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.

FOUNDATIONS & BASIC METHODS

3R1. Boundary Element Method, Volume 1: Applications in Thermo-Fluids and Acoustics. - LC Wrobel *(Brunel Univ, UK).* Wiley, W Sussex, UK. 2002. 451 pp. ISBN 0-471-72039-9. $160.00.

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

This is Volume 1 of a two-volume set offering a comprehensive treatment of the fundamentals and applications of the boundary element method (BEM) in thermo-fluids, acoustics, and solid mechanics. Volume 1 is authored by Prof Luis Wrobel of Brunel University, and Volume 2, by Prof Ferri Aliabadi, of the College of London, both of whom are recognized authorities on and long-standing contributors to the development of the BEM. The BEM is a numerical method for the solution of boundary integral equations that can be derived for a variety of engineering field problems. This is possible if a fundamental solution is available for the differential operator governing the field problem of interest, and in such cases, the BEM only requires a discretization of the bounding surface, a distinct advantage over volume meshing techniques such as the finite volume and finite element method. This advantage is even more pronounced when dealing with moving surface and inverse problems as well as optimization.

This 11-chapter book begins with a historical review of integral equations and the BEM over the last 40 years. Basic mathematical notations and theory of integral equations methods useful in development of the BEM in potential theory are covered in the ensuing chapters. A brief treatment of hypersingular equations, dual and multiple reciprocity, axi-symmetry, Galerkin BEM formulation, and fast solvers is also provided. The next two chapters address heat transfer applications of the BEM in steady and unsteady regimes. Linear as well as nonlinear heat transfer are both covered with applications to nonlinear materials, radiation, phase change, and materials processing. Convection-diffusion, bio-heat transfer, hyperbolic heat conduction, as well as coupled heat and mass transfer are treated in some detail.

The next chapter develops the BEM for acoustics modeling in the frequency domain. Attention is given to the ensuing hyper-singular integrals and to regularization of the integral equations as well as to the treatment of the well-known non-uniqueness arising in exterior acoustics problems. Much detail is provided in the formulation and implementation of the BEM in acoustics as well as a wide range of applications ranging from muffler simulations to acoustic barrier modeling. The dual BEM is developed for the case of thin barriers. Finally, BEM in transient acoustics is presented using the time dependent fundamental solution along with time marching schemes. The chapter closes with a brief review of BEM in acoustics including FEM/BEM coupling, bio-engineering applications, and modeling of musical instruments.

The following chapter treats the application of the BEM in electrochemistry, which begins with a derivation of the potential equation governing the problem of electrochemistry as well as the definition of the polarization curve that serves as a boundary condition for these problems. Several examples are presented ranging from 2D to 3D applications in circular corrosion cells, buried tanks, seawater pump analysis, and cathodic protection of offshore platforms as well electro-deposition.

The next three chapters address fluid mechanics problems in ideal flows, slow viscous flows, and general viscous flows governed by the Navier-Stokes equations. The theory and applications of ideal flow to salt-water intrusion in confined and unconfined aquifers, flow in heterogeneous porous media, viscous fingering, evolution of capillary fountains, and propagation of nonlinear surface waves are all detailed. Integral equation theory for slow viscous flows governed by the Stokes equation is considered in detail, and the complete double layer potential boundary integral equation method is addressed. This is a class of viscous flow problems where the BEM excels as explicit fundamental solutions exist and are readily available to formulate the required boundary integral equation that is the theoretical foundation of the BEM. Moreover, the problem of suspended particles in Stokes flow is considered along with a review of the literature on fast solvers for such problems. BEM application to Oseen and non-Newtonian flows is briefly treated. The chapter on general viscous flows considers several alternatives to address the lack of fundamental solutions for the general Navier-Stokes equations. The alternatives range from cell integration to the dual reciprocity BEM. Velocity-pressure, velocity-vorticity, and penalty formulations are presented.

Following the series of chapters on fluid mechanics is an extensive chapter on the subject of BEM applications to inverse problems in all of the fields discussed in the prior chapters of the book. The mathematical theory of inverse problems is first reviewed, and the concept of regularization is introduced. Applications of the BEM to inverse heat transfer, acoustics, fluid mechanics, and electrochemical problems are provided.

The final chapter is dedicated to the important subject of numerical integration in 2D and 3D and to the treatment of special integrals appearing in the BEM. In particular, methods are discussed for the numerical evaluation of nearly singular, singular, and hyper-singular integrals.

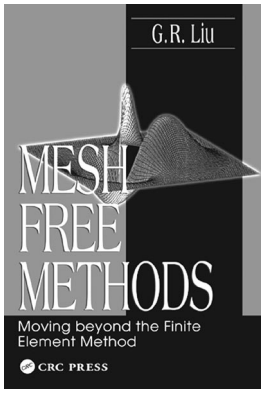
The book is well organized, and written in a pleasant and approachable style. It provides an excellent up-to-date source of information on the BEM. The author is meticulous in his presentation and offers comprehensive references at the end of each chapter. The chapters are self-contained, and all rely on fundamentals of integral equations and the BEM detailed in Chapter 2. Each chapter contains numerous examples and high-quality illustrations. There are no exercises at the end of each chapter. The book has a table of contents and a subject index. *Boundary Element Method, Volume 1: Applications in Thermo-Fluids and Acoustics* is highly recommended as a textbook for graduate courses of the BEM, and it is also strongly recommended for acquisition by university and research center libraries as an important and modern contribution by a leading authority to the growing literature on the BEM.

3R2. Mesh Free Methods: Moving Beyond the Finite Element Method. - GR Liu *(Center for Adv Computations in Eng Sci, Natl Univ of Singapore).* CRC Press LLC, Boca Raton FL. 2003. 691 pp. ISBN 0-8493-1238-8. $149.95.

Reviewed by D Karamanlidis (Dept of Civil Eng, Univ of Rhode Island, Bliss Hall, Kingston RI 02881).

As anyone who has ever used finite elements over a prolonged period of time

knows, the method does have its share of shortcomings. Hence, in the early 1980s commercial software started popping up, which was based on boundary elements—elements, that is, defined only over the boundary of the problem under consideration. Mesh free methods attempt to ''move beyond the Finite and Boundary Element Methods'' in as much as they abandon the element (subregion) concept altogether and use instead a set of nodal points to discretize the domain. Now, according to the author's preface, ''...the book provides systematic steps that lead the reader to understand mesh free methods, how they work, how to use and develop a mesh free method, as well as the problems, associated with the element free methods...'' The author further states that the book is intended for ''...senior university students, graduate students, researchers, and professionals in engineering and science. Mechanical engineers and practitioners and structural engineers and practitioners will also find the book useful.''



The book is quite voluminous and covers a whole range of engineering mechanics problems both for solids and fluids. The author certainly did a commendable job in preparing a single source that presents not only his own research work, but also the accomplishments by others working in this relatively new area of computational mechanics. Of the 16 chapters of which the book is comprised, the first two serve as an introduction, the third gives a short presentation of the equations of linear elasticity, the following 12 outline, in great detail, the various possible approaches in developing mesh free methods. Along with the theoretical background, numerous examples are presented that highlight the performance of mesh-free versus mesh-based methods. In the last chapter, a software for 2D analyses based on mesh free techniques is presented.

Overall, the book is well-written, the figures and illustrations are very good, the list of references is quite comprehensive, and the subject index is useful. The overall impression of the book is somewhat diminished by a large number of inaccuracies, which were not detected in the proofs. Some examples follow:

On page 148, ''sensor'' should read ''tensor.''

On page 148, ''displacement comment'' should read ''displacement component.''

On page 161, Eq. (6.51) is attributed to Timoshenko and Goodier. However, the equation found on page 44 of that reference is quite different. The same applies to the formulas presented on page 162 of the present book. For example, Eq. (6.54) states that the normal stress on the cross section of the beam is

$$\sigma_x = -P \cdot (L-x)/I$$

Obviously, the variable y is missing.

On page 219, ''numerical investigation'' should read ''numerical integration.''

On page 240, $0 \leqslant t \leqslant \Delta t$ should read $0 \leqslant \tau \leqslant \Delta t$.

On page 404, ''bulking'' should read ''buckling.''

Also, some of the statements made in the book seem confusing if not wrong. For example,

''...For centuries, people have been using the finite difference method...'' While, older than FEM, FDM has certainly not been used for centuries.

''...Hamilton's principle is...based on the energy principle.'' Hamilton's principle is valid for both conservative and nonconservative systems for which no energy principle exists.

''Natural and essential boundaries.'' They are more commonly referred to as boundaries on which natural and respectively essential conditions are prescribed.

The term of ''stability'' in conjunction with a mesh-free local discretization does not appear to have been defined in the book.

''The Lagrange multipliers...can be viewed physically as smart forces that can force $\mathbf{u}-\overline{\mathbf{u}}=0$. If the trial function can be so chosen that $\mathbf{u}-\overline{\mathbf{u}}=0$, the smart force will be zero...'' For one ''smart force'' is a bit unusual terminology. As one sees from the pertinent Euler equations, the Lagrange multipliers are the support reactions. More importantly though, satisfying the geometric boundary conditions does not make the Lagrange multipliers themselves but the work produced by them zero.

The heading of Section 6.4.1, ''Basic Equations for Nonlinear Mechanics Problems,'' is misleading insofar that the following equations are not correct for a general nonlinear problem involving material and geometric nonlinearities.

The above notwithstanding, *Mesh Free Methods: Moving Beyond the Finite Element Method* is recommended for purchase to libraries and researchers who have a solid background in discretization methods and are interested in learning about mesh free methods.

3R3. A New Kind of Science. - S Wolfram *(Wolfram Res Inc, 100 Trade Center Dr, Champaign IL 61820-7237)*. Wolfram Media, Champaign IL. 2002. 1197 pp. ISBN 1-57955-008-8. $44.95.

Reviewed by M Gad-el-Hak (Eng Build, Rm 303, Virginia Commonwealth Univ, 601 W Main St, PO Box 843015, Richmond VA 23284-3015).

Reviewing *A New Kind of Science* is like stepping in a minefield. The danger lies in going against the deluge of praise, proving relevance to this audience, and arguing against the proposed new science that allegedly is set to replace science, as we know it. Those issues will be addressed in turn, but first a brief background. Stephen Wolfram is considered by many to have been a child prodigy: first journal paper in particle physics at age 15; a stint at Oxford; PhD from Caltech at 20; youngest recipient of the MacArthur Prize; faculty positions at Caltech, Princeton, and Illinois; significant contributions to cellular automata and complexity theory; developer of the popular software Mathematica; and a successful entrepreneur, becoming a multi-millionaire at 30. Running his software company via e-mail and videoconference, Wolfram spent the last 10 years in virtual seclusion, relentlessly, tirelessly, secretly, and nocturnally working on an idea that possessed him: generating complexity from simple computations, algorithms of only a few lines.

The book, targeting both scientists and non-scientists, is partially about using simple rules of cellular automata to generate complex patterns. In this task, the author has succeeded beyond reproach not only in showing that this can be done brilliantly and beautifully, but also in explaining it lucidly enough for all to understand, appreciate, and savor. In the opinion of several reviewers, including this one, this aspect of the book is a *tour de force* of clarity, elegance, and simplicity. The problem is the huge leap the author takes in arguing that since nature is complex and many of the computer-generated complex patterns look or behave similarly to natural or man-made things all around us—a snow flake, a turbulent flow, a lung, a mollusk shell, a traffic jam, an outbreak of starfish on a coral reef, the entire universe—therefore that must be the way nature works. Nature runs its course the same way that a computer runs a program. That is the essence of the new science: cellular automata will yield all the secrets of the universe, solve our long-standing problems, and provide the theory of everything. More on that flight of fancy later.

The Deluge: The book was widely anticipated several years before its actual publication. Published on May 14, 2002, it quickly became an Amazon.com bestseller and was promptly reviewed by both the popular and scientific press. Heavyweights of the former included *The New York Times*, *Chicago Tribune*, *Newsweek*, *Time*, *The Daily Telegraph*, *Le Monde*, *Frankfurter Allgemeine Zeitung*, and *The Economist*. Except for the last, the popular press went gaga over the book, touting the author's claim of a new science that will stand ex-

isting science on its head. *The Economist* (p 79, June 1, 2002) was more subdued even provocatively titling its review ''The Emperor's New Theory.'' In the scientific press, the reviews were somewhat less glorious and more skeptical. In *Physics Today* (p 55, July 2002), Leo Kadanoff's review was at once pointed, subtle and polite, concluding that he cannot support the view that any ''new kind of science'' is displayed in Wolfram's book. *Newsweek* (p 59, May 27, 2002) quoted the famed physicist Freeman Dyson: ''There's a tradition of scientists approaching senility to come up with grand, improbable theories. Wolfram is unusual in that he's doing this in his 40s.'' Kadanoff and Dyson express the minority opinion, however, with the majority of reviewers being excited beyond reason about the new science that will solve every human mystery including the currently depressed stock market, human free will, quantum field theory, and entropy. For the present reviewer, danger lurks in going against the deluge of high praise, but particularly doing so several months behind the reviewers who have already anointed Stephen Wolfram as the Isaac Newton of the 21st century.

