 1–3 of this book provide a state-of-the-art introduction to active vibration control, active sound control, and active vibroacoustic control, respectively. Chapter 4 discusses actuator/sensor placement, Chapter 5 deals with robust control of vibrating structures. Chapter 6 discusses finite element modeling of piezoelectric continua, and Chapter 7 addresses trends in piezoelectric multiple-degree-of-freedom actuators/sensors. Chapters 8–12 deal with example applications, including semi-active joint, active isolation and health monitoring. Chapter 13 addresses MEMS technology, and Chapter 14 discusses the design of power amplifiers for piezoelectric actuators.

IV. MECHANICS OF SOLIDS

5R18. Analysis and Design of Elastic Beams: Computational Methods. - WD Pilkey *(Dept of Mech and Aerospace Eng, Univ of Virginia).* Wiley, New York. 2002. 461 pp. ISBN 0-471-38152-7. $95.00.

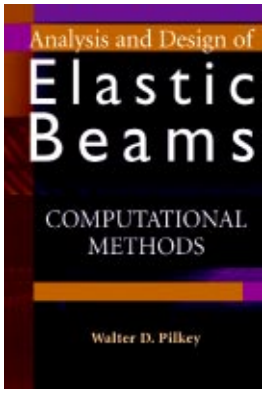
Reviewed by SN Krivoshapko (Dept of Strength Mat, Peoples Friendship Univ of Russia, 6, Micklukho-Maklaya Str, Moscow, 117198, Russia).

The book is printed on good acid-free paper. It has a hard cover of nice-looking color and considered design. Text, figures, and tables are well read.

The book begins with an introduction to the classical theory of linear elasticity. The six linearized strain-displacement relations, the six stress-strain equations for linearly elastic isotropic materials, and the three static relations with 15 unknown parameters (ie, the three components of the displacement vector, the three normal and three shear stress components, and the three normal and three shear strains) are presented without deduction. The author is punctual in notations and descriptions of properties, functions, constants, and coefficients, but it might also be good to present alternative descriptions for some equations and relations. For example, the strain compatibility conditions are known as the B de Saint-Venant's conditions. The stress-strain equations are also known as the generalized Hooke's law, but this is mentioned only in passing in the middle of the book (p 237). Formulas, in which the normal stresses are expressed through the dilatation and the normal strains, are also called as Hooke's law in Lamé's form. All basic relations and equations are written in matrix form. A beam in pure bending is studied in detail, and several numerical examples of analysis of thin-walled horizontal cantilevered beam with an asymmetrical cross section loaded with a vertical concentrated force at the free edge or subjected to joint action of the vertical concentrated force and the horizontal compressive force are presented. As a variant, a beam with nonhomogeneous material properties on the cross section is consid-

ered. The presented brief list of references dealing with the contents of Chapter 1 defines the status of the linear theory of elasticity in our time, but it would be desirable to see the book by SP Timoshenko and JN Goodier, *Theory of Elasticity* (McGraw-Hill, NY, 1970) in this list.

Engineering beam theory, presented in Chapter 2, is an approximate theory because it neglects the normal stresses σ_y and σ_z and assumes that Poisson's ratio is zero, but the error of the calculation will be insignificant because the normal stresses rejected are much smaller than the axial stresses σ_x. This theory gives good results if a beam has two general dimensions of cross section, much smaller than a length of the beam element. The author presents fundamental engineering theory equations in analytical and in matrix form illustrating their application for planar engineering beam theory. Examples of determination of the deflections of the beams with symmetric and asymmetrical cross sections through use of integration of the differential equation of the elastic axis of the beam are given. Cantilevered beams and statically indeterminate beams are examined. But in the given examples, the author does not mention in the text and does not show in the figures that concentrated forces subjected to the beams must pass through a shear center of the section to avoid the appearance of torque. The solution of the first-order form of the differential equations is demonstrated, and examples of the determination of a transfer matrix for a general beam element based on planar engineering beam theory are adduced. After that, WD Pilkey goes on to the determination of stiffness matrices for a Bernoulli-Euler beam element and for a beam element on an elastic foundation. He assumes that the deflection of a beam element can be approximated by a polynomial of the third order. In one example, torsion is considered too. The chapter is ended by the consideration of exact and lumped mass matrices and dynamic stiffness matrices for dynamic problems of an undamped structure.



Complex beams and planar frameworks are studied in Chapter 3 with the application of the element matrices of Chapter 2, and that is why local and global coordinate systems are introduced into use. The discussion is directed primarily to the static analysis based on the displacement method. Each node of the beam element has three degrees of freedom. A two-element framework with the three nodes subjected to nodal loading and a beam on elastic foundation under action of concentrated forces were chosen for demonstration of the theoretical proposition of the chapter. The free vibration analysis and forced response is discussed briefly. The form of cross-sections of the beam elements is not specified.

In the short Chapter 4, the author describes the idea of an isoparametric element in which the functions used for presentation of behavior under deforming are also applied for the description of the cross-sectional properties (ie, the cross-sectional area, the first moments of area, the area moments of inertia, and the product of inertia). The constructing of an isoparametric element represents transformation of nondimensional square element, called a reference domain, with nine nodes into the real element curved with the same number of nodes. An example of determination of properties of an asymmetric cross section with the help of the finite-element mesh definitions of Chapter 4 has shown that the values calculated here are the same as those of the analytical method presented in Chapter 1. For those who want to have additional information on finite elements for cross-sectional analysis, Pilkey listed three textbooks where detailed accounts of the FEM are available.

Chapter 5 begins with the description of fundamentals of Saint-Venant's pure torsion. The fundamental assumption in this analysis is that cross sections are free to warp without restraint. The displacement formulations are illustrated by examples of analysis of bars with circular, elliptical, and rectangular cross sections. The force method relations are used to solve analytically torsion problems for two bars with elliptical and equilateral triangle cross-sectional shapes. Subsequently, Pilkey addresses classical formulas for thin-walled open and closed cross sections of bars subjected to pure torsion. The examples presented and comparisons illustrating the opportunities of closed and open cross sections help the reader to learn the theoretical material better. The formulas in this part are extended to apply to an n-celled tube, a hollow section with fins, a wing section, and a composite cross section. The analysis of the composite cross section, transformed to an equivalent cross section with the help of the modulus weight ratio for the shear modulus, is presented without any concrete example. Using the analytical expressions described before, the author goes over to a finite element formulation for the linear Saint-Venant torsion problem and shows that the principle of virtual work and Galerkin's method lead to the same element stiffness relations. Chapter 5 concludes with brief information on alternative computational methods such as the boundary element method and the direct integration method. The presented references can provide additional information on the examined problem. Those who want to know more on torsion can also read the book by NH Arutyunyan and BL Abramyan, *Torsion of Elastic Bodies*, (1963, 688 pp.).

Shear stresses generated by shear forces on straight beams are considered in Chapter 6. First, the standard methods of determination of shear and normal stresses in homogeneous and nonhomogeneous beams subjected to transverse shear loads are described with the help of engineering beam theory and theory of elasticity. After that, the same problems are solved in finite element solution formulation. One section is devoted to the determination of shear center for thin-walled cross sections and traditional formulas for the location of shear centers for common cross sections are provided. Having briefly described a history of the study of shear deformation, Pilkey goes over the determination of shear deformation coefficients for various cross-sections, assuming that the strain energy for a beam is equal to the strain energy for a 1D beam based on technical beam theory and using the finite element solution formulation and traditional approximate analytical formulas.

In Chapter 7, Restrained Warping of Beams, the traditional analytical method for studying thin-walled beams within the limits of linear theory is described. The method was devised in general by VZ Vlasov. New concepts such as the warping function, moment of warping, sectorial characteristics, principal pole, warping torque, warping constant, a bimoment, and so on are introduced into practice. It is shown that the shear center and the principal pole are the same point. Having assembled governing equations, the author expresses them in first-order form. Analytical formulas for the determination of normal and shear stresses due to restrained warping are presented. The theory is illustrated by several examples.

In Chapter 8, additional information from the theory of elasticity is presented. Principal stresses, extreme shear stresses, and three failure theories (maximum stress theory, maximum shear theory, and distortion energy theory) are discussed. Such failure theories as maximum normal strain theory (Mariott, 1682), simplified theory of strength of O Mohr for brittle materials, and some others are not considered.

Chapter 9 gives elementary information necessary for understanding the idea of an optimal cross-sectional shape design of thin-walled beams with the help of rational B-spline curves.

Chapter 10, Shape Optimization of Thin-Walled Sections, is one of the important parts of the book because the problem designated in the chapter's title often becomes the main object of investigation. A shape

design method described in this chapter is assumed to be defined by nonuniform rational B-spline curve.

In one appendix, Pilkey describes how to prepare input data files for some of the computer programs in Fortran 90 presented on his web site.

Analysis and Design of Elastic Beams: Computational Methods can be a training appliance for students and post-graduate students learning the theory of elasticity and matrix calculus. This book will be a good reference for mechanical and civil engineers and designers working in corresponding fields of industry where the thin-walled bars are used. Lecturers and instructors dealing with beam analysis also should take an interest in this book.

In this book, the author undertook describing the very wide circle of the theory of elasticity, and he carried out the stated aims not repeating other published manuals and reference books. That is why this book can be recommended for libraries as well as individuals.

5R19. Imperfect Bifurcation in Structures and Materials: Engineering Use of Group-Theoretic Bifurcation Theory. Applied Mathematical Sciences, Vol 149. - K Ikeda *(Dept of Civil Eng, Tohoku Univ, Aoba Sendai, 980-8579, Japan)* and K Murota *(Dept of Math Informatics, Univ of Tokyo, Tokyo, 113-0033, Japan).* Springer-Verlag, New York. 2002. 411 pp. ISBN 0-387-95409-0. $69.95.