Relevance: As *New Kind of Science* aims at replacing existing science, readers of *Applied Mechanics Reviews* have a significant stake in the matter. Mechanics—classical for the most part but occasionally quantum—is the underlying branch of physics upon which almost all of applied mechanics is based. The mathematics here is often in the form of partial differential field equations, where both space and time are indefinitely divisible continuum. For example, most, but not all, fluid flows can be described via the well-known, well-posed Navier–Stokes equations. In simple problems, those first-principles equations can be solved and agreement with experiment is beyond reproach. It is the complex problem, such as a turbulent flow, that frustrated Wolfram and scores of scientists before him. The search for simpler alternative to the field equations is, therefore, quite alluring. The field equations of mechanics, when they can be solved, provide a powerful predictive tool to explain the mechanical world around us as well as to help design our man-made machines. When analytical solutions are unattainable, the field equations are discretized and brute force numerical integration is used. But even that is not possible for some situations, for example for realistic high-Reynolds-number turbulent flows and other multi-scale problems where the required computational memory and speed overwhelm today's supercomputers. For such impenetrable problems, a certain degree of empiricism is introduced to the first-principles equations and relatively faster computations can then proceed. Heuristic turbulence modeling is an example of such compromise. Despite those limitations, traditional science works exceedingly well, and applied mechanicians happily practice their craft. Readers of this journal should, therefore, care passionately if the traditional laws of mechanics are to be supplanted by a new kind of science.

The Argument: Cellular automata were introduced in the late 1940s by John von Neumann and Stanislaw Ulam, although Stephen Wolfram claims to have independently discovered the tool three decades later. Cellular automata are discrete dynamical systems whose behavior is completely specified in terms of a repetitive local relation. The space continuum is represented by a uniform one-, two-, or three-dimensional grid, with each cell containing a single bit of data, for example 0 or 1, red, white, or blue, etc, a few bits of data, or even a continuum of states. The time continuum also advances in discrete steps. The state of each cell, or memory location, is computed at each time step from a simple algorithm in terms of its *a priori* defined close neighbors. Simple computer programs could, in fact, result in complex patterns. Stephen Wolfram particularly researched one-dimensional automata arranged in a line. The bit of data in each cell is updated at each time step based only on the value of that cell and that of its two nearest cells. Wolfram methodically studied such automata and identified a total of 256 different rules. Space–time diagrams of the bits generated show four distinct patterns: dull uniformity; periodic time-dependence; fractal behavior; and truly complex non-repetitive patterns.

Stephen Wolfram says that science has been broken for more than 300 years and that he can fix it. The ''errors'' of Darwin, Newton, and the other great ones will be corrected once and for all. *A New Kind of Science* proposes a radical notion about the development of the natural world, and Wolfram aims to uncover the fundamental rules underlying the complex universe. The pattern-generating capabilities of discrete cellular automata are to supplant the difficult-to-solve or even yet-to-be-found continuum equations of traditional science. But just because the patterns of cellular automata *can* resemble those of the natural world does not mean that nature *must* work that way. Furthermore, traditional equations are believed to represent reality because they can be used to make predictions that agree with observations. This is the essence of Galileo's paradigm that is the underpinning of modern science. The explanatory power and authority of science stem from its ability to make verifiable predictions; otherwise theory is a mere *post-hoc* speculation. That is exactly what the proposed new science is. The computer games of cellular automata provide mere *post-hoc* speculation and cannot possibly compete with the predictive horsepower of $F=ma$ or $E=mc^2$.

Wolfram's boasting, throughout 1200 pages, is at a minimum excessive. He writes, ''I have discovered vastly more than I ever thought possible, and in fact what I have done now touches almost every existing area of science, and quite a bit besides.'' Wolfram writes of several ideas as originating by him, but in fact the credits belong elsewhere. Alan Turing conceptualized the simplest universal computer, the Turing machine. Thinking of the universe as a vast digital computer was the brainchild of Edward Fredkin. The use of a cellular automata machine as an environment for physical modeling was detailed by Tommaso Toffoli and Norman Margolus. Other ideas by Per Bak, Charles Bennett, and Hans Meinhardt percolate throughout the present book, but are not properly credited. Writing in the first person, relegating all notes to the last 350 pages of the book, grudgingly as well as dismissively mentioning few names, and restricting the list of references to his own publications, Wolfram does not help to dispel this important shortcoming.

Wolfram took the unusual approach of bypassing the peer review process. He self-published the present book, acting as author, editor, and publisher. The opening paragraph in the mostly favorable *Time*'s review of the book (May 20, 2002) is worth reflecting on: ''Cranks are an occupational hazard that every scientist eventually faces. Fortunately, these characters are usually easy to spot. If someone claims to have a grand theory that overturns centuries of scientific knowledge—especially when the theory spans unrelated fields like physics and biology and economics—the odds are good that he or she is a crank. If the author publishes not in standard scientific journals but in a book for general readers, watch out. And if the book is issued by the author rather than a conventional publisher, the case is pretty much airtight.'' *A New Kind of Science* claims are more extravagant than those of cold fusion—à la Stanley Pons and Martin Fleischman—and deserve proportionally more vigilant scrutiny. Wolfram has not validated his theory nor has he subjected it to the peer review process like the rest of us mere mortals are expected to do. Furthermore, in contrast to the old kind of science, Wolfram's *anti-Newtonian* model of the universe cannot be used to predict much of anything. The new emperor has no clothes. The present book is an offense to all those who play by the rules and brick by brick build this edifice we call science, good old science.

The Bottom Line: For fun reading and pretty pictures, this book is not a bad recommendation. For inspiration, read Isaac Newton's *Principia Mathematica*, in Latin. For problem solving in applied mechanics, the Newtonian framework is still the best bet, and one's time is better spent reading traditional books and journals in mechanics.

3R4. Nonlocal Continuum Field Theories. - AC Eringen *(Prof Emeritus, Princeton Univ, 15 Red Tail Dr, Littleton CO 80126-5001)*. Springer-Verlag, New York. 2002. 376 pp. ISBN 0-387-95275-6. $159.00.

Reviewed by JL Wegner (Dept of Mech Eng, Univ of Victoria, Eng Office Wing, Room 537, Victoria BC, V8W 3P6, Canada).

The main purpose of this book is to present a unified foundation for the development of the basic field equations of nonlocal continuum field theories. In order to achieve this goal, the author has relied on the natural extensions of the two fundamental laws of physics to nonlocality: 1) the energy balance law is postulated to remain in global form, and 2) a material point of the body is considered to be attracted by all points of the body, at all past times. By means of these two natural generalizations of the corresponding local principles, theories of nonlocal elasticity, fluid dynamics, and electromagnetic field theories are formulated that include nonlocality in both space and time. It is a well-written, rigorous mathematical treatment of nonlocal continuum field theories, and deals with such concepts such as nonlocal electromagnetic thermoelastic solids and nonlocal electromagnetic thermoviscous fluids.

The volume consists of 15 chapters and an appendix on the derivation of the Riemann Christoffel curvature tensor, and the Laplacian of the stress tensor in curvilinear coordinates.

Chapter one covers kinematics, that is the geometry of motion and the deformation of material bodies. The outline follows the script of most texts on classical continuum mechanics. That is, the concepts of material bodies and the material derivative are introduced. The deformation gradient tensor is introduced, and its physical meaning is described by the transformation of material line, surface, and volume elements. Similar to most treatments on classical continuum mechanics, the appropriate strain and stretch tensors are described. The remainder of the first chapter discusses the principle of objectivity, fundamental to the constitutive theory, and the compatibility conditions. As a departure from classical mechanics, the concept of nonlocal materials is introduced by the compatibility equations governing the dispacement field. Here, it is shown that if the compatibility conditions are satisfied, then there will not be a singled valued solution for the displacement field, and in this case the body will contain dislocations, cracks, inclusions, or other discontinuous fields. The first chapter is fundamental to the mathematical developments presented in later chapters.

Chapter 2 is concerned with the fundamental concept of stress. The energy and mass balance, for the entire body, are postulated. By means of the transport and Green Gauss theorem, the global laws of mass and energy are localized. An important theorem shows that the invariance of the energy balance, under each Galilean group, leads to a balance law. Localization involves residuals, which are shown to be incorporated into the concepts of the stress and energy. This leaves the new residuals only in the jump conditions governing the equations across a discontinuous surface moving through the material surface. In this way, new concepts of stress and energy involving long-range interactions are made part of the classical concepts. The remainder of the second chapter is devoted to thermodynamics, in which the concept of the second law of thermodynamics is first introduced. The Clausius-Duhem (C D) inequality, fundamental to the development of constitutive equations, is presented. Section 2.3, discusses the concept of dissipation. A theorem shows how one may obtain the solution of the C D inequality. Onsager reciprocal relations are also discussed. The solution of the C D inequality is extended to the memory functionals relevant to the discussions of the dissipative media.

In Section 3.1, eight axioms that are fundamental to the development of the constitutive equations are postulated and discussed separately. In Section 3.2, using these axioms, constitutive equations are obtained for memory dependent nonlocal thermoelastic solids, and in Section 3.3, for memory dependent, nonlocal thermoviscous fluids. Thus far, these developments are exact and applicable to nonlinear media undergoing finite deformations and motions.

The interaction of electromagnetic (E M) fields with deformable bodies requires new concepts which are developed in chapter four. Here, the Mawell equations are extended to nonlocal media, *ie* the global balance laws involving E M fields are written in Section 4.1. The localization involves some E M residuals. Here, also, Eringen is able to incorporate the nonlocal residuals into the E M fields. In this way, there remains one surface residual only, relevant to the jump conditions governing the magnetic field at a moving discontinuity surface through the surface. Electromagnetic force, couples, and power are discussed in Section 4.2, where the expressions of the stress tensor, the E M momentum, and Poynting stress vector that enter into the mechanical balance equations, are derived. The jump discontinuities of the E M force, couples, and power are developed in order to account for jump discontinuities. This is elaborated in Section 4.3. The expressions for the mechanical balance laws for electromechanically active media are derived in Section 4.4. The energy balance equation and the C D inequality are obtained for the development of the constitutive equations E M elastic solids.

The formulation of the constitutive equations of electromagnetic (E M) elastic solids must employ a special type of Helmholtz free energy functions and dissipation potential. To this end, the energy equations, the C D inequality, and constitutive equations, are developed in the material frame of reference. Separate constitutive equations for the static and dynamic members of the constitutive dependent variables are developed by employing an additive functional and the C D inequality. The dynamic members of the constitutive equations require the introduction of the difference histories of the dependent variables. The resulting constitutive equations are nonlocal both in space and time. Section 5.2 develops the constitutive equations of the memory dependent nonlocal E M thermoviscous fluids in the spatial domain.

The remainder of the book, Chapters 6–15, is devoted to applications of the theory developed in Chapter 3. In Chapter 6, certain problems of nonlocal linear elasticity are solved. In order to linearize the equations, the linear strain tensor, ekl, is introduced and small temperature changes T from a constant ambient temperature, TO are considered. The Helmholtz free energy function is written as a quadratic in terms of ekl and T, and a dissipative functional in terms of the gradient of the temperature field. The constitutive equations for nonlocal anisotropic elastic solids are then obtained using the equations developed in Chapter 3. Later, the constitutive equations for isotropic linear elastic solids are obtained, along with various different, but equivalent, forms of these equations. In Section 6.2, the same constitutive equations are obtained through the lattice dynamical approach.

The linear constitutive equations of nonlocal thermoviscous fluids are obtained in Chapter 7. In particular, the channel flow problem is solved where it is shown that the nonlinear theory predicts that the shear stress is 50% of the shear stress predicted by the classical theory. It is shown that the shear stress depends on the ratio of the internal characteristic length to the channel depth. Other problems solved in this chapter include lubrication problems in microscopic channels, and on rotating discs.

Chapter 8 covers nonlocal linear electromagnetic theory. Memory dependent nonlocal thermoelastic solids are included in Chapter 9. The isotropic solids and Kelvin Voigt type models are given as special cases. The constitutive equations for memory dependent nonlocal thermoviscous fluids are obtained in Chapter 10, along with the formulation of mixed boundary initial value problems.

Chapters 11 and 12 discuss memory dependent nonlocal electromagnetic elastic solids and thermofluids, respectively. For nonlocal elastic solids, memory effects include the E M absorptions and viscous dissipation. The formulation for memory dependent nonlocal electromagnetic thermofluids obtained in Chapter 12, is important to the discussions of various physical phe-

nomena connected with magnetohydrodynamics, plasma physics, and atmospheric ionization. Chapters 13–15 investigate the effects of nonlocality in the case of continua with microstructure.

Nonlocal Continuum Field Theories is suitable for a reader knowledgeable in the general area of classical continuum mechanics, but not necessarily familiar with the concept of nonlocality. What is refreshing in the treatment presented by Eringen, is that in addition to providing the requisite mathematical background, he presents a discussion of nonlocal material behavior throughout the volume, which provides a reader unfamiliar with this concept, an intuitive understanding of the physical nature of this phenomenon.

3N5. Applied Parallel Computing. Proc of 6th Int Conf, Espoo, Finland, June 2002**.** - Edited by J Fagerholm, J Haataja, J Jarvinen, M Lyly, P Raback, V Savolainen *(CSC, Espoo, Finland)*. Springer-Verlag, New York. 2002. 626 pp. Softcover. ISBN 3-540-43786-X. $91.00.

Fifty revised full papers presented at the conference together with nine keynote lectures were carefully reviewed and selected for inclusion in this proceedings. The papers are organized in topical sections on data mining and knowledge discovery, parallel program development, practical experience in parallel computing, computer science, numerical algorithms with hierarchical memory optimization, numerical methods and algorithms, cluster computing, grid and network technologies, and physics and applications.

3N6. Boundary Elements XXIV: Incorporating Meshless Solutions. Proc of 24th Int Conf on Boundary Element Methods, Sintra, Portugal, June 2002**.** - Edited by CA Brebbia *(Wessex Inst of Tech, Southampton, UK)*, A Tadeu *(Univ of Coimbra, Portugal)*, V Popov *(Wessex Inst of Tech, Southampton, UK)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech, Billerica MA. 2002. 776 pp. ISBN 1-85312-914-3. $369.00.

The BEM is a very active area of research with the method being successfully applied to solve difficult engineering and scientific problems, including the solution of nonlinear and time-dependent problems. Considerable advances have also been made in the use of high performance computing. The contributors to this volume cover the latest research and applications of the BEM in areas such as fracture mechanics and fatigue, composite materials, geomechanics, biomechanics, fluid flow and acoustics, as well as topics of a more theoretical character. State-of-the-art reviews and advanced mathematical and computational aspects are also included.

Papers from the conference's Meshless Methods Seminar discuss the use of integral equations without meshes and also highlight techniques including fundamental solutions. Galerkin, diffuse methods, localized collocation, cloud and diffusive methods, and modified Trefftz techniques.

The volume is divided in the following 13 sections: BEM in Portugal; Meshless methods; Plates and shells; Advanced formulations; Dual reciprocity method; Acoustics; Electrostatics and electromagnetics; Transport and fluid problems; Wave propagation problems; Stress analysis; Composite materials; Inverse problems; and Computational techniques.

3N7. Chebyshev Polynomials. - JC Mason *(Univ of Huddersfield, Queensgate, UK)* and D Handscomb *(Oxford Univ Comput Lab, UK)*. Chapman and Hall/CRC, Boca Raton FL. 2002. 352 pp. ISBN 0-8493-0355-9. $99.95.

Providing an highly readable exposition on the state of the art of Chebyshev polynomials, this book includes rigorous yet down-to-earth coverage of the theory along with an in-depth look at the properties of all four kinds of Chebyshev polynomials—properties that lead to a range of results in areas such as approximation, series expansions, interpolation, quadrature, and integral equations. Problems in each chapter, ranging in difficulty from elementary to quite advanced, reinforce the concepts and methods presented.

The book discusses theoretical aspects, including definitions, properties, and key formulas for generating the polynomials and computing the expressions that involve them. It includes practical discussions centering on applications such as polynomial approximation, rational approximation, integration, integral equations, and ordinary and partial differential equations, particularly the tau and spectral methods. Problem sets are included in each chapter.

3N8. Computational Technologies for Fluid, Thermal, Structural, Chemical Systems with Industrial Applications - 2002, Volume II. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by S Kawano, VV Kudriavtsev, CR Kleijn. ASME International, New York. 2002. 344 pp. ISBN 0-7918-4659-8. ASME Book No H1246B. $130.00. (ASME members $65.00).

Flow in multiphase systems, flow and mixing, flow and fluid-structure interaction, various applications of industrial CFD, use of CFD to design melt blowing die, and CFD of flow with heat transfer are among the topics covered in this volume of 37 full-length, peer-reviewed technical papers.

3N9. Encyclopedia of Nanoscience and Nanotechnology. - Edited by HS Nalwa. Am Sci Publ, Stevenson Ranch CA. 2003. 6000 pp. 10-Vol set (Available both in print and online). ISBN 1-58883-001-2. $5975.00.

This is said to be the first encyclopedia published in the field of nanotechnology. In 10 volumes, this single reference source provides introduction and overview of advances and emerging aspects of nanotechnology spanning from science to engineering to medicine. It covers aspects of nanoscale science and technology dealing with materials synthesis, processing, fabrication of probes, spectroscopy, physical properties, electronics, optics, mechanics, biotechnology, devices, etc. The encyclopedia provides basic information on all fundamental and applied aspects of nanotechnology by drawing on two decades of pioneering research. It is written for all levels and allows non-scientists to understand nanotechnology while providing up-to-date latest information to active scientists and experts in the field. Key features include

- Comprehensive coverage of all aspects of the nanoscale science and technology in all disciplines
- Up-to-date reference work drawing on the past two decades of pioneering research
- About 400 review chapters contributed by over 1000 of the world's leading scientists
- Entries organized alphabetically in an A-Z order, browsing capabilities within different categories
- State-of-the-art review chapters of approximately 8–35 encyclopedia pages in length
- Edited and written by internationally known authoritative experts familiar with current technologies
- Contributions by authors from 30 countries
- Nearly 50,000 bibliographic citations from hundreds of different journals
- Thousands of figures, illustrations, tables, photographs, chemical structures, and equations
- Published in both print and online formats (online edition will be updated)
- Extensive cross-referencing in each article provides reader with broader range of knowledge
- Online edition allowing multiple users and fully searchable text
- Multidisciplinary reference source for researchers spanning from science, engineering, and medicine

Encyclopedia scope covers Nanostructured materials including semiconductors, metals, conductors, superconductors; Nanofabrication and processing of nanoscale materials and devices, CVD, epitaxy; Nanoprobes, spectroscopic characterization, STM, AFM, TEM, etc; Properties of atomic, molecular, and nanoscale materials, interactions at nanoscale; Nanocomposites, nanoparticles, nanocrystalline materials, nanoclusters, and nanocrystals; Superlattices, quantum dots, molecular and nanowires, nanoscale thin-films, nanoporous systems; Hybrid materials, colloids, alloys, nanoceramics, self-assembled monolayers, and multilayers; Nanoelectronics, nanooptics, nanophysics, nano-integration, quantum optics, nanomagnetism; Fullerenes, nanotubes, nanorods, molecular wires, molecular nanotechnology; Supramolecules, dendrimers, self-assemblies, low-dimension structures, polymers; Structure analysis at atomic, molecular, and nanometer range; Atomic manipulation, computational nanotechnology, molecular nanoscience; Nanorobotics, nanomechanics, nanotribology, nanofluidics; Applications in LEDs, displays, solar cells, batteries, lithography, catalysis, memories, coatings; and Nanobiotechnology, nanobiology, nanomedicines, drug delivery, biomedical applications. Separate pricing is available for the print editions plus online edition, which includes 1-year online access. An annual subscription is required for access in subsequent years.

3N10. Handbook of Nanoscience, Engineering, and Technology. - Edited by WA Goddard III *(Beckman Inst, Pasedena CA)*, DW Brenner *(North Carolina State Univ)*, SE Lyshevski *(Purdue Univ, Indianapolis IN)*, GJ Iafrate *(Univ of Notre Dame)*. CRC Press LLC, Boca Raton FL. 2002. 1500 pp. ISBN 0-8493-1200-0. $179.95.

Nanotechnology, science, and engineering spearhead the 21st century revolution that is leading to fundamental breakthroughs in the way materials, devices, and systems are understood, designed, made, and used. With contributions from a host of experts and pioneers in the field, this handbook sets forth the fundamentals of nanoelectromechanical systems, studies their fabrication, and explores some promising applications. It provides comprehensive information and references for nanoscale structures, devices, and systems; molecular technology; and nanoelectromechanical theory.

3N11. Mathematical Modeling and Numerical Simulation in Continuum Mechanics. Proc of Int Symp, Sept/Oct 2000, Yamaguchi, Japan**.** - Edited by I Babuska *(Univ of Texas, Austin TX)*, PG Ciarlet *(Univ Pierre et Marie Curie, Paris, France)*, T Miyoshi *(Yamaguchi Univ, Japan)*. Springer-Verlag, New York. 2002. 309 pp. Softcover. ISBN 3-540-42399-0. $89.95.

This book shows the latest frontiers of the research by active researchers in the field of numerical mathematics. The papers in the book were presented at the symposium, the subject of which was mathematical modeling and numerical simulation in continuum mechanics. The topics of the lectures ranged from solids to fluids and included both mathematical and computational analysis of phenomena and algorithms. The reader can study the latest results on shells, plates, flows in various situations, fracture of solids, new ways of exact error estimates, and many other topics.

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. (Under review)

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. (Under review)

Natural Boundary Integral Method and Its Applications. - De-hao Yu *(Inst of Comput Math and Sci/Eng Comput, Chinese Acad of Sci, Beijing, ROC)*. Kluwer Acad Publ, Dordrecht, Netherlands. Distributed in USA by Kluwer Acad Publ, Norwell MA. 2002. 539 pp. ISBN 1-4020-0457-5. $155.00. (Under review)

Random Perturbation Methods with Applications in Science and Engineering. Applied Mathematical Sciences, Vol 150**.** - AV Skorokhod *(Inst of Math, Ukrainian Acad of Sci, 3 Tereshchenkivska St, Kiev, 01601, Ukraine)*, FC Hoppensteadt *(Syst Sci and Eng Res Cen, Arizona State Univ, Tempe AZ 85287-7606)*, H Salehi *(Dept of Stat and Probab, Michigan State Univ, E Lansing MI 48824)*. Springer-Verlag, New York. 2002. 488 pp. ISBN 0-387-95427-9. $79.95. (Under review)

Simulating, Analyzing, and Animating Dynamical Systems: A Guide to XPPAUT for Researchers and Students. - B Ermentrout *(Dept of Math, Univ of Pittsburgh)*. SIAM, Philadelphia. 2002. 290 pp. Softcover. ISBN 0-89871-506-7. $63.00. (Under review)

II. DYNAMICS & VIBRATION

3R12. Analytical Mechanics: A Comprehensive Treatise on the Dynamics of Constrained Systems; for Engineers, Physicists, and Mathematicians. - JG Papastavridis *(Georgia Inst of Tech, Atlanta GA)*. Oxford UP, New York. 2002. 1392 pp. ISBN 0-19-512697-1. $295.00.

Reviewed by K Yagasaki (Dept of Mech and Syst Eng, Gifu Univ, 1-1 Yanagido, Gifu, 501-1193, Japan).

This big book consisting of about 1400 pages and 174 figures provides comprehensive treatments for constrained systems with finite degrees of freedom, and it is intended for graduate students and researchers in physics, applied mathematics and mechanics, and mechanical, aerospace, and structural engineering. It may also be suitable for advanced undergraduates in these fields. An intermediate knowledge level of mechanics is required. Many examples and problems including ones from engineering are given.

The author refers to so-called Lagrangean and Hamiltonian mechanics as ''analytical mechanics'' in principle, and discusses analytical mechanics of constrained systems in this meaning. The book is very different from some recent celebrated textbooks on mechanics such as *Foundations of Mechanics, 2nd Edition* (Addison-Wesley, Redwood City, CA, 1978), by R Abraham and J E Marsden, and *Mathematical Methods of Classical Mechanics, 2nd Edition* (Springer-Verlag, New York, 1989), by V I Arnold, which were written from a geometrical point of view (note that mechanics has a long history!). This reviewer feels that this book is difficult to read due to the specialty of symbols and notations and style of descriptions, as well as its length.

The book begins with an explaination of the term *analytical mechanics* in the Introduction. Several pages are used for expositions of symbols and notations there. In Chapter 1, basic concepts and results of elementary theoretical mechanics are summarized in handbook fashion after prerequisites on vector and tensor algebra are given. In Chapters 2 and 3, kinematics and kinetics of constrained systems are described in the Lagrangean formalism. These are the key chapters of the entire book and use about 500 pages. Some fundamental concepts on constraints like nonholonomicity are introduced, and important techniques like Lagrange's principle and virtual work are presented. In Chapter 4, impulsive or discontinuous motions are considered and their Lagrangean principles and equations are given. Rigid body dynamics is also discussed in some detail through the first four chapters.

In Chapter 5, the results of Chapters 2 and 3 are extended to systems with nonlinear nonholonomic constraints. In Chapter 6, differential variational principles of constrained systems are treated from simple and unified viewpoints, and the associated kinematico-inertial identities and corresponding generalized equations of motion are given. In Chapter 7, time-integral theorems and the integral variational principle are derived. Finally, in Chapter 8 another formalism of analytical mechanics, *ie*, Hamiltonian mechanics, is introduced and described in some detail. A long reference list is also given for background, and concurrent and further reading.

Analytical Mechanics will be useful for students and researchers in the related fields who are interested in mechanics of constrained systems, but this reviewer feels that it would be much more useful if it were written in a different format, *ie*, in a compact style and with the use of standard notations.

3R13. Dynamics of Mechanical Systems. - H Josephs *(Dept of Mech Eng, Lawrence Tech Univ, Southfield MI)* and RL Huston *(Dept of Mech, Indust, and Nucl Eng, Univ of Cincinnati, Cincinnati OH 45221-0072)*. CRC Press LLC, Boca Raton FL. 2002. 757 pp. ISBN 0-8493-0593-4. $89.95.

Reviewed by K Anderson (Dept of Mech Eng, Aeronaut Eng, and Mech (JEC4006), RPI, Troy NY 12180-3590).

This book represents a truly massive collection of material presenting many of the basic procedures in modern engineering dynamics, numerous examples, and introductions to more advanced topics. The text represents a collection of work and experience from the authors that spans roughly 30 years and fills 20 chapters and 750-plus pages. This text is massive in size and impressive in scope. The text is intended for mid to upper level undergraduate students in engineering and physics. The stated objective of the book is to give the reader a working knowledge of dynamics, enabling them to analyze a broad range of mechanical and biodynamic systems. The emphasis of the book is on presenting the fundamental procedures, but not so much the theory, underlying the dynamic analyses. The authors attempt to convey and develop the skills associated with potentially sophisticated dynamics analysis through the presentation and study of the fundamental engineering components (pendulums, cams, gears, balancing, and the like) which comprise many more complex systems. The book is also intended to serve as an independent study and/or a reference book for either beginning graduate students or practicing engineers.