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

Stability theory is of fundamental importance in structural engineering, and there is a large body of literature in the field. Much of the theory is directed toward the prediction of buckling or bifurcation loads for ideal structures. However, the role of imperfections is crucial for real structures, particularly for those that are sensitive to these effects. The current book is a graduate-level text that presents an overview of imperfections and the prediction of the initial post-buckling response of a system. The treatment is predominately analytical, rather than numerical. Hence, the problems treated are relatively simple since the analysis of most practical systems requires numerical techniques such as the finite element method.

The book is divided into three parts and 15 chapters. Each chapter includes a range of problems and a summary to consolidate the material. The theory is complemented by nearly 200 references from the field. The first chapter provides an overview of the problems that are considered in the book. This chapter, although brief, could be used as an upper-undergraduate level introduction to the field.

The first part of the book introduces the basic theory and derives the imperfection sensitivity laws for simple critical points. The theory is also linked to the classification system from chaos theory. The discussion includes procedures to identify critical imperfections and the role of probability theory for modeling random imperfections. Part 1 concludes with a chapter that links the theory to the behavior of real structures and materials. Two restrictions of the theory should be noted. Firstly, the loading is assumed to be described by one parameter only. Hence, the theory is not applicable to non-proportional loading, which occurs frequently in practice. Secondly, only the initial post-buckling response is considered. Other techniques need to be used if the complete load-deflection response of the system is required.

Part 2 extends the theory to the analysis of systems with multiple critical points. This is inherently more difficult and the mathematical demands on the reader increase considerably. In particular, extensive use is made of group theory. Although the basics of this theory are covered, readers will probably need to supplement this with material from standard texts in the field to provide an adequate background to follow this part. Part 3 is primarily focused on modeling bifurcation in materials, including both metals and soils. This part of the books also relies on group theory.

In summary, *Imperfect Bifurcation in Structures and Materials* provides an extensive range of material on the role of imperfections in stability theory. It would be suitable for a graduate-level course on the subject or as a reference to research workers in the field.

5R20. 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.

Reviewed by DA Mendelsohn (Dept of Mech Eng, Ohio State Univ, 206 W 18th Ave, Columbus OH 43210-1154).

This book is a combination of the author's work in modeling elastic-plastic crack-tip fields with the pertinent work of others. It provides a, heretofore unavailable, detailed look at the recent state of research on this specific subject. Much of that work has been in accounting for the effects of 3D, thickness induced geometric constraints, loading parallel to the crack plane, and related material behavior issues. In none of these situations can the crack tip fields be characterized by a single term asymptotic expansion as in the original pioneering Hutchinson, Rice, and Rosengren (HRR) fields based on J_2 flow theory with a Ramberg-Osgood stress-strain model, for which the single controlling parameter is the famous J integral. The thrust of the book is to determine the appropriate higher-order asymptotic crack-tip field characterization for a given situation and to examine its validity through a variety of finite element (FEM) computations. Extensive graphical results of the stress field distributions and singularity behavior are provided throughout.

The chapter on Cracks Under Stationary Conditions gives the HRR formulation and reviews the literature since then dealing with the conditions for its validity, followed by a review of work on constraint and parallel loading effects. This review sets the stage for most of the rest of the book. Pressure-sensitive materials are discussed next, whose yield stress is reduced by hydrostatic tension, and hence greatly affected by geometric constraints. The extension by O'Dowd and Shih of the HRR fields to include the pressure-sensitivity and to extend the expansion to the two parameter J-Q characterization is presented and explored in detail. The effects of non-Ramberg-Osgood hardening are explored using an FEM, small-scale-yielding calculation with an experimentally determined stress strain curve. A comparison of the J-Q characterization to the J-T characterization (the second T term depends on the stress parallel to the crack) under full-scale yielding is also carried out.

Cracks Under Thermal-Mechanical Loading Conditions is a chapter dealing with a modified HRR expansion in which the yield stress is reduced as the temperature gradient increases. The path dependence of J and lack of J dominance induced by a spatial variation in temperature gradient parallel to the crack growth direction is explored in bend specimens. This is extended to a two-term expansion to study transient thermal loading in cracked pressure vessel walls. The development in time of the spatial variations in the second asymptotic term is compared to the time-independent results from the deformation theory of plasticity.

The chapter on Interface Cracks examines the fields for cracks along a straight interface. Stationary crack-tip fields are analyzed for an elastic-plastic medium on one side and a rigid substrate on the other side of the interface, a two term asymptotic expansion is derived. Results are given for the first and second order expansions of both closed and open cracks and their validity examined as a function of mode mixity, pressure-sensitivity of the material, and the rigid substrate assumption. The fields at quasi-statically and (constant velocity) dynamically growing crack tips are then shown to be significantly different from the stationary fields due to elastic unloading and plastic re-loading in the wake of the propagating crack tip. The case of dissimilar elastic-plastic materials on either side of the interface is considered and the effects of dissimilar elastic and plastic properties and the propagation velocity on the crack tip fields are demonstrated.

The Mixed Mode Crack Propagation chapter treats dynamic or quasi-static crack growth under mixed modes I and III load-

ing, with the specimen thickness effect in mind. Perturbation analyses in the two extremes of predominantly mode I and predominantly mode III are carried out using the unloading and re-loading formulation of the previous chapter and the effects of the mode-mixity are discussed. The final chapter, Assessment of Apex-V Notches, develops higher-order notch tip expansions of sharp notches, and examines their validity. Finally, pressure sensitivity of the yield stress is added to the analysis.

Numerical Assessments of Cracks in Elastic-Plastic Materials is a research monograph focused on asymptotic expansions of elastic-plastic crack and notch tip fields. It is suitable as a reference source for parts of a second graduate-level course in fracture mechanics. It is recommended for all research libraries and for researchers and practitioners of elastic-plastic fracture mechanics.

5R21. Physics and Mathematics of Adiabatic Shear Bands. - TW Wright *(US Army Res Lab, Aberdeen Proving Ground MD).* Cambridge UP, Cambridge, UK. 2002. 241 pp. ISBN 0-521-63195-5. $60.00.

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

This little book is based on a course of lectures given by the author on visits to the University of California at San Diego in 1990 and 1995. The topics were chosen primarily because of the author's particular research interests, but also to fill a gap of research monographs in the field of the material instability known as adiabatic shear banding.

TW Wright has a reputation of long standing as a particularly lucid and methodical expositor, both when writing and lecturing. This book also is a model of clarity (with, however, some exceptions to be mentioned), and it is a pleasure to read.

Adiabatic shear banding is a new and very important field of mechanics. In dynamic loading plastic flow processes in solid bodies failure may arise as a result of an adiabatic shear band localization which is generally attributed to a plastic instability generated by thermal softening during dynamic deformation. This is why the investigations of adiabatic shear banging now have a crucial role.

The contents of a book can be divided into three parts. The first four chapters set the physical and mathematical foundations for detailed study of adiabatic shearing. Chapters 5, 6, and 7 explore the dynamics of band formation in a one-dimensional (1D) setting. The last two chapters extend the discussion to two dimensions. The references not complete, but representative, are chosen according to the author taste.

The most important first part of the book is written very superficially. In the first chapter, the physical foundations and experimental observations of adiabatic shear banding are treated only as introductory considerations. The author does not consider the fundamental problems of adiabatic shear banding in single crystals. Chapters 2 and 3 bring a brief summary of balance laws, and fundamental description of thermoelasticity and thermoplasticity. In Chapter 4, several flow models for thermoviscoplasticity are presented. The author has privilege concerning the choice of models in description and application, however, he considered mostly the 1D models of thermoviscoplasticity and omitted such important 3D models like the Duvant-Lions model, the consistency model, and the model based on the overstress function (this last one has a long tradition, cf, Bingham 1922, Hohenemser and Prager 1932, Sokolovsky 1948, Malvern 1950, Perzyna 1963). It is noteworthy to add that these three models have been recently broadly used in study of the problems of adiabatic shear banding (for the review articles of presented results in these fields, cf, P Perzyna (ed), *Localization and Fracture Phenomena in Inelastic Solids*, Springer-Verlag, Wien, New York, 1998).

The second part of the book (Chs 5, 6, and 7) recapitulates the notable contributions to description of adiabatic shear banding by the author. Several 1D initial boundary value problems are solved, and major features of band formation are discussed. These features for the linear differential equations include the timing of localization, the morphology of fully developed bands, and the quantitative role of various physical properties, such as thermal conductivity, heat capacity, work hardening, thermal softening, and strain rate sensitivity. Without heat conduction and strain rate sensitivity, the dynamic governing equations in a 1D problem may show a change of type from wave propagation phenomena to instability phenomenon. It is very strange and very difficult to understand the result obtained by the author that strain rate sensitivity (viscosity) has the effect of delaying only, but not eliminating instability phenomenon. For the three models of the theory of thermo-elastoviscoplasticity mentioned earlier (namely, the Duvant-Lions model, the consistency model, and the model based on the overstress function), it has been proved that viscosity has the effect of regularization of the mathematical problem, so that the solution may have diffuse localization of plastic deformation but the instability phenomenon is avoided. Very good example of this proof for two models (Duvant-Lions model and the model based on overstress function) may be found in the monograph by JC Simo and TJR Hughes, *Computational Inelasticity* (Springer-Verlag, New York, 1998). It is noteworthy to stress that the regularization property is accomplished because viscosity introduces implicitly a length-scale parameter into the dynamical initial-boundary value problem, ie, $l=\alpha c\tau$, where τ is the relaxation time for mechanical disturbances, c denotes the velocity of the propagation of the elastic waves in the material, and α is the proportionality factor which depends on the particular initial-boundary value problem. The final part of the book (Chs 8 and 9) is concerned with discussion of the results obtained by 2D experimental observations and the principal known solutions of 2D problems with propagating shear bands. In Chapter 8, the author focuses the discussion on three kinds of 2D experiments. The discussion of solutions presented in Chapter 9 is confined to local analysis near the tip of a propagating shear band or to boundary layer and similarity solutions.