The book begins with an introduction to the basic concepts and assumptions, basic terminology, a review of units, as well as the concepts of reference frames and coordinate systems. Chapter 2 continues with a review of vector algebra. The next three chapters are devoted to kinematics, with the last of these being on the planar motion of rigid bodies. Chapter 6 discusses force systems and equivalent representation of these force systems. While Chapter 7 presents a detailed review of rigid body inertia properties, including inertia dyadics.

The fundamental principles of dynamics (Newton's equations of motion, and D'Alembert's Principle) are presented in Chapter 8, with use work-energy and impulse-momentum principles covered in the next two chapters. Application of indirect/analytical methods are presented in Chapters 11 and 12 for a variety of simple systems, with effectively no theoretical development. The next five chapters present very useful application-oriented material on vibrations, engine balancing, cam design, and gear trains. The last three chapters present introductory material on multibody dynamics, robotics, and bio-dynamics.

The book is generally clearly written. The organization is acceptable, but this reviewer's tastes would have changed when and where some materials are presented. The figures are very simple line diagrams (and are thus not very exciting), but convey the intended points well. The authors' delivery of material shows an intent that the students learn through example and analogy, more than through understanding. Indeed, surprisingly little theory is presented in the text. This point will make the book attractive to some users and unattractive to others. This reviewer's feeling is that applications-oriented students and instructors will approve of this format and like the book, while theory/fundamentals-oriented individuals will not. Thus anyone considering this book, as a text, should give it a very hard look and be sure of how it fits with their personal goals and style.

Being that as it may, this reviewer feels that one of the strongest aspects of *Dynamics of Mechanical Systems* is its representa-

tion of ''Kane's Method'' for the analysis of dynamic systems. In too many books, this approach and its relatives (ie, velocity projection-based methods, of which Kane's method is just one member) are glossed over and/or incorrectly described, particularly as they relate to computer simulation of multibody dynamic systems. Since *Dynamics: Theory and Applications* by Kane and Levinson has been allowed to go out of print, this text by Josephs and Huston represents one of very few books that accurately introduce this powerful family of methods, which are now so pervasive for industrial strength multibody dynamic system analysis and simulation.

3R14. Elastic Waves in Anisotropic Laminates. - GR Liu and ZC Xi *(Natl Univ of Singapore, Singapore)*. CRC Press LLC, Boca Raton FL. 2002. 452 pp. ISBN 0-8493-1070-9. $149.95.

Reviewed by Y Horie (Los Alamos Nat Lab, Group X-7, MS D413, Los Alamos NM 87545).

Sound waves are a wonderful tool to probe the interiors of materials and structures that are invisible from outside. Ultrasounds are used to detect flaws and abnormalities not only in inanimate objects, but also in living bodies. A clear advantage of probing with sounds is that the examination can be carried out without destroying the object, nor changing the existing conditions of the object under investigation. It is, however, well known that the interpretation of probing with sounds is not always clear nor straightforward, particularly difficult are those that have complex interior structures and compositions. Examples are composites such as those used on aircraft and human bodies.

A modern foundation of probing with sounds is the study of wave propagation in materials. This book offers a combined analytical-numerical method for linear elastic wave analysis of anisotropic laminates, drawing heavily from the research work of the authors and their colleagues over the last 15 years. Attention is focused specially on two techniques: a hybrid numerical method (HNM) and a strip element method (SEM). These techniques are aimed at reducing the computational burden of direct finite element methods and obtaining insightful results that reveal important characteristics of complex wave phenomena, through use of judicially chosen discretizing elements (plates and strips) and a combined analytical-numerical method.

The book is intended primarily for senior university students, postgraduate students, and engineers in civil, mechanical, geophysical, aeronautical, and engineering mechanics. Prerequisites are matrix algebra, Fourier Transform, complex variables, and the linear theory of elasticity. To that we should add Green's function method. The first chapter covers fundamentals of one dimensional wave propagation using bars as an example. Subsequent 17 chapters are written in a relatively independent manner and do not always follow a logical progression. Topics covered in these chapters include: waves in functionally graded plates, Lamb waves in anisotropic laminates, harmonic and transient waves in laminates, waves in piezoelectric plates, wave scattering by cracks and flaws, crack and flaw characterizations, bending wave in laminates, helical waves in laminated cylinders, inverse construction of impact loading, and inverse characterization of laminates properties. HNM and SEM methods are formulated in Chapter 8 and 11, respectively. HNM uses first a plate element to calculate modal solutions in the wave number domain and then inverse Fourier transform to obtain displacement in the spatial domain. SEM is similar to HNM, but it combines FEM, the modal analysis, and the Fourier transform technique. Strength of these methods are demonstrated through examples in Chapters 9-10, and 12-14, and 16, respectively. A useful feature of the book is that select software codes of these methods are available on a website.

The book is fairly easy to follow and numerous drawings and charts are useful in understanding concepts and theories, and appreciating the results. The writing of the book is guided by ''the philosophy: make all the topics insightful but simple, informative but interesting, and theoretical but practical.'' I think that the authors have succeeded in achieving the stated goals. However there are some minor, but recurring editorial questions. For example, the judgment of what is simple appears very uneven. Many trivial algebraic manipulations are shown in details, but derivations and explanations of some important subjects are not discussed at all. Examples are the quadratic shape function that plays an important in the layer method and Green's function method. There are also many statements that are not informative, nor insightful without accompanying clarification. Again examples are ''A laminate is mechanically governed by solid mechanics while a laminated plate is governed by a theory of laminated plates (p. 3),'' and ''Matrix G is generally ill-conditioned; it cannot be solved by directly using conventionally methods (p. 412).'' You need to know the subjects to understand what he means in these passages.

Plus, there are some inaccurate statements. They are, *eg*, ''a vibration is a motion of waves with very long wavelength'' (no vibrations with short wavelengths?) and ''waves in solids are invisible to human eyes'' (no photoelasticity?).

These shortcomings may be explained in part by the impression that basically the book is a collection of expanded journal papers and introductory materials. This explains that most chapters can be read independent of others, as mentioned by the authors.

In spite of some minor glitches, *Elastic Waves in Anisotropic Laminates* is a useful compilation of recent advances in the numerical study of linear elastic waves in anisotropic laminates. It is recommended not only for engineers, but also students and researchers in non-engineering fields who are interested in ultrasonic-based nondestructive evaluation.

3R15. Linear Water Waves: A Mathematical Approach. - N Kuznetsov *(Russian Acad of Sci, St Petersburg, Russia)*, V Maz'ya *(Univ of Linkoping, Sweden)*, B Vainberg *(Univ of N Carolina, Charlotte NC, Sweden)*. Cambridge UP, Cambridge, UK. 2002. 513 pp. ISBN 0-521-80853-7. $100.00.

Reviewed by J Miles (Inst of Geophysics and Planetary Phys, UCSD, La Jolla CA 92093-0225).

As its subtitle suggests and its preface proclaims, ''The aim of the present book is to give a self-contained and up-to-date account of mathematical results in the linear theory of water waves.'' An almost identical aim is expressed by Stoker in the opening sentence of his 1957 monograph: ''The purpose of this book is to present a connected account of the mathematical theory of wave motion in liquids with a free surface....'' But Stoker is now dated, and the authors opine that ''there is no monograph on the progress achieved in the more mathematical approach to the linear water-wave theory during the last few decades.''

The book is divided into three parts covering, respectively, monochromatic waves associated with the uniform translation of a body, ship waves, and forced unsteady waves. There is also an introductory chapter in which the linear equations governing gravity-wave motion are derived from the Euler and continuity equations and the kinematic boundary conditions. There are good subject and author indexes and a 370-entry bibliography that supplements the earlier bibliographies of Stoker [1] and Wehausen and Laitone [2] and is particularly valuable in its coverage of the post-1960 Russian literature.

Specific problems are attacked using integral-equation and Green's-function techniques at the level of Morse and Feshbach [3]. These techniques are standard in mathematical physics and facilitate a uniform approach to a variety of problems, but at least in the present case, they may obscure the physics. This is especially evident in the authors' treatment of group velocity. After calculating the energy flow across a geometric surface, they remark that, ''The velocity of energy propagation is known as the group velocity. However, it does not play any significant role in the considerations presented in this book, and we restrict ourselves to references to... Stoker... and Wehausen and Laitone...'' But, above all, it is dispersion, and hence the distinction between wave speed and group veloc-

ity that separates water waves from such simpler phenomena as sound waves. It plays a major role in the classical presentations of Lamb [4], Stoker ([1], §3.4), and Wehausen and Laitone (1960, §15), and (in this reviewer's view) any discussion of water waves that omits dispersion (which, as far as this reviewer could determine, does not appear in either the text or the index of the present monograph) is idiosyncratic in the extreme.

This reviewer concludes that *Linear Water Waves: A Mathematical Approach* is indeed ''A Mathematical Approach.'' It may be of interest to applied mathematicians with a secure understanding of the physics of dispersive waves, and it deserves a place in the fluid-mechanics section of any large, technical library, but it is not for the novice.

REFERENCES

[1] Stoker JJ (1957), *Water Waves*, Interscience.

[2] Wehausen JV and Laitone EV (1960), Surface Waves, *Encyclopedia of Physics*, Vol IX, Springer.

[3] Morse M and Feshbach H (1953), *Methods of Theoretical Physics* (2 vols), McGraw-Hill.

[4] Lamb H (1932), *Hydrodynamics*, Cambridge Univ Press, p. 236.

3R16. Random Vibration. Mechanical Vibration and Shock Series, Vol III**.** - C Lalanne *(French Atomic Energy Authority, France)*. Hermes Sci Publ, Paris. Distributed in USA by Taylor & Francis Publ, New York NY. 2002. 346 pp. ISBN 1-56032-988-2. $150.00.

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

This book is the third volume in the series *Mechanical Vibration and Shock* published by Hermes Science Publications. The objective of the series is to provide state-of-the-art developments in different aspects of vibration and shock analysis from both theoretical and practical standpoints. This work is intended first of all for engineers.

This book is a fine handbook for engineers working in design and project teams and in laboratories dealing with the vibration tests, since it comprises the basics of random vibrations and stochastic mechanics, which are adapted to the needs of the mechanical engineer practicing design of structures and equipment subjected to random vibrations in real environments and in laboratory tests.

The book includes seven chapters followed by five appendices, a list of references, and an index. The first chapter is an introduction reviewing statistical properties of random processes occurring in engineering systems and the methods of analysis of random vibrations. The second chapter presents the fundamental concepts of probability theory and the statistical analysis of random variables and stochastic processes in the frequency domain. Chapter 3 is devoted to practical calculation of acceleration, velocity, and displacement mean square values. Practical calculation of power spectral density is discussed in Chapter 4 under the assumption that random vibrations are stationary and ergodic. Chapter 5 describes properties of random vibration in the time domain. The following two chapters are devoted to probability distribution of maxima of random vibration and statistics of extreme values, which is very useful information for the pre-sizing of a structure. The main results are summarized in tables given at the end of Chapter 7. Appendices contain some useful formulas for different laws of probability, in 1/*n*th octave analysis, power spectral density, mathematical functions, and transfer functions.

Random Vibration has features intended to support its use as primarily a reference book by engineers and graduate students. The book is well written, with good quality figures and tables to illustrate the subject. A list of references includes textbooks and monographs in the field, as well as original papers. The author provides a reasonable subject index. Consequently, this reviewer recommends purchase by libraries and individuals with an interest in stochastic mechanics.

3N17. Advances in Nonlinear Dynamics in China: Theory and Applications. Advances in Engineering, Vol 5**.** - Edited by Wenhu Huang *(Harbin, China)*. Swets and Zeitlinger Publ, Lisse, Netherlands. 2002. 205 pp. ISBN 90-265-1870-6. $85.00.

The theoretical research on nonlinear dynamics has been very active since the epoch-making discovery of the phenomenon chaos more than thirty years ago. The rapid progress of nonlinear dynamics is also due to the high demands of modern technology and engineering, civil engineering, aerospace engineering, marine engineering, environment engineering, to name but a few. Recently considerable advances have been made in China in nonlinear dynamics, both in theory and application, and hundreds of papers have been published in Chinese peer-reviewed journals. Some of them contain important contributions to the development of nonlinear vibration and nonlinear dynamics, many of them not yet introduced to the West.

This book is a collection of representative papers published recently in the Chinese journals: *Journal of Vibration Engineering, Vibration and Shock*, and *Journal of Nonlinear Dynamics*. Part 1 is a brief summary of the achievements on nonlinear vibration in China; Part 2 presents the phenomenon study; Parts 3 and 4 outline the theory research and the experimental technique respectively; Part 5 deals with controlling chaos; and Part 6 presents the engineering applications.

The book offers new ideas and references in both theoretical and practical aspects to those interested in nonlinear vibration and nonlinear dynamics.

3N18. Emerging Technologies in Fluids, Structures and Fluid/Structure Interactions - 2002, Volume 1: Fluid Dynamics, Fluid-Structure Interaction, and High Explosive Detonation. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by S Itoh and M Souli. ASME International, New York. 2002. 264 pp. ISBN 0-7918-4657-1. ASME Book No H1244A. $110.00. (ASME members $55.00).

This compilation of 27 full-length, peer-reviewed technical papers focuses on advances in computer codes, advances in fluid-structure interaction, and advances in piping systems.