We conclude that the author disregarded many important problems that recently have been very well developed. For instance, he did not consider analytical methods for investigation criteria for adiabatic shear band formation (initiation). There exist two very well-known methods that are broadly used in the investigation criteria for shear band localization for both single crystals and polycrystalline solids. The first method is based on the analysis of acceleration waves. In this investigation the instantaneous adiabatic acoustic tensor plays a fundamental role. The second is called the standard bifurcation method (cf, JR Rice, The localization of plastic deformation, *Theoretical and Applied Mechanics* (WT Koiter, ed), North-Holland, Amsterdam, 1976, 207-220). The author did not discuss the softening effect generated by microdamage mechanisms within the material during plastic flow processes. It is a very well-known fact that this kind of softening in many practical cases may have decisive importance in the formation process of shear bands. Interaction of stress waves and dispersion effects has a very important role in the development of adiabatic shear bands. These problems need also to be considered more deeply. Very recently, experimental observations have been performed to investigate the initiation and propagation characteristics of dynamic shear bands in several kinds of steel, (cf, PR Gudurn, AJ Rosakis, and G Ravichandran, Dynamic shear bands: An investigation using high speed optical and infrared diagnostics, *Mechanics of Materials*, **33** (2001), 371-402). These investigations open a new branch of research works focusing on dynamics of shear bands as the problems of mesomechanics.

This reviewer's opinion is that no attempt has been made to do more than touch on a small fraction of the subject of adiabatic shear banding. Thus, *Physics and Mathematics of Adiabatic Shear Bands* can be treated as a very introductory course on adiabatic shear banding. The book should be purchased by individuals as well as by libraries.

5N22. Advances in Mechanics of Structures and Materials. Proc of 17th Australasian Conf

(ACMSM17), Queensland, Australia, June 2002. - Edited by Y-C Loo, SH Chowdhury, S Fragomeni. Balkema Publ, Rotterdam, Netherlands. 2002. 808 pp. ISBN 90-5809-386-7. $239.00.

Topics covered in this proceedings are composite structures and materials; concrete structures; design and construction methodologies; optimization and reliability; steel structures; computational mechanics; concrete technology and products; geotechnical engineering and pavement technology; stability and special analysis; and structural dynamics and earthquake engineering. Also included are two invited lectures that discuss the engineering aspects of the disastrous 1999 Chi Chi earthquake in Taiwan and the special design features of the proposed Q1 Tower, the world's tallest residential building to be constructed on the Gold Coast.

5N23. Analysis of Bolted Joints 2002. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada. - Edited by KH Hsu, H Kockelmann, T Sawa. ASME International, New York. 2002. 216 pp. ISBN 0-7918-1944-2. ASME Book No H01231. $100.00. (ASME members $50.00).

This collection of 23 full-length, peer-reviewed technical papers discusses the following topics: design standards, gasket technology, finite element applications, bolted joint and gasket testing, compact flange joints, bold assembly and disassembly, and GRP bolted flanged connections.

5N24. Basic and Applied Salt Mechanics. Proc of 5th Conf, Bucharest, August 1999. - Edited by ND Cristescu, HR Hardy, RO Simionescu. Balkema Publ, Rotterdam, Netherlands. 2002. 480 pp. ISBN 90-5809-383-2. $138.00.

Topics discussed include laboratory and in-situ testing; coupled effects and permeability; creep damage and dilatancy; constitutive modeling; crushed salt behavior; numerical modeling; storage and disposal projects; mining applications; case studies; and salt pillars and cavities. This proceedings also contains a bibliography update (some 170 references not included in the proceedings of earlier conferences) and a detailed subject and author index.

5N25. Composite Materials: Testing, Design, and Acceptance Criteria. (STP 1416). - Edited by A-H Zureick *(Georgia Inst of Tech, Atlanta GA)* and AT Nettles *(NASA Marshall Space Flight Center)*. ASTM, W Conshohocken PA. 2002. 279 pp. Softcover. ISBN 0-8031-2893-2. $125.00.

This book provides the latest data on the experimental, analytical, and computational aspects of composite materials to the civil and aerospace engineering communities. Featuring 17 peer-reviewed papers covering various aspects of testing, design, and acceptance criteria for composite materials, the book's topics include test method development, material qualification, full-scale structural testing, NDT evaluation, durability, damage resistance and tolerance, buckling, impact, and micromechanics.

5N26. Computational Mechanics: Developments and Applications -2002. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada. - Edited by N Badie, RG Sauve, WD Reinhardt. ASME International, New York. 2002. 232 pp. ISBN 0-7918-4652-0. ASME Book No H01239. $110.00. (ASME members $55.00).

This compilation of 22 full-length, peer-reviewed technical papers promotes the development of computer technology related to the design, analysis, and life-assessment of pressure vessels and piping. The topics included are nonlinear finite element and discrete approximation techniques, developments and applications, and efficient computational models for limit load analysis of pressure vessel components.

5N27. Computational Weld Mechanics, Constraint, and Weld Fracture. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada. - Edited by FW Brust. ASME International, New York. 2002. 212 pp. ISBN 0-7918-1945-0. ASME Book No H01232. $100.00. (ASME members $50.00).

This compilation of 25 full-length, peer-reviewed technical papers is organized into two sections covering the following topics: bimetallic welds; fracture of welds; finite elements and constraint effects on fracture; large-scale weld modeling of structures; residual stresses, distortions, and measurements; and computational weld mechanics.

5N28. Design and Analysis of Piping, Vessels, and Components -2002. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada. - Edited by AA Dermenjian. ASME International, New York. 2002. 236 pp. ISBN 0-7918-4651-2. ASME Book No H01238. $110.00. (ASME members $55.00).

This is a collection of 26 full-length, peer-reviewed technical conference papers presented on the following topics: design and analysis of piping and piping components; and design and analysis of pressure vessels, heat exchangers, and components.

5N29. Encyclopedia of Smart Materials. - M Schwartz. Wiley, New York. 2002. 1632 pp. ISBN 0-471-17780-6. $595.00.

At the cusp of several disciplines, smart materials—those that combine two or more functions in a single material or element—are generating significant excitement in industry. Their use supports both dematerialization—using less to accomplish the same volume—and mechatronics—the intelligent electronic control of mechanical systems. This encyclopedia offers A-to-Z coverage, including adaptive structures and related processing.

5N30. Environmental Geomechanics. - Edited by L Vulliet, L Laloui, B Schrefler. Presses Polytech, Lausanne. 2002. 432 pp. ISBN 2-88074-515-2.

Environmental geomechanics is a relatively new discipline at the interface between built and natural environments. It is devoted to the understanding of the mechanical behavior of geomaterials (mainly soil and rock, but also concrete and others) under various environmental conditions. An international workshop was held in early July 2002 to provide a forum of discussion for scientists of different disciplines (geomechanics, soil physics, environmental chemistry, and biology) and to promote interdisciplinary work.

This volume, based on the workshop, covers the following topics of environmental geomechanics:

- Constitutive aspects–Mechanics of unsaturated soils, thermal behavior, influence of chemical content of fluids on the mechanical properties, durability, creep, and long-term effects
- Coupled formulations–Thermodynamics, mixture theories, interaction between constituents, and phase changes
- Case studies–Advanced modeling of real cases providing examples of potential and limitations of the existing theories

5N31. Fatigue Life Prediction of Solder Joints in Electronic Packages with ANSYSA®. - E Madenci, I Guven, B Kilic *(Univ of Arizona, Tucson AZ)*. Kluwer Acad Publ, Norwell MA. 2002. 208 pp. ISBN 1-4020-7330-5. $140.00.

Fatigue reliability of solder joints is an important issue in the electronics industry. There have been several attempts to accurately predict the expected service life of an electronic component. Over the last ten years, one method has emerged as widely used for a multitude of package configurations. However, this method requires the knowledge of finite element modeling and simulation with ANSYSA®, a commercially available finite element program. Furthermore, a 3D finite element modeling of any electronic package remains a formidable task even if the analyst has extensive knowledge of ANSYSA.

This book describes the method in great detail starting from the theoretical basis. The reader is supplied with an add-on software package to ANSYSA that is designed for solder joint fatigue reliability analysis of electronic packages. Specific steps of the analysis method are discussed through examples without leaving any room for confusion. The add-on package along with the examples make it possible for an engineer with a working knowledge of ANSYSA to perform solder joint reliability analysis. The book allows the engineers to conduct fatigue reliability analysis of solder joints in electronic packages.

5N32. Fatigue, Fracture, and Damage Analysis-2002, Volume 1. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada. - Edited by D Moinereau. ASME International, New York. 2002. 152 pp. ISBN 0-7918-4654-7. ASME Book No H1241A. $80.00. (ASME members $40.00).

This compilation of 20 full-length, peer-reviewed technical papers covers fracture design and analysis; fracture mechanics: global and local approaches; and fracture mechanics and materials. This volume, combined with a second companion volume, covers all fatigue and fracture mechanics areas of design and analysis.

5N33. Fatigue, Fracture, and Damage Analysis-2002, Volume 2. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada. - Edited by D Moinereau. ASME International, New York. 2002. 192 pp. ISBN 0-7918-4654-7. ASME Book No H1241B. $90.00. (ASME members $45.00).

This compilation of 24 full-length, peer-reviewed technical papers covers probabilistic damage evaluation; fracture mechanics: application to components; fracture mechanics: development of new methods; re-evaluation of pressurized thermal shock assessment; and selected topics in composites and fatigue. This volume, combined with its companion volume, covers all fatigue and fracture mechanics areas of design and analysis.

5N34. Fitness for Service Evaluations and Non-Linear Analysis-2002. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada. - Edited by JF McCabe, WJ Koves, C Rodery, MY Younan. ASME International, New York. 2002. 180 pp. ISBN 0-7918-4653-9. ASME Book No H01240. $90.00. (ASME members $45.00).

Nineteen full-length, peer-reviewed technical papers covering a wide range of topics in the fields of fitness or service evaluations and nonlinear analysis are included in this volume. The topics discussed are fitness for service, life extension, remediation, and repair; and inelastic and nonlinear analysis.

5N35. Mathematical Modelling for Polymer Processing: Polymerization, Crystallization, Manufacturing. - Edited by V Capasso *(Milan Res Cen for Indust and Appl Math and Dept of Math, Univ of Milano, Via C Saldini 50, Milano, 20133, Italy)*. Springer-Verlag, Berlin. 2003. 320 pp. ISBN 3-540-43412-7. $79.95.

This book provides a unified presentation of the mathematical modeling of polymerization, crystallization, and extrusion of polymer melts, by means of advanced methods, presented in an accessible way for applied scientists and engineers.

5N36. Proceedings of the 2002 ASME/STLE International Joint Tribology Conference. Held October 2002, in Cancun, Mexico. - ASME International, New York. 2002. CD-Rom. ASME Book No I623CD. (Distribution only to Conference Attendees).

This proceedings presents a collection of papers on the broad topic of tribology compiled on CD-Rom. The CD contains ASME general pa-

pers and papers from the Magnetic Storage Symposium; STLE papers; and Tribology Letters. This CD-Rom has been created using Adobe Acrobat Reader 5.0 with Search. This Adobe software application allows the user to view, search, download, and print information electronically generated and produced in PDF format.

Foundations of Nanomechanics: From Solid-State Theory to Device Applications. - AN Cleland *(Dept of Phys, Univ of California, Santa Barbara CA 93106-9530).* Springer-Verlag, Berlin. 2003. 436 pp. ISBN 3-540-43661-8. $69.95. (Under review)

Functional Analysis in Mechanics. - LP Lebedev *(Dept of Math, Univ Nacional de Colombia, Bogota, Colombia)* and II Vorovich *(Deceased).* Springer-Verlag, New York. 2003. 238 pp. ISBN 0-387-95519-4. $59.95. (Under review)

Models and Phenomena in Fracture Mechanics. Foundations of Engineering Mechanics. - LI Slepyan *(Dept of Solid Mech, Mat, and Syst, Tel Aviv Univ, Ramat Aviv, 69978, Israel).* Springer-Verlag, Berlin. 2002. 576 pp. ISBN 3-540-43767-3. $229.00. (Under review)

V. MECHANICS OF FLUIDS

5R37. High-Order Methods for Incompressible Fluid Flow. - MO Deville *(Ecole Polytechnique Federale, Lausanne, Switzerland), PF Fischer (Argonne Natl Lab, Argonne IL 60439),* EH Mund *(Univ Libre, Brussels, Belgium).* Cambridge UP, Cambridge, UK. 2002. 499 pp. ISBN 0-521-45309-7. $80.00.

Reviewed by DK Gartling (Comp Fluid Dyn, Sandia Natl Labs, MS 0826, Albuquerque NM 87185-5800).

This book is focused on the development and use of numerical methods for the solution of problems in incompressible fluid dynamics. Though not completely evident from the title, the methods of primary interest are spectral and spectral element methods and the closely associated orthogonal collocation techniques. In terms of flow problems, the text is limited in scope to isothermal, laminar flows, which are sufficient to discuss and demonstrate the essentials of the numerical approach. The book is designed as a graduate-level text and uses a standard progression of increasingly complex equations and algorithms to develop the topic. There are no problem sets or exercises for the student, though this is not really a deficit for a high-level text of this type. The authors are acknowledged experts in this field, and the text certainly demonstrates the breadth of their experience. The book is very well written and produced, with no discernible typographical errors.

The first chapter is primarily comprised of standard introductory material on viscous, incompressible, fluid mechanics and the Navier-Stokes equations. The summary is well done and includes some discussion of turbulence. The last section discusses computational issues, such as computing hardware and software, and makes the argument for the use of high-order methods in simulation. The second chapter is an introduction to variational methods including standard finite elements, spectral elements, and orthogonal collocation. The topics are developed using one-dimensional elliptic equations as the model problem. The chapter is nicely completed with sections on solution methods for algebraic systems, matrix conditioning and preconditioning, and a few numerical examples. Chapter 3 continues with the development of methods for time-dependent, one-dimensional equations, including algorithms for both parabolic and hyperbolic systems. The discussion of linear multistep, predictor-corrector, Runge-Kutta and Taylor-Galerkin methods is well done; the section on splitting methods is a welcome addition to a text. The advection equation, advection-diffusion equation, and Burgers equation are all used to illustrate spatial discretization via spectral techniques and the coupling with time integration methods.

Multidimensional problems form the main part of Chapter 4, starting with elliptic equations (diffusion and Helmholtz) and concluding with parabolic (unsteady advection-diffusion) and hyperbolic (unsteady advection) equations. Initially, rectangular domains that can be represented by tensor products of one-dimensional basis functions are considered, followed by mapping methods for distorted geometries. Spectral element methods are introduced for general geometries and orthogonal collocation is covered in several sections. The next two chapters concentrate on the incompressible flow equations, with the steady Stokes and Navier-Stokes equations covered in Chapter 5 and the unsteady equations discussed in Chapter 6. Essential to these chapters are sections on weak forms and the LBB condition, spectral element and orthogonal collocation choices for single or staggered grids, and solution algorithms including pressure Poisson and projection methods. Also discussed are divergence free bases and methods for free surface flows and simulations requiring ALE procedures. Both chapters conclude with several multidimensional examples of isothermal flow computations.

Chapter 7 is devoted to the important topic of domain decomposition. The main areas covered include preconditioning methods for solving large matrix problems, mortar element methods for joining subdomains, and the treatment of singularities. These topics are of current research interest, but are introduced and well summarized in this chapter. The last chapter also covers topics of current concern in terms of method implementation on vector and parallel computers. A good general description of parallel programming issues is followed by detailed discussion of spectral element implementation. The text is completed by two extensive appendices covering function spaces and orthogonal polynomials. The bibliography is also quite extensive and complete.

As a graduate text on spectral methods for fluid dynamics, this is a very complete and well-written book. The development of the numerical methods featured in the book are well organized and sufficiently detailed to allow the reader to implement the algorithms. *High-Order Methods for Incompressible Fluid Flow* is certainly recommended for use in both the classroom and as a self-study text for the postgraduate.

5R38. Introduction to Hydrodynamic Stability. - PG Drazin *(Univ of Bath, UK).* Cambridge UP, Cambridge, UK. 2002. 258 pp. Softcover. ISBN 0-521-00965-0. $30.00. (Also available in Hardcover ISBN: 0-521-80427-2; $85.00).

Reviewed by JC Crepeau (Dept of Mech Eng, Univ of Idaho, 1776 Science Center Dr, Idaho Falls ID 83402).

For practitioners in the field of fluid stability, *Hydrodynamic Stability* by PG Drazin and WH Reid, together with *Hydrodynamic and Hydromagnetic Stability* by S Chandrasekhar, are commonly used as references, are well marked, and oft cited. In this reviewer's experience, however, he has found them difficult books to use as introductory texts for fluid stability courses. Few other books were available for teaching the topic.

Professor Drazin's latest book, *Introduction to Hydrodynamic Stability*, admirably and thoroughly fills that void. The book was specifically written with the student in mind, since it is a compilation, expansion, and development of lecture notes from courses he taught at various schools. The author assumes that the student has already had preliminary courses in fluid mechanics along with the requisite mathematics. It contains many worked examples and exercises to help the student learn the principles of fluid stability. Included are mathematical models that are suitable for upper division or first-year graduate-level scientists and engineers, along with descriptions of laboratory experiments and numerical simulations.

Many of the topics presented in the Drazin and Reid book have been simplified and offered in a manner more accessible to the target audience. These topics include the Kelvin-Helmholtz instability, thermal and centrifugal instabilities, and parallel shear flows. In addition to these areas, the text gives a very readable introduction to bifurcation analysis and its relation to instabilities, but only briefly touches on chaos and turbulence. A welcome addition, and a change from the way many fluids tomes are written, is the inclusion of case studies in the transition to turbulence. This chapter discusses flow stability in common geometries such as flow over a flat plate, flow over bluff bodies, and flow in diverging channels. Here, Drazin minimizes the math-

ematical analysis and instead focuses more on physical arguments and description of flow phenomena, the effects of critical parameters like the Reynolds number, and global flow behavior. By doing so, he provides a qualitative explanation of flow stability and transition, and acknowledges our current relative lack of understanding.

Introduction to Hydrodynamic Stability is an excellent, affordable (at least in paperback) introduction to fluid stability. The examples are plentiful and well written, and there are many applicable exercises in each chapter. This reviewer looks forward to using the book the next time he teaches fluid stability, and highly recommends it for use at the upper level and first-year graduate level.

Philip Drazin passed away on January 10, 2002. This book was published a few months after his death. According to his obituary printed by the Royal Meteorological Society, he was unassuming, and a genuine scholar with a brilliant mind. He served as the mathematics consultant to the Oxford English Dictionary. Both he and his contributions to fluid mechanics will be greatly missed by the scientific community.

5R39. Kinetic Theory and Fluid Dynamics. - Y Sone *(Kyoto Univ, 230-133 Iwakura-Nagatani-cho, Sakyo-ku Koyto, 606-0026, Japan).* Birkhauser Boston, Cambridge MA. 2002. 353 pp. ISBN 0-8176-4284-6. $69.95.