3N19. Emerging Technologies in Fluids, Structures and Fluid/Structure Interactions - 2002, Volume 2: Shock, Wave Propagation, Tube Bundle Dynamics, and Structural Dynamics. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by M Fischer and A Holdo. ASME International, New York. 2002. 216 pp. ISBN 0-7918-4657-1. ASME Book No H1244B. $100.00. (ASME members $50.00).

This compilation contains 29 full-length, peer-reviewed technical papers on the following topics: advances in turbulent flow, advances in flow-induced vibrations, advances in fracture dynamics, advances in fluid dynamics, and advances in tube bundle dynamics.

3N20. Flow-Induced Vibrations in Engineering Practice. - Edited by P Anagnostopoulos *(Univ of Thessaloniki, Greece)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech, Billerica MA. 2002. 400 pp. ISBN 1-85312-644-6. $199.00.

Flow-induced vibrations are complicated flow-structure interaction phenomena that may have disastrous effects. The poor understanding of these can lead to sever damage, which, apart from economic loss, may even claim human lives. Although not so spectacular, flow-induced vibrations of tube banks in heat exchangers or nuclear reactors may result in the damage of installations and the loss of power generating time.

The book's contents include: Vibrations induced by vortex shedding, by A Anagnostopoulos (Ch 1); Mathematical models for vortex-induced vibrations of beams, by AR Massih and K Forsberg (Ch 2); Galloping of slender bodies, by M Pirner and O Fischer (Ch 3); Fluidelastic instabilities of cylinder arrays in cross-flow: an investigation of the use of Connors AE equation, by SJ Price (Ch 4); Dynamics of rotor-flow coupled system, by J Antunes (Ch 5).

3N21. Nonlinear Dynamics and Chaos: Where Do We Go From Here?. - Edited by SJ Hogan, AR Champneys, B Krauskopf, M di Bernardo, RE Wilson, HM Osinga, ME Homer *(Univ of Bristol, UK)*. Inst Phys Publ, Bristol, UK. 2002. 350 pp. ISBN 0-7503-0862-1. $65.00.

Nonlinear Dynamics explains complicated phenomena in well-defined, low-dimensional systems. It focuses on real-life problems that are high-dimensional or ill-defined, for example, due to delay, spatial extent, stochasticity, or the limited nature of available data. In 13 chapters by world experts, this book tries to assess what the future holds for nonlinear dynamics and chaos. The central question is Where do we go from here? The chapters address one or more of the broad and interconnected main themes: *i*) neural and biological systems, *ii*) spatially extended systems, and *iii*) experimentation in the physical sciences. The authors offer suggestions as to what they see as the way forward, often in the form of open questions for future research.

Classical Mechanics: Systems of Particles and Hamiltonian Dynamics. - W Greiner *(Inst für Theor Phys, Johann Wolfgang Goethe-Univ, Robert Mayer Str 10, Postfach 11 19 32, Frankfurt, D-60054, Germany)*. Springer-Verlag, New York. 2003. 542 pp. Softcover. ISBN 0-387-95128-8. $69.95. (Under review)

Hyperbolic Systems of Conservation Laws: The Theory of Classical and Nonclassical Shock Waves. - PG LeFloch *(Center de Math Appliquees and CNRS, Ecole Polytechnique, Palaiseau, 91128, France)*. Birkhauser Verlag AG, Basel, Switzerland. 2002. 294 pp. Softcover. ISBN 3-7643-6687-7. $34.95. (Under review)

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. (Under review)

Vehicle Crash Mechanics. - M Huang *(Dearborn MI)*. CRC Press LLC, Boca Raton FL. 2002. 481 pp. ISBN 0-8493-0104-1. $99.95. (Under review)

III. AUTOMATIC CONTROL

Applied Linear Optimal Control: Examples and Algorithms. - AE Bryson *(Dept of Aeronaut and Astronaut, Stanford Univ, Stanford CA)*. Cambridge UP, Cambridge, UK. 2002. 362 pp. Softcover, CD-Rom incl. ISBN 0-521-01231-7. $45.00. (Also available in Hardcover ISBN 0-521-81285-2, $120.00). (Under review)

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. (Under review)

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. (Under review)

IV. MECHANICS OF SOLIDS

3R22. Boundary Element Analysis of Cracks in Shear Deformable Plates and Shells. Topics in Engineering, Vol 43**.** - T Dirgantara *(Aerospace Eng Dept, Inst Teknologi Bandung, Indonesia)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech Publ, Billerica MA. 2002. 250 pp. ISBN 1-85312-950-X. $169.00.

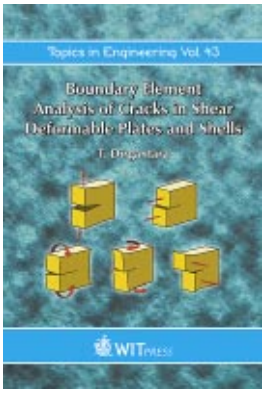
Reviewed by L Mishnaevsky Jr (MPA, Univ of Stuttgart, Pfaffenwaldring 32, Stuttgart, D-70569, Germany).

The purpose of this monograph is to present recent developments of the boundary element method for the analysis of bending problems and fracture of shear deformable plates and shells. The author is successful in his aim to provide a detailed and consecutive introduction into the concepts and methods of the new boundary element formulation for the modeling the deformation and fracture in shear deformable plates and shells.

The book consists of eight chapters. The discussion of the importance of the strength of shells and plates problem for the aircraft industry and the short history of the numerical analysis of fracture of plates and shells are given in the Introduction.

Chapter 2, *Basic concepts*, contains definitions, concepts, and equations of the elastic theory of shear deformable shallow shells and flat shear deformable plates, as well as a short review of the linear elastic fracture mechanics.

In Chapter 3, *Boundary Element Method*, boundary integral equations (BIE) are derived for the analysis of shallow shear deformable shells. The formulation is developed by coupling the BE formulation of the shear deformable plate bending and the two-dimensional (2D) plane stress elasticity equations. The domain integrals that appear in the formulation are treated in two different ways: first, using the constant cell discretization and second, by transforming the domain integrals into the boundary integrals using the dual reciprocity technique. BIE for the analysis of the shear deformable plates and 2D plane stress problems are presented as well. Several numerical examples for shallow shell problems with different geometries and loading conditions are given.



Chapter 4, *Hypersingular integral equations*, presents the hypersingular (stress based) formulation for the analysis of the shear deformable shell bending. The traction (hypersingular) boundary integral equations are derived, which contain both domain and boundary integrals. The domain integrals are transformed to boundary integrals using the dual reciprocity technique. Computational aspects of the singular integrals are discussed in this chapter as well.

In Chapter 5, *Dual Boundary Element Method*, the dual boundary element formulation for the analysis of shear deformable shallow shells and plates subjected to bending and tension is presented. The dual boundary element method (DBEM), based on displacement and traction integral equations, is introduced. Some new solutions for the discretization of the problem and the analysis of the stress intensity factors (SIFs) and the displacement distribution near the crack tip are suggested, as special crack tip shape functions and the crack surface displacements extrapolation (CSDE) for determination of SIFs. Some examples are solved to demonstrate the accuracy of the method of determination of the stress intensity factors for shear deformable plates subjected to bending and tension.

In Chapter 6, *Crack growth simulation*, the crack propagation in shear deformable shallow shells and plates subjected to bending and tension is modeled using the dual boundary element method. The crack extension is simulated by introducing a new boundary element in each crack growth increment. The single and multiple crack growth problems are studied, and the fatigue life is determined using the developed method.

In Chapter 7, *Multi-domain BEM formulation for assembled plate-structures*, the deformation of assembled plate-structures subjected to arbitrary loadings is analyzed. The structures are divided into several regions, and the conditions of the compatibility of translations and rotations are enforced along the interface. Finally, conclusions and directions of future works are discussed in Chapter 8. Details of the mathematical approaches used in the book are given in the appendices.

The layout of the book is pleasant, the figures are original, and a list of notations is available. The list of references includes many pioneering scientific papers on the strength of plates and shells and the boundary element method in engineering, as well as most recent research publications. All the concepts, ideas and solutions are presented and explained clearly and exactly, taking into account the state of the art of the corresponding areas of the theories of BEM, and shells and plates. When a new idea or a concept is introduced, the history of the development of this and related concepts and the place of the concept in the overall picture are described. Possibilities of the practical application of the new concepts are illustrated by many numerical examples at the end of the chapters.

Boundary Element Analysis of Cracks in Shear Deformable Plates and Shells is highly recommended to libraries and specialists working in the areas of the strength and reliability of the shell and plate structures and fracture mechanics, as well as to engineering and science students.

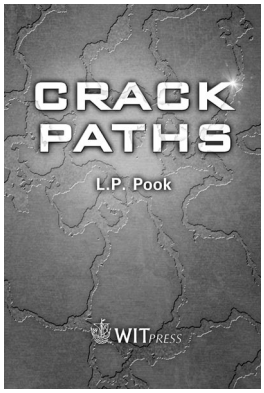
3R23. Crack Paths. Advances in Damage Mechanics, Vol 2**.** - LP Pook *(Univ College, London, UK)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech Publ, Billerica MA. 2002. 154 pp. ISBN 1-85312-927-5. $98.00.

Reviewed by AS Grandt (Sch of Aeronaut and Astronaut, Purdue Univ, 1282 Grisson Hall, W Lafayette IN 47907-1282).

The author's objective for this 154-page volume is to assemble the technical literature associated with establishing the direction of crack growth in an ''easily accessible form.'' Although prediction of crack propagation paths is essential for a complete crack growth analysis, this task is difficult and is often determined by experimental observation from full-scale tests. This book seeks to collect and discuss the research on crack path direction in a manner that can be readily understood by those familiar with elementary fracture mechan-

ics concepts. Emphasis is on the ambient temperature behavior of metals.

The book's seven chapters and postscript present a total of 91 figures, 103 equations, and 357 references. Chapter 1, entitled Crack Description, sets the context for issues involved in determining the direction of crack growth a priori. Chapter 2 deals with geometric constraints that arise from three-dimensional considerations (free surfaces, notches, etc), and lead to particular crack front shapes. Chapter 3 discusses failure criteria and crack tip plasticity as related to crack growth direction. Chapter 4 focuses on directional stability of mode I cracks, which is dominated by the maximum principal stresses. The author points out, however, that in addition to maximum principal stress dominated paths, shear oriented paths that involve both modes II and III are also possible, particularly when crack tip plasticity is significant. Thus, Chapters 5 and 6 deal with determining the crack direction for initial mixed modes I and II cracks. Chapter 5 treats fatigue crack growth, while Chapter 6 covers static crack growth. Since Chapters 4–6 employ two-dimensional approaches to crack directional stability, the final chapter, 7, discusses additional aspects of three-dimensional crack growth. This more general problem involves the addition of mode III displacements along with a number of other practical considerations.



In summary, this is a well-written book authored by a leading authority in fracture mechanics. The author has been interested in the crack path issue for over 45 years and has had the opportunity to discuss the matter with many other distinguished researchers during the past five decades. This unique background has allowed him to bring together a critical discussion of the literature on a complex topic that is not covered in depth by other standard textbooks. *Crack Paths* will be of interest to researchers involved with the specific problem of predicting the direction of crack growth under static or cyclic loading, and well as to a more general audience of fatigue and fracture practitioners who desire a broad introduction to the literature on this important subject.

3R24. Fatigue Damage. Mechanical Vibration and Shock Series, Vol IV**.** - C Lalanne *(French Atomic Energy Authority, France)*. Hermes Sci Publ, Paris. Distributed in USA by Taylor & Francis Publ, New York NY. 2002. 352 pp. ISBN 1-56032-989-0. $150.00.

Reviewed by SF Stiemer (Civil Eng Dept, Univ of British Columbia, 2324 Main Mall, Vancouver BC, V6T 124, Canada).

This reference book provides a very complete discussion of the behavior of material suffering fatigue and basics dealing with fatigue accumulation. The format of the book and its presentation is of high quality and in a classic style. The text is well written and reads easily, while the formula and graphs are presented in a very orderly and appealing way.

This book is unique in that it tightly integrates random vibration procedures with fatigue analysis. Many authors have attempted to effectively combine the topics of random vibration and fatigue analysis. Christian Lalanne is one of the few who succeeded in covering as well as relating both topics. This book can be highly recommended to students, researchers, and development engineers involved in random vibration related fatigue analysis and design.

The author emphasizes the complete and systematic presentation of often-used formulations and theories related to random vibrations and fatigue designs. The coverage on related topics in random analysis and fatigue is comprehensive, which is rarely found in engineering books of the same category. The formulations are clearly laid out and properly referenced.

A minor weak point of the book is its lack of dealing with practical design issues. While focusing more on theories and formulations, the author fails to expand on comprehensive design examples. These are needed to illustrate as well as verify complex calculation formulations in today's design scenario. A few simple and precisely described calculation examples are provided in the book; however, if the book is to be used by practicing engineers and designers, more concrete numerical examples of higher complexity are desirable.

This reviewer can highly recommend this outstanding book, *Fatigue Damage: Mechanical Vibration and Shock Series, Volume IV* for use mainly in the academic and theoretical fields. The author needs to be commended for concentrating on the basic theories and smooth integration of the issues in vibration and fatigue. This might reduce the appeal of the book to the practicing engineer; however, it could make the book one of the standard reference tools for academics.

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 MS Qatu (Ford Motor Co, EVB Bldg, MD X8, 20800 Oakwood Blvd, Dearborn MI 48124).