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

Kinetic Theory and Fluid Dynamics provides a comprehensive description of the relationship between kinetic theory and continuum fluid dynamics. The author applies asymptotic analysis to the governing kinetic equations in the continuum limit in an attempt to bridge the gap between kinetic theory and continuum theory.

The author first derives the appropriate set of equations governing the flow in the form of a series expansion on Knudsen number. The Knudsen number is a measure of the degree of rarefaction in the flow, defined as the ratio of mean free path to some scale length. If the Knudsen number is very small, then the flow may be described as a continuum. The author then reduces the system of equations by applying limits for various applications, such as small Reynolds number, small temperature variations, etc. Finally, the appropriate kinetic theory-based boundary conditions are derived and applied. An extensive discussion of the Knudsen-layer, a region that extends a few mean free paths from a boundary, is given. It is shown that for weakly rarefied flows, continuum theory can be used with a modification of the boundary conditions to account for rarefaction effects.

The mathematical relationship between kinetic theory and continuum theory is studied by looking at several examples. The linear limit as the Reynolds number becomes small is explored. Generally, for all problems, the author discusses both the solid wall and gas phase/condensed phase interface boundary conditions. Several examples of rarefied flows induced by temperature fields are discussed. Such flows cannot be found in a gas in the continuum limit. By far the most interesting application discussed is the Knudsen compressor, a pumping system that is created by applying a temperature gradient across a pipe connecting two reservoirs. An extensive discussion of both optimal configurations and experimental set-ups is included.

The author discusses weakly nonlinear flows where the Reynolds number is finite and temperature variations are small. Nonlinear theory is explored by systematically eliminating restrictions on temperature variations, Mach number, and speed of evaporation and condensation. One of the thrusts of the author is his finding that classical gas dynamics is found to be incomplete in describing the behavior of a gas in the continuum limit. The book concludes with a discussion of bifurcation of cylindrical Couette flow with evaporation and condensation.

The author approaches the book from the point of view of applied mathematics. Heavy emphasis on mathematical derivations deducts from the overall readability of the book. The book would be more complete if it included physics-based discussion to support the mathematical analysis and augment the theory. Further, more illustrative figures should have been included to explain the problems of interest. The figure captions were not sufficient to understand many of the figures. The target audience for the book is scientists and mathematicians working in kinetic theory. Practicing engineers will find the book to be too mathematical to be useful. Graduate students should find this to be a useful reference for theoretical work. *Kinetic Theory and Fluid Dynamics* is an excellent compilation of Yoshio Sone's lifetime works in kinetic theory and asymptotic methods. The book provides a comprehensive theoretical foundation for those interested in bridging kinetic and continuum theory.

5R40. 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.

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

This book by Jackiw differs significantly from what is traditionally understood as ''lectures on fluid dynamics.'' The author's aim is to show that the apparatus, methods, language, etc, developed for physics of particles can be successfully applied to fluid mechanics. Roughly speaking, Jackiw shows how classical and very non-classical models of fluids can be derived from suitably constructed Lagrangian or Hamiltonian functionals, and that these models are just particular, specific cases of a general theory. As a result, some relations between seemingly different models, new invariants, and symmetries are discovered.

Chapter 1 is a brief introduction. In Chapter 2, the classical fluids, both irrotational and with nonvanishing vorticity, are discussed. To be able to give the canonical formulations for the latter case as well as that of magnetic fluids, the Clebsch parametrization is introduced and its use explained. Chapter 3 concerns specific models, both relativistic and nonrelativistic. As the first, Jackiw chooses so called Chaplygin gas for which the pressure is negative and proportional to the inverse of the density, and as the relativistic fluid, he takes the so called Born-Infeld model, which has the property to reduce to the Chaplygin gas in the nonrelativistic limit. In Chapter 4, it is shown that the Chaplygin gas as well as the Born-Infeld model follow from the Nanbu-Goto action for a ''d-brane,'' ie, a d-dimensional object in $(d+1)$-dimensional space. Two approaches to the problem are presented: the Chaplygin gas and the Born-Infeld model are derived either by a choice of a proper parametrization or by a hodograph transformation. In Chapter 5, it is shown that the d-brane theory is able to produce a fluid model with nonvanishing vorticity if one starts with a super d-brane. Then the resulting fluid model possesses supersymmetry. Chapter 6 deals with a one-dimensional case of the theories developed in the previous chapters. In this particular case, both the Chaplygin gas and the Born-Infeld model are completely integrable, therefore, many additional results concerning both models can be obtained. Chapter 7 concerns a non-Abelian fluid mechanics, and the final chapter, 8, is devoted to non-commutative fluid mechanics. The need for such theories follows mainly from magnetohydrodynamics. The monograph ends with solutions to problems, which are immersed in the book.

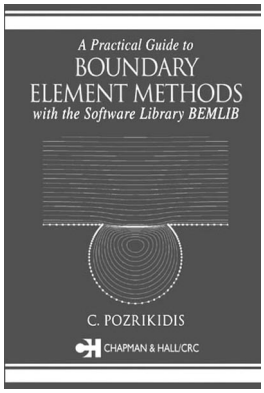
In this reviewer's opinion, the beautiful monograph, *Lectures on Fluid Dynamics: A Particle Theorist's View of Supersymmetric, Non-Abelian, Noncommutative Fluid Mechanics and d-Branes* will be more valuable for theoretical physicists and applied mathematicians than engineers. So, this re-

viewer does not see this book as a primary reading, but everyone interested in fundamentals and deep theoretical approach to fluid mechanics should become acquainted with it.

5R41. Practical Guide to Boundary Element Methods with the Software Library BEMLIB. - C Pozrikidis *(UCSD).* Chapman and Hall/CRC, Boca Raton FL. 2002. 423 pp. ISBN 1-58488-323-5. $99.95.

Reviewed by Jeng-Tzong Chen (Dept of Harbor and River Eng, Natl Taiwan Ocean Univ, PO Box 7-59, Keelung, Taiwan, 202, ROC).

This book provides a concise introduction to the theory and implementation of the boundary element method (BEM). It emphasizes programing aspects with the software library BEMLIB, available from the internet site http://bemlib.ucsd.edu or http://stokes.ucsd.edu. Well over a dozen textbooks on the BEM have been published over the years. Many of these have been written by authors whose background is in solid mechanics, as opposed to fluid mechanics; few books include problems and exercises. The present book provides problems in the end of each section to complement and extend the theory. As is common with other books on BEM, this text begins



with the integral formulation and boundary-element implementation of Laplace equations (1D, 2D, and 3D) in Chapters 1–5. Indirect formulations in terms of single-layer and double-layer representations for 2D cases are developed in Chapter 2, and axisymmetric formulations are discussed in Chapter 4. Special topics, including the treatment of inhomogeneous, nonlinear, and time-dependent problems are discussed in Chapter 6. The method of particular solutions and the dual reciprocity BEM are addressed to transform domain integrals for 1D, 2D, and 3D problems. Since the author's background is in fluid mechanics, this topic is further discussed in Chapter 7, and corresponding material in elasticity is given in an Appendix in the form of a primer.

The user guide of BEMLIB is given in Chapter 8. Although this book can be used as a text in a course, it contains some original results regarding the application of radial basis function (RBF) and the regularization of hypersingularity. The user guide of the software library will be of practical interest to students and engineers. This book will be read by graduate students and engineers. The generation of lines and surfaces for 2D and 3D problems, respectively, is given in Chapter 9. A handy user manual of the three programs for Laplace, Helmholtz, and Stokes flow are given in Chapters 10–12. The source files are available from the website. The author has succeeded in fulfilling his aim of dual-purpose by providing a textbook for teachers, undergraduate, and graduate students, as well as a reference for researchers and engineers. The quality of print and figures is adequate. In general, *Practical Guide to Boundary Element Methods with the Software Library BEMLIB* is a well-written book and is recommended to individuals and libraries.

5N42. Advanced Hypersonic Test Facilities. - Edited by FK Lu *(Dept of Mech and Aerospace Eng, Univ of Texas, Arlington TX)* and *DE Marren (Arnold Eng Dev Center, USAF). AIAA, Reston VA. 2002. 639 pp. ISBN 1-56347-541-3. $99.95.*

This book presents a number of new, innovative approaches to satisfying the enthalpy requirements for air-breathing hypersonic vehicles and planetary entry problems. It covers hypersonic test requirements; principles of hypersonic test facility development; shock tunnels; long duration hypersonic facilities; ballistic ranges, sleds, and tracks; and advanced technologies for next-generation hypersonic facilities.

5N43. New Results in Numerical and Experimental Fluid Mechanics III. Contributions to the 12th STAB/DGLR 2000 Symp, Stuttgart, Germany. - Edited by S Wagner, U Rist *(Inst fur Aerodyn und Gasdyn, Univ Stuttgart, Pfaffenwaldring 21, Stuttgart, D-70569, Germany),* HJ Heinemann *(Inst fur Aerodyn und Gasdyn, DLR, Bunsenstr 10, Gottingen, D-37073, Germany),* R Hilbig *(Tech 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.

This volume contains 50 papers presented at the symposium that are based on research and project work in numerical and experimental fluid mechanics and aerodynamics for aerospace and other applications.

5N44. Thermal Spray 2001: New Surfaces for a New Millennium. Proc of ITSC 2001. - Edited by CC Berndt, KA Khor, EF Lugscheider. ASM Int, Materials Park OH. 2001. 1381 pp. ISBN 0-87170-737-3. $225.00.

Papers in this proceedings cover the following topics: Applications (17 papers), Thermal barrier coatings (9), Ceramics, intermetallics, and metal composite coatings (14), Polymer feedstocks and coatings (6), Nanostructured materials (7), Cold spray processes and coatings (6), Equipment and systems (17), Coating treatments (8), Microstructural focused studies (11), Diagnostics and process control (13), Formation impact and solidification of droplets (10), Modeling and simulation (14), Mechanical properties (10), Wear and erosion (12), Corrosion properties and characteristics (12), Nondestructive testing and quality control (7), and Commercial aspects (7). Also included is an historical endnote: The origins of thermal spray literature.

VI. HEAT TRANSFER

5R45. Fundamentals of Surface Mechanics with Applications, Second Edition. Mechanical Engineering Series. - FF Ling *(Manuf Syst Center, Univ of Texas, Austin TX 78712),* WM Lai *(Dept of Mech Eng, Columbia Univ, New York NY 10027),* DA Lucca *(Sch of Mech and Aerospace Eng, Oklahoma State Univ, Stillwater OK 74078).* Springer-Verlag, New York. 2002. 392 pp. ISBN 0-387-95423-6. $69.95.

Reviewed by P Puri (Dept of Math, Univ of New Orleans, 2000 Lakeshore Dr, New Orleans LA 70148).

This is a very well written book. The reader is assumed to be familiar with introductory continuum mechanics. Adequate references are given for the elementary continuum mechanics. This book explores the topic of surface mechanics using classical continuum mechanics throughout. The authors have successfully accomplished their stated purpose of setting down concrete examples dealing with surface mechanics and of providing analytical tools relevant to quantitative study of surface mechanics. The book can be used as a reference for understanding fundamental problems in surface mechanics by researchers and can also be used as textbook on this subject. While the book covers a wide range of topics, no mention of surface waves has been made. The organization of the material is as follows:

Chapter 1 is concerned with the basic equations of balance of momentum and energy, a discussion of entropy, constitutive equations, and energy balance for an elastic solid. Then there is a section on constitutive relations for heat conduction. Fick's and Darcy's laws are given in Section 6. Sections 7–11 contain constitutive relations for linearly viscous fluids, perfectly plastic bodies, viscoelastic bodies, Maxwellian dielectric, and classical electromagnetic theory, respectively. This chapter can be used as quick reference for constitutive equations for a variety of combined fields.

The first section in each of the remaining chapters introduces the main subject of the chapter. There are, in all, 24 main sections in Chapter 2. Sections 2–16, 18, and 22 give solutions to some typical problems of heat conduction. Section 17 is on the finite Fourier transform, 19 on Legendre polynomials, 20 on Legendre series, 21 on the Legendre transform, 23 on the Fourier cosine transform, and Section 24 contains a discussion on the effects of temperature dependent thermal conductivity and specific heat. There are 13 solved examples and 12 exercises.

Elastic problems for the half-space and circular cylinders are discussed in Chapter 3. Sections 2 and 3 list the stress-strain relations and the equations of motion. Section 4 lists the Papkovitch-Neuber functions and the differential equations satisfied by them. Sections 5–13 present the solutions to the

fundamental problems of determining stress and displacement fields due to concentrated point, line, or distributed sources. Section 14 contains solved examples of plain strain due to a load on a finite strip on the bounding plane of the half-space. Section 15 lists some Fourier integral formulas and 16 contains the application of Fourier transform for several half-space problems. In Section 17, solutions to plane strain problems due to surface loading have been presented. Section 18 is on plane strain problems due to moving surface loads, and Section 19 contains solutions to the plane strain problem of a hollow circular cylinder. Sections 20–29 are concerned with problems arising due to indentation on the bounding plane of the half-space, flat-ended smooth cylinders, and rigid spheres. An integral equation approach is used for solving indentation problems. Some typical integral equations and their solutions are given in an appendix. There are 39 examples and 25 exercises in this chapter.

Chapter 4 gives a short account of thermoelasticity. This chapter contains general solutions for a 2D steady state thermoelastic problem for the half-space, the inertia effects in a half-space problem, the effect of coupling of displacement and temperature, and both the 2D and 3D steady state thermoelastic problem for the half-space due to a moving heat source.

Viscoelasticity is the subject of Chapter 5. The basic stress-strain relations of various models viz the Hookien, Kelvin-Voigt, Maxwell, and finally the Boltzmann and Biot are given in Section 2. Section 3 contains the well-known analogy between elasticity and viscoelasticity. Section 4 contains the integral form of stress-strain relationships for viscoelastic materials. Temperature effects are discussed in the next section. Sections 6–9 present solutions of some standard problems in viscoelasticity. The last section gives a reference to the problem of a multilayered viscoelastic media under a moving load.

The next chapter is on perfect plasticity. Slip-Line theory is discussed in Section 2. The rest of the sections, 17 in all, contain concepts or solutions to problems in plasticity: stress distribution in a semi-infinite solid under a lubricated flat punch, stress distribution in a truncated wedge under a lubricated flat punch, stress field in a wedge under lateral pressure, compression of a wedge by a flat die, sliding of a wedge under a flat die under load indentation of a semi-infinite solid by a lubricated wedge, a friction model, friction of ploughing by rigid asperities, different regimes of friction and wear, indentation of sandwich metal strips between flat dies, oblique impact of a hard ball against a ductile solid, slip-line field of the rolling contact problem at high loads, indentation of a semi-infinite solid by a cylinder, flattening of circular cylinder by a lubricated die, indentation of a semi-infinite solid by a spherical die, indentation of a semi-infinite solid by the end of a lubricated cylinder, and entation of a semi-infinite solid by a lubricated truncated cone.

Chapter 7 contains a brief discussion on rough surfaces. It includes bearing area curves, profilometric representation of surfaces, characterization of surfaces by auto correlation functions, characterization of surfaces by actual area of contact, characterization of surfaces by compliance, characterization of surfaces by fractal geometry, and the chapter ends by describing some studies involving surface textures.

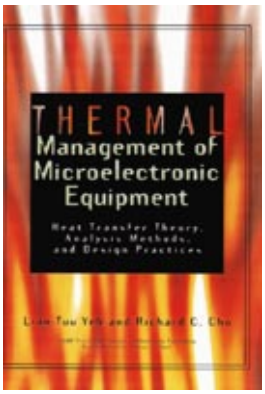
Applications are discussed in the last chapter. Starting with a section on Blok's conjecture, the chapter contains a total of 26 solutions to a variety of problems including one concerning couple stress. The last nine sections are devoted to the following topics: deformation friction, 2D rolling in viscoelastic material, contact problems in linear theory of viscoelasticity, thermal softening of mechanism of fading of lubricated brakes and clutches, plastic shakedown in rolling contact, soft metals in static and dynamic loading and friction under metalworking process, contact between rough surfaces with longitudinal texture, transient temperatures in the vicinity of an asperity contact, and the normal impact model of rough surfaces.

In view of the large number of solutions to basic problems in diverse areas of solid mechanics, *Fundamentals of Surface Mechanics with Applications* is a valuable resource for both researchers and students in solid mechanics. It is recommended for libraries of educational institutions with a program in engineering and research institutions where research in solid mechanics is carried out.

5R46. Thermal Management of Microelectronic Equipment: Heat Transfer Theory, Analysis Methods, and Design Practices. ASME Press Book Series on Electronic Packaging. - Lian-Tua Yeh *(Lockheed Martin Vought Syst, Propulsion and Thermodynamics, PO Box 650003, MS SP-97, Dallas TX 75265-0003)* and RC Chu *(Dept AYJB, M/S P520, IBM Corp, 522 South Rd, Poughkeepsie NY 12601).* ASME International, New York. 2002. 414 pp. ISBN 0-7918-0168-3. ASME Book No 801683. $95.00. (ASME members $76.00).

Reviewed by WS Janna (Herff Col of Eng, Univ of Memphis, 201E Eng Admin, Memphis TN 38152).

This text is published by ASME, and is part of the ASME Press Book Series on Electronic Packaging. The series covers a broad range of topics ranging from electronic cooling to thermally induced stress and vibration. The authors are both Fellows of ASME.



In the preface of the text, the authors describe the challenges that exist in the field of thermal management of electronic systems. The objective in such systems is to have high performance, high heat dissipation devices. The authors acknowledge that no one design method is best suited for all applications. Because it is common to employ several different heat transfer modes simultaneously, the authors provide a wide range of subjects in the text that are related to various heat transfer technologies.

Following the preface is a five-page list of figures, and a two-page list of tables that appear in the text. A three-page nomenclature section is also included. The nomenclature list gives symbols, definitions, and units. The units found in the nomenclature table, however, are engineering units, and this seems unusual given ASME's policy ''that SI units of measurement be included in all papers, publications, and ASME Codes and Standards (see http://www.asme.org/pubs/bodyelem.html). Even so, the absence of SI units in the nomenclature list in no way detracts from the usefulness of this text.

The authors have tried to keep higher level mathematics to a minimum and concentrate more on getting the reader to understand the physics of each topic. Traditional heat transfer topics are covered in Chapters 2–8, while the remaining chapters discuss practical applications of heat transfer from electronic systems.

The first chapter provides an introduction to the main focus of the text as stated in the title: Thermal Management of Microelectronic Equipment. The need for reliable thermal control in electronic equipment is discussed, as is the importance of optimization and determination of life cycle costs.

As with most texts that address applications of heat transfer, the first few chapters (2–8 in this text) discuss traditional heat transfer subjects. Chapter 2 is about Conduction. Topics include: the general differential equations for conduction, one-dimensional conduction, thermal-electrical analogy, and lumped system transient analysis.

Chapter 3 is about Convection, with sections on flow and temperature fields, the heat transfer coefficient, thermal properties of fluids, and convection correlations.

Chapter 4 continues with Radiation Heat Transfer. Discussed in this chapter are the Stefan-Boltzmann Law, Kirchhoff's Law, emissivity, as well as black and gray surfaces.