This is mainly a research monograph on the theory and application of the homogenization method in shape optimization problems. Applications given in the book are in the fields of composite materials, conductivity, and elasticity with emphasis on the minimization of compliance. The audience for this book includes researchers and advanced graduate students in applied mathematics and engineers interested in the design of shapes of structures for conductive and elastic purposes. It also fits very well for material scientists with inclination towards theoretical aspects of design and analysis of composite materials.

Based on the theoretical content and examples in the book, the word *shape* in the title should rather be understood as *topology*. In some engineering fields, shape is more related to boundary perturbation, however, the methods presented in this book are designed to *define* the boundary, rather than to perturb it. This concept of defining the boundary is closer to the idea of topology optimization as a material distribution problem.

The book is divided into five chapters. The first chapter covers the subject of homogenization in quite details. Periodicity is first assumed and used to derive homogenized operators in elasticity by means of the two-scale asymptotic expansion. Definitions and proofs of H- and G-convergence are then presented in a rigorous way.

The second chapter is titled *mathematical modeling of composite materials*. In this chapter, Allaire explains carefully the G-closure problem and its interpretations in the mechanical setting. Finding bounds on elastic properties of bi-phase materials is an old problem in mechanics that can be explained and treated mathematically with the help of the G-closure theory. Rank laminated materials are used to demonstrate the bounds derived in the book.

Optimal design of materials under electric conductivity considerations is addressed in the third chapter. With an extensive number of proofs, this chapter explains the theory behind the computation of optimal topology (shape) using homogenization theory as a mean to relax the optimization problem. Composite materials are used to relax the problem, and homogenization of conductivity tensors is then used to go from an ill-posed problem to a well-posed one.

Structural optimization has been an important subject of research since the days of Lagrange and Saint Venant. This chapter is the counterpart of the previous one, this

time, in the field of elastic structures. Composite materials are again introduced to relax the optimization problem and homogenized elastic properties are computed in order to attain a solution to the problem. The minimization of compliance (maximization of stiffness) is addressed intensively in this chapter.

The fifth and last chapter is titled *Numerical Algorithms*. Academic two-dimensional rectangular domains using quadrilateral elements in regular meshes are used to exemplify the theory presented in the previous chapters. Examples include minimization of compliance and maximization of eigenvalues. Multiple loadings and optimum topologies (shapes) of complaint mechanisms were considered.

In summary, *Shape Optimization by the Homogenization Method* is an excellent book that complements very well the extensive literature in the field, including Sanchez-Palencia and Zaoui [1], Bendsøe [2], Cherkaev [3], and Bendsøe and Sigmund [4].

REFERENCES

[1] Sánchez-Palencia E and Zaoui A (eds) (1987), *Homogenization Techniques for Composite Media*, Springer.

[2] Bendsøe MP (1995), *Optimization of Structural Topology, Shape and Material*, Springer.

[3] Cherkaev A (2000), *Variational Methods for Structural Optimization*, Springer.

[4] Bendsøe MP and Sigmund O (2003), *Topology Optimization: Theory, Methods and Applications*, Springer.

3R26. Soil Mechanics: Basic Concepts and Engineering Applications. - A Aysen *(Univ of Southern Queensland, Australia)*. Balkema Publ, Rotterdam, Netherlands. 2002. 459 pp. ISBN 90-5809-358-1. $139.00.

Reviewed by ME Popescu (Dept of Civil and Architec Eng, Illinois Inst of Tech, 3201 S Dearborn St, Chicago IL 60616).

Despite the long history of the use of soils as a construction material, the development of the engineering science of soil mechanics occurred only relatively recently. In the early 1920s Karl Terzaghi, now widely recognized as the father of soil mechanics, started working with a rational approach to the behavior of soils using continuum mechanics. Experimental evidence proved that this approach was a significant and powerful procedure in phenomenological terms. The fundamentals of such an approach and recent developments in the rapidly growing science of soil mechanics are presented in this book.

Designed primarily to serve the needs of the undergraduate civil engineering students, this book provides a clear explanation, in adequate depth, of fundamental principles of soil mechanics. The understanding of these principles is considered to be an essential foundation upon which future practical experience in soil engineering can be built.

The three areas contributing to a successful teaching of geotechnical engineering are covered, namely, applied mechanics, tests and experiments, and observation The student should have a good understanding of basic mechanics.

The book covers the soil mechanics and geotechnical engineering topics typically included in university courses in civil engineering and related subjects. The first chapter is on Nature of soils, plasticity, and compaction and is a general introduction in the first course in soil mechanics offered at the undergraduate level. The remaining nine chapters are presented in a logical and integrated manner. They deal with Effective stress and pore pressure in saturated soils, Movement of water through soil, Shear strength of soils and failure criteria, Stress distribution and settlement in soils, One-Dimensional consolidation, Application of limit analysis to stability problems in soil mechanics, Lateral earth pressure and retaining walls, Stability of earth slopes, and Bearing capacity of shallow foundations and piles.

The book provides the reader with a good understanding of the nature of soil, an appreciation of soil behavior, and insight into how the principles are applied in the practical engineering context. It builds a robust and adaptable framework of ideas to support and accommodate the more complex problems and analytical procedures that confront the practicing geotechnical engineer.

The book includes a comprehensive range of worked examples and problems set for solution by the student to consolidate understanding of the fundamental principles and illustrate their application in simple practical situations. A list of references is included at the end of each chapter as an aid to the more advanced study of any particular topic.

The text has been extensively illustrated for better understanding. There are many detailed and informative line illustrations included in all chapters, together with useful tabular data.

The book is written at a simple rather than sophisticated level. The emphasis throughout is on the practical knowledge of soil behavior required by the geotechnical engineer for the design and construction of foundations and embankments. The treatment of the chapters is modern and up-to-date. The use of SI units throughout, and frequent references to current international codes of practice and research papers, make the contents universally applicable.

Even though primarily aimed to undergraduate students, the book could also be of interest to graduate students in that it covers the more advanced aspects of soil behavior. Furthermore, practicing engineers who are in search of a rational introduction to the mechanical behavior of soils will find this work a valuable aid.

Soil Mechanics: Basic Concepts and Engineering Applications is recommended as a reference for university libraries serving civil engineering, mining engineering, and geological engineering programs, as well as for engineering consulting firms.

3R27. Theory of Composites. Cambridge Monographs on Applied and Computational Mathematics**. -** GW Milton *(Dept of Math, Univ of Utah, Salt Lake City UT)*. Cambridge UP, Cambridge, UK. 2002. 719 pp. ISBN 0-521-78125-6. $80.00.

Reviewed by AT Sawicki (Inst of Hydro-Eng, Koscierska 7, Gdansk-Oliwa, 80-953, Poland).

This is a book about the mathematical world of composites, where the electrical, thermal, magnetic, thermoelectric, mechanical, piezoelectric, poroelastic, and electromagnetic properties of these materials are described in detail. It is rather unusual to cover such a broad spectrum of difficult problems in a single volume, since most other books on composite materials are restricted to particular aspects of their behavior as, for example, mechanical properties, or even particular geometries as fiber-reinforced composites, etc.

For applied mathematicians, the theory of composites *is the study of partial differential equations with rapid oscillations in their coefficients*. These equations have similar mathematical structure for different physical phenomena, as those mentioned above, which enables unified treatment of various problems. Obviously, such an approach restricts applicability of various theories presented only to certain classes of materials and their properties, but the author is aware of it. For example, important problems dealing with plasticity and strength of composites, etc, are not analyzed, but respective references to other sources of information are provided.

In this book, the author presents the classical approach, where the effective (or homogenized) equations describe composites' properties at the macroscopic level. These properties are related to the microstructure of composites and respective properties of the constituents. The book consists of 31 chapters, each containing several sections (from 3 to 14), and an extensive list of references. The first two chapters are of an introductory character. Chapters 3–9 deal with the exact results for effective moduli, and Chapter 10 discusses some approximations for estimating these moduli. In Chapter 11, some wave propagation problems are considered. Chapters 12–18 cover the general theory concerning effective tensors, including important variational principles. Chapters 19 and 20 provide some information on the so-called theory of Y-tensors which parallels that of effective tensors. Chapters 21–26 are devoted to variational

methods for bounding effective tensors. Chapters 27–29 deal with the analytical properties of the effective tensors. The last two chapters discuss the set of effective tensors and bounding of effective moduli as a quasiconvexification problem.

In this reviewer's opinion, this book is written mainly for applied mathematicians working in the field of composites. Engineers and other specialists may find it difficult to follow. Engineers would expect more practically oriented theoretical guidelines and experimental validations of sophisticated theories. But we cannot expect such definite treatment from a single textbook. This book shows the deep erudition of the author and is well organized, written with precision, and nicely edited. Particular parts have been discussed with many professionals, including well-known barons of the science of composites, for example, Zvi Hashin or John Willis, who, together with the author's outstanding achievements in the field of mathematical analysis of composites, guarantee a high standard. *Theory of Composites* deserves its proper place in each library of applied mathematics and mechanics of materials, as it is an excellent addition to the existing literature on composites.

3N28. Material and Device Characterization Measurements. - LI Berger *(California Inst Electron and Mat Sci)*. CRC Press LLC, Boca Raton FL. 2002. 800 pp. ISBN 0-8493-1174-8. $139.95.

Combining the basic theoretical principles of measurements with a detailed description of techniques, this handbook is an encyclopedic treatment of measurements of electrical, magnetic, mechanical, optical, physicochemical, and thermal properties of materials and devices. It covers theoretical principles of test methods and concrete technical information on test performance that is in accordance with current standards.

3N29. Nanotribology: Critical Assessment and Research Needs. - Edited by SM Hsu and ZC Ying *(NIST, Gaithersburg MD)*. Kluwer Acad Publ, Norwell MA. 2002. 456 pp. ISBN 1-4020-7298-8. $160.00.

This book provides a critical assessment of the current state of the art of nanotribology within the context of MEMS, mesomanufacturing, nanotechnology, and microsystems. It contains chapters written by the leaders in these fields. It identifies gaps in current knowledge and barriers to applications, and recommends research areas that need to be addressed to enable the rapid development of technologies.

3N30. NDE Engineering: Applications. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by G Ramirez, C Miyaska, O Hedden. ASME International, New York. 2002. 88 pp. ISBN 0-7918-4661-X. ASME Book No H01248. $80.00. (ASME members $40.00).

This volume of 11 full-length, peer-reviewed technical papers expands on the usual scope of technical presentations to include applications of NDE to medicine and biology.

3N31. New and Emerging Computational Methods: Applications to Fracture, Damage, and Reliability. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by FW Brust. ASME International, New York. 2002. 256 pp. ISBN 0-7918-1949-3. ASME Book No H01236. $110.00. (ASME members $55.00).

Containing 25 full-length, peer-reviewed technical papers, this volume is organized into the following three sections: High temperature behavior of structures and materials, New and emerging computational methods, and Recent advances in fracture and damage studies. These papers present novel analytical and computational methods related to fracture mechanics, probabilistic methods, and creep damage for evaluation of structural integrity and reliability of pressure vessels and piping.

3N32. Numerical Models in Geomechanics. Proc of 8th Int Symp, Rome, April 2002**.** - Edited by GN Pande and S Pietruszczak. Balkema Publ, Rotterdam, Netherlands. 2002. 720 pp. ISBN 90-5809-359-X. $198.00.

The papers in this proceedings reflect the current research and advances made in the application of numerical methods in geotechnical engineering. They are organized in the following six sections: Constitutive relations for geomaterials; Modeling of instabilities and strain localization in geomaterials; Numerical algorithms: formulation and performance; Modeling of transient, coupled, and dynamic problems; Application of numerical techniques to practical problems; and Miscellaneous topics. Many new developments on a wide variety of topics have been reported at the symposium, which include partially saturated soil, instabilities in soil behavior, environmental geomechanics, hydromechanical coupling in problems of petroleum and nuclear engineering, applications of artificial neural networks to a variety of geotechnical problems, *intelligent* finite element modeling, and application of numerical methods to the analysis of tunnels, embankments, slopes, foundations, and anchors.

3N33. Pressure Vessel and Piping Codes and Standards - 2002. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by MD Rana, WH Bamford, Y Hari,M Higuchi, HS Mehta, DP Jones, A Kalnins, S Yukawa. ASME International, New York. 2002. 380 pp. ISBN 0-7918-4650-4. ASME Book No H01237. $130.00. (ASME members $65.00).

This is a collection of 36 full-length, peer-reviewed technical papers divided into the following several broad categories: plastic analysis in pressure vessel design, environmental fatigue issues, new developments in pressure vessel codes, structural integrity of pressure components, new developments in Section XI, and background on recent changes in Section III rules for seismic piping design. Three panel sessions describe the new developments in the ASME Code and compliance with FED regulations. This volume is also respectfully dedicated to Martin D Bernstein.

3N34. Service Experience and Failure Assessment Applications. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by P-S Lam. ASME International, New York. 2002. 196 pp. ISBN 0-7918-1948-5. ASME Book No H01235. $90.00. (ASME members $45.00).

This compilation of 21 full-length, peer-reviewed technical papers covers the application of novel analytical and experimental methods in fracture mechanics to assess structural integrity of the pressure vessels and piping. The volume is divided into two sections: Application of fracture mechanics in failure assessment and Service experience in operating nuclear plants.