The typical boiling curve is presented and discussed in Chapter 5, on Pool Boiling. Nucleate boiling is described and associated correlations are given. Correlations for critical heat flux are also given. Parameters that affect pool boiling (including gravity) are covered. Chapter 6 continues with Flow Boiling. Flow patterns, boiling crisis, and thermal enhancement are all addressed.

In Chapter 7, which is about Condensation, modes of condensation are the very first topic. Specific problems include filmwise condensation on a vertical surface, and condensation inside a horizontal tube. Chapter 8 is about Extended Surfaces, in which fins of uniform cross section are described and modeled mathematically using classical approaches. Fin efficiency as well as selection and design of fins are both covered.

Chapter 9 is on Thermal Surface Resistance and the factors that have an effect on it. Joint thermal contact resistance is discussed, as are methods of reducing it. Solder and epoxy joints are also covered here, and some practical design data are provided.

Chapter 10 finally takes the reader to Electrical Components and Printed Circuit Boards. Chip packaging, thermal resistance, and attachment methods are all described. Cooling methods and a thermal analysis for boards are also included. Chapter 11 is about direct air-cooling and fans. Heat transfer and pressure drop correlations are provided for electronic systems in which air is used as the cooling medium.

Chapter 12 is about Natural and Mixed Convection Systems. Parallel plates, straight fin arrays, pin fin arrays, and enclosures are all covered. A number of correlations are provided in equation form with data trends displayed graphically.

In Chapter 13, on Heat Exchangers and Cold Plates, compact heat exchangers are described and their performance modeled. Other topics relevant to compact heat exchangers that are included here are: flow arrangements, overall heat transfer coefficient, effectiveness, pressure drop, and geometric factors. Correlations for modeling compact heat exchangers are also provided.

Chapter 14 is titled Advanced Cooling Technologies I: Single Phase Cooling. It addresses cooling selection, natural convection and forced convection applications where there is cooling without phase change. Chapter 15, Advanced Cooling Technologies II: Two Phase Flow Cooling continues with the definition of Figure of Merit, direct immersion cooling, and flow boiling, among other topics.

In Chapter 16, on Heat Pipes, an excellent description is given of how they operate, how they are constructed, operational limits, operating temperatures, and applications. Micro heat pipes are also described.

Chapter 17 on Thermoelectric Coolers is the last chapter of the text. Basic theory of thermoelectricity is presented, which is exactly the same theory that applies to thermocouples. Figure of merit as applied to thermoelectric coolers is defined, and operating principles are described. Performance analysis and practical design procedures are also given.

The book also includes nine Appendices. These are thermal properties of materials, properties of various fluids, emissivities and absorptivities of material surfaces, properties of phase change materials, friction factor and heat transfer correlations, and unit conversion tables.

References used by the authors are given at the end of each chapter, and these seem complete. There are several example problems solved throughout the text, but there are no practice problems provided at the end of each chapter. The emphasis of this text is on providing the reader with specific design information needed for electronic cooling, rather than on producing a textbook for use in the classroom.

Following the appendices is a seven-page index. The index of this text might be considered a bit lengthy, but it is rather complete. It is prepared in a single-spaced, two column format, and there is an absence of entries that refer the reader to another entry.

The text is over 400 pages and contains numerous drawings, graphs, and useful, as well as practical, correlations. It provides the reader with specific information that can be used to thermally manage microelectronic equipment, as the title suggests.

Thermal Management of Microelectronic Equipment: Heat Transfer Theory, Analysis Methods, and Design Practices is readable and very clearly written. The material would appeal to anyone working with microelectronic equipment in any capacity, as well as to the engineer or researcher who wishes to design a cooling system for microelectronic equipment. This book would make an excellent addition to any personal or reference library.

5N47. Airborne Microparticle: Its Physics, Chemistry, Optics, and Transport Phenomena. - EJ Davis *(Dept of Chem Eng, Univ of Washington, Box 351750, Seattle WA 98185-1750)* and G Schweiger *(Inst fur Automatisierungstechnik, Lehrstuhl fur Laseranwendungstechnik un Mebsysteme, Maschinenbau, Ruhr-Universitat-Bochum, Universitatsstr 150, Bochum, 44780, Germany).* Springer-Verlag, Berlin. 2002. 833 pp. ISBN 3-540-43364-3. $149.00.

This book is an extensive yet self-contained reference on single microparticle studies as they have been performed for many years by the authors. With the range of theoretical and experimental tools available, it has become possible to use the many unique properties of droplets and small particles to investigate phenomena as diverse as, linear and nonlinear optics, solution thermodynamics, gas/solid and gas/liquid chemical reactions, transport properties such as gas phase diffusion coefficients, rate processes in the continuum and non-continuum regimes, trace gas uptake by aerosol droplets related to atmospheric chemistry and ozone depletion, phoretic phenomena, Raman spectroscopy, particle charge, evaporation and condensation processes. Throughout the book, the main concern of the authors was to provide the reader with a visualization of the significance and application of the theory by experimental results.

5N48. Proceedings of Turbo Expo 2002: Print Version, Volume 1. Held in Amsterdam, June 2002. - ASME International, New York. 2002. 1064 pp. ISBN 0-7918-3606-1. ASME Book No I00575. $270.00. (ASME members $135.00).

This compilation of full-length, peer-reviewed technical conference papers covers the following topic areas: aircraft engine; combustion and fuels; electric power; coal, biomass, and alternative fuels; education; and vehicular and small turbomachines.

5N49. Proceedings of Turbo Expo 2002: Print Version, Volume 2, Held in Amsterdam, June 2002. - ASME International, New York. 2002. 1242 pp. ISBN 0-7918-3607-X. ASME Book No IX0576. $300.00. (ASME members $150.00).

This proceedings includes the full-length, peer-reviewed technical papers presented at the conference on the following topics: controls, diagnostics, and instrumentation; marine; cycle innovations; and oil and gas applications.

5N50. Proceedings of Turbo Expo 2002: Print Version, Volume 3. Held in Amsterdam, June 2002. - ASME International, New York. 2002. 1306 pp. ISBN 0-7918-3608-8. ASME Book No IX0577. $300.00. (ASME members $150.00).

This is a printed compilation of full-length, peer-reviewed technical conference papers covering heat transfer, manufacturing materials, and metallurgy.

5N51. Proceedings of Turbo Expo 2002: Print Version, Volume 4. Held in Amsterdam, June 2002. - ASME International, New York. 2002. 1256 pp. ISBN 0-7918-3609-6. ASME Book No IX0578. $300.00. (ASME members $150.00).

Ceramics, industrial cogeneration, structures, and dynamics are the topics covered in this printed compilation of full-length, peer-reviewed technical papers presented at the conference.

5N52. Proceedings of Turbo Expo 2002: Print Version, Volume 5. Held in Amsterdam, June 2002. - ASME International, New York. 2002. 1314 pp. ISBN 0-7918-3610-X. ASME Book No IX0579. $300.00. (ASME members $150.00).

This printed compilation of full-length, peer-reviewed technical conference papers focuses on the area of Turbomachinery.

5N53. Spacecraft Thermal Control Handbook, Volume I: Fundamental Technologies. - Edited by DG Gilmore. Aerospace Press, El Segundo CA. 2002. 836 pp. ISBN 1-884989-11-X. $99.95.

This handbook is a compendium of corporate knowledge and heritage in the field of thermal control of uncrewed spacecraft. The objective was to develop a practical handbook that provides the reader with enough background and specific information to begin conducting thermal analysis and to participate in the thermal design of spacecraft systems. It expects the reader to have one introductory heat-transfer class and understand the fundamental principles of conductive, radiative, and convective heat transfer. The handbook is designed to be useful to thermal engineers of all experience levels.

Heat Transfer in Single and Multiphase Systems. - GF Naterer *(Univ of Manitoba, Winnipeg, Manitoba, Canada).* CRC Press LLC, Boca Raton FL. 2003. 618 pp. ISBN 0-8493-1032-6. $129.95. (Under review)

Nonequilibrium Thermodynamics: Trans-

port and Rate Processes in Physical and Biological Systems. - Y Demirel *(Dept of Chem Eng, VPI, 127 Randolph Hall, Blacksburg VA 24061).* Elsevier Sci BV, Amsterdam, Netherlands. 2002. 420 pp. ISBN 0-444-50886-4. $210.00. (Under review)

VII. EARTH SCIENCES

5R54. Geodynamics of the Lithosphere: An Introduction. - K Stuwe *(Dept of Geol and Paleontology, Univ of Graz, Heinrichstr 26, Graz, 8010, Austria).* Springer-Verlag, Berlin. 2002. 449 pp. ISBN 3-54041-726-5. $69.95.

Reviewed by H Lippmann (Lehrstuhl A fur Mech, Tech Univ, Boltzmannstr 15, Garching, D-85748, Germany).

This monograph, although titled, an Introduction, deals in a pretty comprehensive way with the physical and mathematical modeling of the lithosphere of the earth, thus representing a textbook and a reference at the same time. Its special character results from the intention, ie, to bridge the gap of understanding between the field geologist and the more theoretically oriented scientist. Therefore mathematics has not been avoided; however, it is limited to the necessary items well explained without using mathematical proofs.