3N35. Small Specimen Test Techniques, 4th Volume. (STP 1418)**.** - Edited by MA Sokolov *(Oak Ridge Natl Lab)*, JD Landes *(Univ of Tennessee)*, GE Lucas *(Univ of Calif)*. ASTM, W Conshohocken PA. 2002. 496 pp. ISBN 0-8031-2897-5. $135.00.

This volume's coverage includes fracture toughness, mechanical properties, charpy tests, punch tests, and reconstitution techniques. Featuring a global review of the latest research in small volume specimen testing, this book includes 31 peer-reviewed papers from an international group of experts.

3N36. Stability Theory and Its Applications to Structural Mechanics. - CL Dym *(Harvey Mudd Col, Pittsburgh PA)*. Dover Publ, Mineola NY. 2002. 191 pp. Softcover. ISBN 0-486-42541-X. $14.95.

This is a Dover (2002) unabridged republication of the edition published by Noordhoff International Publishing, Leyden, The Netherlands, in 1974.

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. (Under review)

Creep Mechanics. - J Betten *(Dept of Math Models in Mat Sci, Tech Univ Aachen, Augustinerbach 4-22, Aachen, 52064, Germany)*. Springer-Verlag, Berlin. 2002. 327 pp. ISBN 3-540-42981-6. $89.95. (Under review)

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. (Under review)

V. MECHANICS OF FLUIDS

3R37. Gas Cyclones and Swirl Tubes: Principles, Design and Operation. - AC Hoffmann *(Dept of Phys, Univ of Bergen, Allegaten 55, Bergen, 5007, Norway)* and LE Stein *(Process Eng Consultant, Mechanical Separations, 5818 Autumn Forest Dr, Houston TX 77092)*. Springer-Verlag, Berlin. 2002. 334 pp. ISBN 3-540-43326-0. $139.00.

Reviewed by P Bradshaw (Dept of Mech Eng, Stanford Univ, 488 Escondido Mall, Bldg 500/Room 501C, Stanford CA 94305).

Cyclones, in this context, are devices for separating two phases in a fluid flow. These are the familiar inverted cones seen in dust-extraction systems, without which many a flour mill or carpenters' shop would be wrecked by a dust explosion. They appear in many other places, such as the catalytic cracking units that are at the heart of an oil refinery. Their design is not trivial.

At the start of Chapter 15, the authors endearingly confess, ''The modeling equations in the previous chapters are not enough to design a cyclone or swirl tube from scratch.'' They proceed to review practical details, ''To give a feel for the range of 'viable' designs.'' This is an engineer's book, but not an old-fashioned handbook. Nearly half the eighty-odd references are less than ten years old, and only eight are from 1960 or before—mainly classical

papers or books cited out of piety rather than as recommended reading. The authors' aim, stated in the Preface, is ''to present a long-overdue overview,'' and they seem to have achieved it very well.

The book is, clearly, intended for design engineers in industry, though college engineering departments could do worse than to make this book required reading as an introduction to real life.

The book begins with three chapters on basic ideas, including some of the mathematics of probability density functions for particle size. Then follow three chapters on modeling of the flow in a cyclone and its efficiency, and the inclusion of special effects such as wall roughness (eg, collected solids), the influence of mass-loading, and the spatial variation of particle-size pdf within the body of the cyclone. Here *modeling* means algebraic equations, based, of course, on the equations of motion for fluid and particles. There are, of course, unknowns in the equations, such as the skin-friction coefficient—and ''wall friction has a profound effect on the flow in cyclones.'' However, there are remarkably few data correlations or design charts.

The 13-page Chapter 7 is a respite from cyclone modeling. It is called *Computational Fluid Dynamics*, but is actually an excellent introduction to turbulence modeling, numerical simulations, and methods of calculating particle-laden flows. This reviewer fears it may be the cause of numerous violations of the Copyright Act by instructors seeking handouts. Current turbulence models are not very good at predicting swirling flows, so it will be some time before the simpler algebraic formulas of the first six chapters go out of use. The authors' attitude is unbiased, and in earlier chapters, CFD results are compared with experimental data and the predictions of the simple formulas.

Chapter 8 is also tutorial, covering dimensional analysis and scaling laws. Most academic authors would have put it earlier, but although the formulas of the first six chapters have to be dimensionally correct, they do not for the most part contain dimensionless parameters.

Chapter 9 on *Other Factors Influencing Performance* (effect of solids loading and of the position near the narrow end where the vortex rolls up) is followed by a chapter on measurement techniques - as Chapters 11–16 deal with practical and specialized matters, this is the right place to discuss testing techniques. Incidentally, it was not until the advent of the laser Doppler anemometer that worthwhile measurements could be made within a cyclone, so a real understanding of the flow was only achieved fairly recently.

Most chapters have worked examples (not problems! this is not a textbook), which are very helpful in illuminating the formulas.

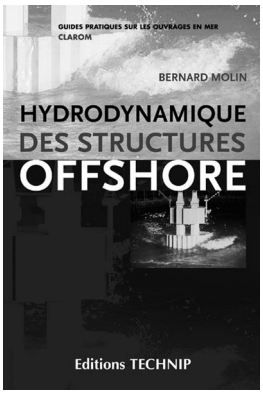
Gas Cyclones and Swirl Tubes: Principles, Design and Operation should be invaluable to designers and even operators of cyclones, and cyclones are so ubiquitous that its influence will be felt in many branches of industry. At $139.00, it is likely to be bought more by libraries and by design groups than by individuals, but anyone involved with cyclones in any way should read it.

3R38. Hydrodynamique des Structures Offshore. (French). - B Molin *(Ecole Superieure d'Ingenieurs, Marseille, France)*. Editions Technip, Paris. 2002. 415 pp. Softcover. ISBN 2-7108-0815-3. $84.00.

Reviewed by JH Ferziger (Dept of Mech Eng, Stanford Univ, Stanford CA 94305-3030).

This book, whose title's English meaning should be clear, is a new work by a well-known French researcher about the behavior of the offshore structures used in the petroleum industry in a wave environment. It covers the subject quite well. Most of the material found in the English-language works on this subject by Sarpkaya and Isaacson, Faltinsen, and Chakrabarti, all of which were published before 1990, are to be found here as well. Molin's book also includes the results of recent research not found in those works.

The first chapter gives a classification of the types of offshore structures and introduces some of the important parameters. The second chapter presents the description of the sea state in terms of spectra and probability density functions of amplitude and period. Short discussions of the wind profile and internal waves are also given.



Chapter 3 presents the theory of water waves including the Stokes theory up to order five, corrections to the simple theory, non-monochromatic waves, and spectra. There is just a little about nonlinear interactions of waves and breaking, but those subjects could easily be the basis of an entire other book.

The fourth chapter, entitled *Small Bodies*, is essentially about flows over cylinders with applications to towers and cables. Other than the flow over circular cylinders, topics covered include non-circular cylinders, proximity effects, roughness, flow induced vibration, and others.

The following three chapters, which form the main part of the book, are about computing the forces and moments on large bodies, eg, platforms and the like. Chapter 5 covers the linear theory including diffraction effects, approximate theories, and a very short mention of numerical techniques. The problems of multiple bodies, sloshing in tanks, and the design of anchors are also covered.

Second-order and other nonlinear effects are the subjects of Chapter 6. This chapter also includes discussion of viscous effects, the effect of a current, and the design of anchors. Comparisons with experimental results are given.

A number of other nonlinear effects are covered in Chapter 7, including still higher-order effects, hydrodynamic impact forces, parametric instabilities, and porous structures.

Finally, Chapter 8 discusses experimental tests in wave and towing tanks, giving information of the design of the tanks, the design of the models, the choice of scale, the generation of waves, and the analysis of the results.

In general, the material is well selected and chosen for its practical applicability. It is well written, but it does vary from quite mathematical theoretical treatment to methods of estimating forces for practical design. It could have included more about computational methods of treating the problem, but that would have added considerable length.

Overall, *Hydrodynamique des Structures Offshore* is an excellent work on the design of offshore facilities by an expert in the field; it includes a number of recent results not found in the earlier works. This book is highly recommended to both those interested in learning about the field and those actively involved in the design of offshore structures.

3R39. Interfacial Instability. - LE Johns and R Narayanan *(Dept of Chem Eng, Univ of Florida, Gainesville FL 32611)*. Springer-Verlag, New York. 2002. 346 pp. ISBN 0-387-95480-5. $79.95.

Reviewed by P Griffith (Dept of Mech Eng, Rm 7-044, MIT, Cambridge MA 02139).

This is a unique reference book that addresses the problem of stability in the presence of surface forces. The effects of geometry and a variety of other forces, including those of viscosity, gravity, and rotation, are considered. The examples they have chosen are quite diverse. In addition to reviewing the classic problems, such as the stability of jets and the stability of a dense liquid over a less dense one, they have looked at the problem of the stability of interface shapes during solidification, precipitation, and electroplating. The approach taken is to describe the problem in physical terms first and then formulate it in mathematical terms before working out the results. The bulk of the book is concerned with the mathemati-

cal methods appropriate for these problems.

A number of pictures and line drawings are included that help to clarify what is being done. Though experiments are described and their results given, the focus of this work is on the formulation of the stability criterion and on the mathematics of working it out. It is not a handbook and does not pretend to be one. The physical significance of their results is discussed in every case, however.

The book starts with a review of Rayleigh's classical work on the stability of liquid jets and continues by looking at the stability of liquid bridges in a variety of geometries. The effect of spinning on the stability of a liquid annulus is also considered. This leads into the stability of a dense liquid over a less dense one in a gravity field. They then turn their attention to a number of quite different problems, such as the stability of the shape of a surface on which precipitation is occurring, the stability of the shape of a casting as it cools, and the stability of the shape of an electrode when electrodeposition is occurring.

Given the wide variety of problems addressed, researchers and workers in a variety of fields should be interested in *Interfacial Instability*. At this very moment, there are certainly engineers and physical chemists working to improve processes that suffer from these instabilities. These processes are found where fibers are formed, salts are precipitated out of solution, batteries are recharged, and castings are made. These instabilities are often unrecognized and can frustrate their best efforts. Engineers and chemists working on products involving these processes need to know about this book, while researchers in schools and laboratories will be able to use it to identify worthwhile and challenging problems on which to work.

3R40. River Mechanics. - PY Julien *(Dept of Civ Eng, Colorado State Univ, Ft Collins CO 80523)*. Cambridge UP, Cambridge, UK. 2002. 434 pp. ISBN 0-521-56284-8. $120.00.

Reviewed by J Tuzson (1220 Maple Ave, Evanston IL 60202).

The author approaches his difficult task by starting each chapter with the fluid mechanic and sediment particle dynamic fundamentals, which serve to define the key variables. However, these theoretical equations cannot be used to predict the flood-wave propagation, river bed changes and needs of navigation, which are the engineering objectives, primarily because the enormous volume of topological and other input data are not available and would anyway exceed the capacity of the available computer. Empirical equations are used, which consist of products of the variables with empirical exponents. To quantify these exponents, many valuable log-log plots are presented with clouds of experimental data points, which, however, scatter by a factor of two or sometimes much more. These correlations validate the approaches and provide a measure of their accuracy. But for actual, numerical predictions, it would be necessary to use data taken from the specific river that is to be studied, to determine the particular empirical coefficients applicable to the case. Available river databases are mentioned in Chapter 7. Finally small-scale river models offer the ultimate approach, as demonstrated in Chapter 10. Numerous case studies illustrate these techniques.

A brief historical introduction is followed by chapters on physical fundamentals, watershed calculations, steady and unsteady water flow, and sediment transport calculations. More qualitative and descriptive chapters follow, on riverbed changes by erosion and deposition and on practical measures to control them. The chapter on river engineering also includes flood control, canals, dams, dredging, and matters of barge traffic in great detail. These later chapters contain several interesting and instructive case studies. Separate chapters discuss small-scale model building and computer programs for flow and sediment transport calculations. The concluding chapter is devoted to surface waves and ocean tides in estuaries, subjects which certainly belongs in such a book.

The author's expertise in sediment transport becomes evident from the brief chapters on the subject, obviously summarized from his numerous publications. Many pleasing illustrations, 340 references, and an index of 850 words help define such words as isohyetal, hypsometric, hyetograph, headcut, nickpoint, point bar, thalweg, washload, tieback, hardpoint, and groyne.

A dozen exercises and problems in each chapter make *River Mechanics* suitable as a textbook. However, the extensive subject matter would be difficult to cover in one semester, as suggested by the author. Indeed, the book contains ample information to make it a valuable reference work for scientists and practicing engineers also.

3N41. Computational Technologies for Fluid, Thermal, Structure, Chemical Systems with Industrial Applications - 2002, Volume 1. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by CR Kleijn, S Kawano, VV Kudriavtsev. ASME International, New York. 2002. 156 pp. ISBN 0-7918-4659-8. ASME Book No H1246A. $80.00. (ASME members $40.00).

This volume of 39 full-length, peer-reviewed technical papers discusses the following topics: fundamental, codes, and post-processing; flow in interaction with electromagnetic fields; reacting and combusting flows; flow in turbo machinery and engines; flow in biological and medical systems; and flow in energy systems.

3N42. Dynamical Systems X: General Theory of Vortices. Encyclopedia of Mathematical Sciences, Volume 67**.** - VV Kozlov *(Moscow State Univ, Moscow, Russia)*. Springer-Verlag, New York. 2002. 190 pp. ISBN 3-540-42207-2. $94.00.