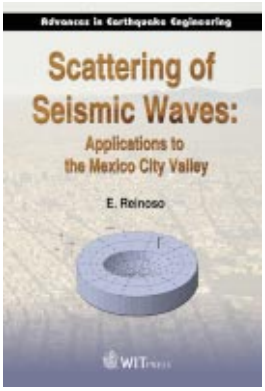
In the first two chapters, a common base of knowledge is generated, for all readers starting from general concepts like modeling as such, geometrical dimension, geometrical or physical approximation, accuracy of measurement or calculation and similar, after which the basic geological and the geographical concepts are outlined. Actually, the lithosphere may be understood as the mainly solid outer shell of the earth, extending down to a depth of 100–150 km. It contains the heterogeneous crust with a depth of up to 80 km under the surface, while it is confined from below by the mostly viscous asthenosphere. Consequently, the lithosphere is governed by plate tectonics responsible, besides other effects for the evolution of the geographical shape and position of the continents as well as for its perturbations by earthquakes or eruptions. Chapter 3 describes the direct influence of heat and temperature. Here, after an introduction into the mathematical background heat production (or consumption) by means of radioactivity, the effect of chemical processes and of mechanical friction is treated in combination with heat conduction, advection (ie, non-stationary convection), and melting. Now the continental lithosphere may even be defined in terms of thermodynamics, ie, as the outer shell of the earth in which heat is primarily transported via conduction. Moreover the thermal evolution in the oceanic lithosphere, in rock intrusions, and around faults is considered. Chapter 4 is mainly mechanical using rigid body or elastic models. It deals with the vertical motion of rock masses (uplift or exhumation), the resulting surface elevation or mass distribution (isostasy), the erosion and the forming of the surface shape (geomorphology), including also the depth of the oceans, the shape of volcanoes, or the boundaries between land and sea in terms of fractals. Three-dimensional states of stress, strain, or strain rate are introduced in Chapter 5 mutually with the constitutive laws of elasticity (Hooke), brittle fracture (Mohr-Colomb), and viscosity (Newton). These laws are then applied in a combined way to models for the lithosphere or, in particular, to the plate motion including the effects of overlapping, sinking, and folding. The collision of continents is, besides other selected geodynamic processes, studied in detail. Chapter 7 illustrates the fundamentals and the use of phase diagrams (as they would commonly be denoted in other disciplines), at which temperature, time, or components of stress and strain are mutually plotted. In three appendices, mathematical tools and a list of symbols are presented.

Each chapter contains also a series of non-trivial problems for the reader, the solutions of which can be found at the end of the book. The list of references is comprehensive; the numerous diagrams, figures, and halftone pictures with detailed legends are impressive. Altogether the author succeeded in writing an excellent book fully meeting the intentions mentioned at the beginning of this review. *Geodynamics of the Lithosphere: An Introduction* can be warmly recommended to geologists or geophysicists looking for a deeper understanding of the complicated phenomena, ruling the evolution of the solid shell around our planet. Moreover, it can be of immediate use to engineers involved in the construction of streets, bridges, buildings, tunnels, or mining facilities closely related to the properties of the earth's mantle and to the processes to which it is submitted.

5R55. Scattering of Seismic Waves: Applications to the Mexico City Valley. - E Reinoso *(Univ Nacional Autonoma, Mexico).* WIT Press, Southampton, UK. 2002. 202 pp. ISBN 1-85312-833-3. $122.00.

Reviewed by CS Manohar (Dept of Civil Eng, Indian Inst of Sci, Bangalore, 560 012, India).

Amplification of seismic energy, as it filters through subsurface formations and mountainous terrain, is a complex dynamical phenomenon. From an engineering point of view, an understanding of this phenomenon is crucial in appreciating the spatial variability of ground motions and the concomitant damage patterns observed during strong motion earthquakes. Mathematical modeling of this phenomenon has become possible in the recent decades due to the developments in the field of computational solid mechanics and emergence of computing power. This book reports on such modeling efforts as applied to Mexico City valley with special emphasis on delineating the model predictions with observed earthquake amplification patterns. The book presents numerical models to predict the scattering from irregular topographies and alluvial valleys due to plane incident waves and Rayleigh waves. This book forms a part of a series on advances in earthquake engineering.



The book consists of eight chapters with a list of references following each chapter. The first chapter summarizes the contents of the book. The basics of linear elastodynamics and wave propagation in infinite media are covered in Chapter 2. The use of the boundary element method for 2D potential problems is detailed in Chapter 3. The problems of 2D and 3D elastodynamics are covered in Chapters 4 and 5. The material covered includes discussion on buried alluvial valleys (made up of two regions: half-space and the valley), canyons of arbitrary shapes, and scattering by mountains with arbitrary geometry. Chapter 6 summarizes the observed amplification patterns in the Mexico City valley. The author here concisely, yet comprehensively, summarizes the features discernable from earthquake accelerographs recorded since the 1985 Michoacan earthquake. In Chapter 7, the gamut of mathematical modeling tools outlined in Chapters 2–5 are brought to bear on the problem of modeling of Mexico City valley. Discussions on comparing observed facts with model predictions are made. While a 1D model is found to be adequate to explain most of the observed amplification, the need for adopting a 2D and 3D model is demonstrated to explain amplification at edges of the valley or when the clay deposits are deeper. The book concludes in Chapter 8 wherein a few suggestions for future research are also provided.

The book is well written and achieves well its stated objectives. The book contains ample references to published work. One of the striking features of this book has been the conception and outlay of the figures. This has added immensely to the eloquence of the book. This reviewer considers *Scattering of Seismic Waves: Applications to the*

Mexico City Valley to be an excellent contribution to the literature on earthquake engineering. The book would serve as a valuable starting point for any efforts in mathematical modeling of seismic response of large valleys and mountains that house many cities of the world. The book qualifies to be a reference book that certainly would be a valuable addition to libraries of universities and research laboratories pursuing research and development in the areas of earthquake engineering and engineering seismology.

IX. BIOENGINEERING

5N56. Bioengineering of the Skin: Skin Biomechanics, Volume V. - Edited by P Elsner *(Friedrich-Schiller Univ, Jena, Germany)*, E Berardesca *(Univ of Pavia, Rome, Italy)*, KP Wilhelm *(proDerm Inst fur Angewandt, Schenefeld, Germany)*, HI Maibach *(Univ of California, San Francisco CA)*. CRC Press LLC, Boca Raton FL. 2002. 320 pp. ISBN 0-8493-7521-5. $139.95.

This volume explores changes in the biomechanical properties of skin.

5N57. Biomechanics: Principles and Applications. - Edited by DJ Schneck *(Virginia Polytech Inst, Blacksburg VA)* and JD Bronzino *(Dept of Eng, Trinity Col, Hartford CT)*. CRC Press LLC, Boca Raton FL. 2002. 288 pp. ISBN 0-8493-1492-5. $99.95.

This book, with its handbook style and tabular format, offers a definitive, comprehensive review of this rapidly growing field, including recent advancements made by biomedical engineers to the understanding of fundamental aspects of physiologic function in health, disease, and environmental extremes. The chapters, each discussed by a leader in the respective area, address the subjects of biosolid mechanics and biofluid mechanics as they pertain to various subsystems of the human body. They also review applications such as sports biomechanics, repair and rehabilitation of body parts, and technology to support or replace ailing physiologic organs with prosthetic parts.

5N58. Polymer Based Systems on Tissue Engineering, Replacement and Regeneration. - Edited by RL Reis *(Dept of Polymer Eng, Univ of Monho, GuimarAles, Portugal)* and D Cohn *(Hebrew Univ of Jerusalem, Israel)*. Kluwer Acad Publ, Norwell MA. 2002. 440 pp. (Softcover: ISBN 1-4020-1001-X, $64.00). ISBN 1-4020-1000-1. $156.00.

Biodegradable, polymer-based systems are playing an increasingly pivotal role in tissue engineering replacement and regeneration. This book contains chapters on biodegradable polymers, polymeric biomaterials, surface modification for controlling cell-material interactions, scaffold design and processing, biomimetic coatings, biocompatibility evaluation, tissue engineering constructs, cell isolation, characterization and culture, and controlled release of bioactive agents.

X. GENERAL & MISCELLANEOUS

5N59. Proceeding of the 2002 ASME International Mechanical Engineering Congress and Exposition, Volume 1. Held November 2002, New Orleans. - ASME International, New York. 2002. CD-Rom. ISBN 0-7918-1691-5. ASME Book No G1185D. $595.00. (ASME members $476.00).

This CD-Rom consists of 600 full-length, peer-reviewed technical papers on the following topics: applied mechanics, bioengineering, biomedical technology, fluids engineering, and heat transfer. The CD interface is Adobe Acrobat 5.0 with the Verity Search engine. It includes full color where provided by the authors, full and fielded search, and help.

5N60. Proceedings of the 2002 ASME International Mechanical Engineering Congress and Exposition, Volume 2. Held November 2002, New Orleans. - ASME International, New York. 2002. CD-Rom. ISBN 0-7918-1692-3. ASME Book No G1186D. $595.00. (ASME members $476.00).

This CD-Rom consists of 423 full-length, peer-reviewed technical papers on the following topics: design engineering, electrical systems and photonic design, fluid powers systems and technology, microelectromechanical engineering, dynamic systems and control, electronic and photonic packaging, MEMS, and nanotechnology. The CD interface is Adobe Acrobat 5.0 with the Verity Search engine and includes full color where provided by the authors, full and fielded search, and help.

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Erratum

One reviewer's name was missing from the *AMR* Book Review Number **3R25** (*App. Mech. Rev.* **56**(2) March 2003, pp. B26-B27). We apologize to the reviewer, CA Soto, and to the readers for this omission. The correct reviewer information appears below.

3R25. Shape Optimization by the Homogenization Method. Applied Mathematical Sciences, Vol 146.-G Allaire *(Center of Appl. Math, Ecole Polytechnic, Paliseau Cedex, 91128, France).* Springer-Verlag, New York. 2002. 456 pp. ISBN 0-387-95298-5. $79.95.
Reviewed by CA Soto (Ford Research and Advanced Eng, 2101 Village Rd, MD2115 SRL, Dearborn MI 48124) and MS Qatu (Ford Motor Co, EVB Bldg, MD X8, 20800 Oakwood Blvd, Dearborn MI 48124).