This book contains a mathematical exposition of analogies between classical (Hamiltonian) mechanics, geometrical optics, and hydrodynamics. This theory highlights several general mathematical ideas that appeared in Hamiltonian mechanics, optics, and hydrodynamics under different names. In addition, some interesting applications of general vortex theory are discussed in the book such as applications in numerical methods, stability theory, and the theory of exact integration of equations of dynamics.

3N43. Hydraulic Information Management. Proc of 9th Int Conf, Montreal, Canada, May 2002**.** - Edited by CA Brebbia and WR Blain *(Wessex Inst of Tech, UK)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech, Billerica MA. 2002. 488 pp. ISBN 1-8531-2912-7. $246.00.

Three main areas are covered in this proceedings: groundwater flow, open channel flow, and pressure flow. Water quality and decision support system issues are also explored. Contents are divided into the following nine sections: Coastal and estuarial engineering; Hydrology; Groundwater and aquifer modeling; Open channel flow; Dams and flooding; Water quality and treatment; Numerical modeling; Hydraulic networks and water supply; and Decision support systems.

3N44. Nonlinear Problems in Mathematical Physics and Related Topics I. - Edited by MS Birman *(St Petersburg St Univ, Russia)*, S Hildebrandt *(Univ of Bonn, Germany)*, VA Solonnikov *(St Petersburg POMI, Russian Acad of Sci, Russia)*, NN Uraltseva *(St Petersburg State Univ, Russia)*. Kluwer Acad Publ, Norwell MA. 2002. 404 pp. ISBN 0-306-47333-X. $125.00.

This volume, in honor of Prof OA Ladyzhenskaya, presents new results from distinguished specialists in the theory of partial differential equations and analysis. A large part of the material is devoted to the Navier-Stokes equations, which play an important role in the theory of viscous fluids. In particular, the existence of a local strong solution (in the sense of Ladyzhenskaya) to the problem describing some special motion in a Navier-Stokes fluid is established. Ladyzhenskaya's results on axially symmetric solutions to the Navier-Stokes fluid are generalized and solutions with fast decay of nonstationary Navier-Stokes equations in the half-space are stated.

Application of the Fourier-analysis to the study of the Stokes wave problem and some interesting properties of the Stokes problem are presented. The nonstationary Stokes problem is also investigated in nonconvex domains and some Lp-estimates for the first-order derivatives of solutions are obtained. New results in the theory of fully nonlinear equations are presented. Some asymptotics are derived for elliptic operators with strongly degenerated symbols. New results are also presented for variational problems connected with phase transitions of means in controllable dynamical systems, nonlocal problems for quasilinear parabolic equations, elliptic variational problems with nonstandard growth, and some sufficient conditions for the regularity of lateral boundary.

Additionally, new results are presented on area formulas, estimates for eigenvalues in the case of the weighted Laplacian on Metric graph, application of the direct Lyapunov method in continuum mechanics, singular perturbation property of capillary surfaces, and partially free boundary problem for parametric double integrals.

3N45. Proceedings of 21st International Conference on Offshore Mechanics and Arctic Engineering, Print Version, Volume 3. Held in Oslo, Norway, June 2002. - ASME International, New York. 2002. 720 pp. ISBN 0-7918-3613-4. ASME Book No I00582. $220.00. (ASME members $110.00).

This printed collection of the full-length, peer-reviewed technical papers presented at the conference covers the following topic areas: Materials technology, and Polar and arctic sciences and technology.

3N46. Proceedings of the 2002 ASME Joint US-European Fluids Engineering Conference, Print Version, Volume 1: Forums (Parts A and B). Held in Montreal, July 2002. - ASME International, New York. 2002. 1608 pp. ISBN 0-7918-3615-0. ASME Book No I0584A. $300.00. (ASME members $150.00).

This print proceedings includes the full-length, peer-reviewed technical papers presented at the following fora: High-speed jet flows; Fluid measurements and instrumentation; Fluid machinery; Cavitation and multiphase flow; Turbulent flows; Open forum on multiphase flows: Work in progress; Advances in free surface and interface fluid dynamics; CFD applications in large facilities; CFD applications at DoE/DoD National Lab; CFD applications in automotive flows; Vehicular flows; Supersonic flows in shock waves; Unsteady flows; Fluidics; Advances in fluids engineering education; 3D flows; Environmental flows; Flow instabilities and control; Fluid mechanics in mixing phenomena II: Fundamentals and industrial applications; and Wavelet application in fluid mechanics.

3N47. Proceedings of the 2002 ASME Joint US-European Fluids Engineering Conference, Print Version, Volume 2: Symposia and General Papers (Parts A and B). Held in Montreal, July 2002. - ASME International, New York. 2002. 1400 pp. ISBN 0-7918-3615-0. ASME Book No I0584B. $300.00. (ASME members $150.00).

This is a printed version of the full-length, peer-reviewed technical papers presented at the following symposia: Flows in manufacturing processes; Experimental and numerical flow visualization and laser anemometry; Erosion processes; Fluid-structure interaction and flow-induced noise in industrial applications; Numerical methods for multiphase flows; Numerical developments in CFD; Finite element applications in fluid dynamics; CFD applications for aerospace; Non-invasive measurement in multiphase flows; Control and stability of multiphase flows; Advances in numerical modeling of aerodynamics and hydrodynamics in turbomachinery; Fluid power; Fluid flow in micro systems, measurements, analysis, and applications; Measurement and modeling of large-scale turbulent structures, marine propulsion, and renewable energy (wind and hydro); and general papers in fluids engineering.

3N48. Proceedings of the 21st International Conference on Offshore Mechanics and Arctic Engineering, Print Version, Volume 1. Held in Oslo, Norway, June 2002. - ASME International, New York. 2002. 912 pp. ISBN 0-7918-3611-8. ASME Book No I00580. $250.00. (ASME members $125.00).

This is a printed collection of the full-length, peer-reviewed technical papers presented at the conference in the topic area of offshore technology.

3N49. Thermal-Hydraulic Problems, Sloshing Phenomena, and Extreme Loads on Structures. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by FJ Moody. ASME International, New York. 2002. 300 pp. ISBN 0-7918-1946-9. ASME Book No H01233. $120.00. (ASME members $60.00).

This volume of 33 full-length, peer-reviewed technical papers covers the following topics: current thermal-hydraulic problems in vessels, piping, and components; sloshing and fluid-structure interaction; and structures under extreme loading conditions.

3N50. Tubes, Sheets and Singularities in Fluid Dynamics. Fluid Mechanics and its Applications, Vol 71**.** - Edited by K Bajer *(Inst of Geophys, Univ of Warsaw, Poland)* and HK Moffatt *(Dept of Appl Math and Theor Phys, Univ of Cambridge, UK)*. Kluwer Acad Publ, Norwell MA. 2002. 382 pp. ISBN 1-4020-0980-1. $105.00.

Modern experiments and numerical simulations show that the long-known coherent structures in turbulence take the form of elongated vortex tubes and vortex sheets. The evolution of vortex tubes may result in spiral structures which can be associated with the spectral power laws of turbulence. The mutual stretching of skewed vortex tubes, when they are close to each other, causes rapid growth of vorticity. Whether this process may or may not lead to a finite-time singularity is one of the famous open problems of fluid dynamics.

This book contains the proceedings of the NATO ARW and IUTAM Symposium held in Zakopane, Poland in September 2001. The papers cover various aspects of the dynamics of vortex tubes and sheets and of their analogues in magnetohydrodynamics and in quantum turbulence.

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. (Under review)

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). (Under review)

Introduction to Symmetry Analysis. - BJ Cantwell *(Sch of Eng, Stanford Univ, Stanford CA 94305)*. Cambridge UP, Cambridge, UK. 2002. 612 pp. Softcover, CD-Rom incl. ISBN 0-521-77740-2. $50.00. Also available in Hardcover ISBN 0-521-77183-8; $130.00. (Under review)

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

Multiphase Flow Dynamics 1: Fundamentals. - NI Kolev *(Framatome ANP GmbH, PO Box 3220, Erlangen, 91050, Germany)*. Springer-Verlag, Berlin. 2002. 699 pp. CD-Rom included. ISBN 3-540-42984-0. $139.00. (Under review)

Multiphase Flow Dynamics 2: Thermal and Mechanical Interactions. - NI Kolev *(Framatome ANP GmbH, PO Box 3220, Erlangen, 91050, Germany)*. Springer-Verlag, Berlin. 2002. 692 pp. ISBN 3-540-43017-2. $139.00. (Under review)

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. (Under review)

Turbulent Flow: Analysis, Measurement, and Prediction. - PS Bernard and JM Wallace *(Univ of Maryland, College Park MD)*. Wiley, Hoboken, NJ. 2002. 497 pp. ISBN 0-471-33219-4. $100.00. (Under review)

Variable Density Fluid Turbulence. Fluid Mechanics and its Applications, Vol 69**.** - P Chassaing *(Inst de Mecanique des Fluides de Toulouse, Toulouse, France)*, RA Antonia *(Univ of Newcastle, Newcastle, NSW, Australia)*, F Anselmet *(Inst de Recherche sur les Phenomenes hors Equilibre, Marseille, France)*, L Joly *(Ecole Natl Superieure d'Ingenieurs de Constructions Aeronautiques, Toulouse, France)*, S Sarkar *(Dept of Mech and Aerospace Eng, UCSD)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2002. 380 pp. ISBN 1-4020-0671-3. $110.00. (Under review)

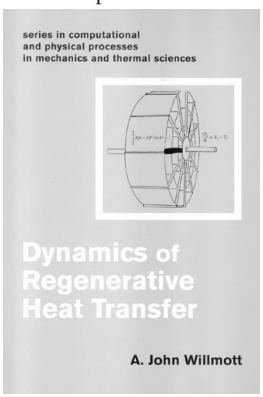
VI. HEAT TRANSFER

3R51. Dynamics of Regenerative Heat Transfer. Series in Computational and Physical Processes in Mechanics and Thermal Sciences**.** - AJ Willmott *(Dept of Comput Sci, Univ of York, UK)*. Taylor & Francis Publ, New York NY. 2002. 298 pp. ISBN 1-56032-369-8. $99.00.

Reviewed by H Perez-Blanco (Dept of Mech Eng, Penn State, 338 Reber Bldg, University Park PA 16801).

This book offers an insightful blend between theory and practice in an area where the deficiency of steady-state treatments is apparent. The text has an engaging style; a rigorous, but clearly explained mathematical treatment; and an organization that develops the reader from the fundamentals to the most intricate aspects of dynamic response of regenerators. In this way, the book accomplishes two simultaneous objectives: enabling the calculation of conventional or novel regenerators and furnishing useful procedures for practical applications.

The material is divided into ten chapters. The introductory Chapter 1 is followed by the simplest problem, called the *single-blow problem*, addressed in a comprehensive form in Chapters 2 and 3. The initial conditions of the single-blow problem are restrictive from a practical view point, and the more complete case and variations are introduced in Chapters 4–8.



Chapter 4 has a practical bent, presenting both a rigorous mathematical model based on cyclic operation and actual regenerator configurations. Chapter 5 introduces methods for solution of the models presented in Chapter 4, introducing nonlinearities in the models. Chapter 6 is a labor-saving chapter, in that starting from basic principles, heat transfer coefficients can be readily estimated via normalization of the Fourier equation. Integral equation methods are covered in Chapter 7, with the caveat that, at present, they cannot cover nonlinear models, with variable gas or solid properties for instance.

Most vexing problems, namely those associated with nonlinear problems are ad-

dressed in Chapter 8. Here, nonlinearities arise from inhomogeneous properties, construction, or operational strategies. A general numerical approach to these unique problems is presented along with a number of well-developed examples. The practitioner will find here approaches to include radiative heat transfer effects as well. In many ways, this particular chapter alone may justify the purchase of this book. Chapter 9 focuses on transient regenerator performance. The topics here are somewhat refractory to analysis because the characterization of transients throughout a variety of applications is elusive at best. Yet, a general method of attack based on a matrix method is presented as a starting point. The approach of this chapter could be invaluable to those involved in the growing area of risk analysis. Parallel-flow regenerators are briefly addressed in Chapter 10, where closed-form and numerical solutions (somewhat simpler than those for counterflow) are presented. A performance comparison between parallel and counterflow regenerators closes the chapter.

Whereas regenerators have often been used in the steel and glass industries, the advent of heat recovery technology for environmental control purposes, especially gas-activated dehumidifying equipment has resulted in new applications for the techniques that this book so aptly describes. Perhaps in the future, the author will include simultaneous heat and mass transfer treatments for enthalpy wheels. We attempted to convey via this review that *Dynamics of Regenerative Heat Transfer*, offers the most insightful blend of mathematical rigor oriented towards practical applications. The former is a necessary condition for accurate and consistent design; the latter is a necessary condition for relevance to the engineering endeavor. It is a reasonable expectation that those involved at all levels (ie, from researchers to practitioners) in heat recovery technology, and those with an interest in transient regimes of thermal technology, will find this book extremely useful for their work.

3N52. Proceedings of the International Solar Energy Conference, Held in Reno, NV, June 2002. - Edited by JB Pearson and BN Farhi. ASME International, New York. 2002. 396 pp. ISBN 0-7918-1689-3. ASME Book No G01183. $140.00. (ASME members $70.00).

This is a compilation of 47 full-length, peer-reviewed technical conference papers on the following topics: conservation and solar buildings, fundamentals and theory, heating and cooling applications and analysis, photovoltaics, solar chemistry, solar thermal power, and testing and measurement.

Continuum Models for Phase Transitions and Twinning in Crystals. Applied Mathematics, Volume 19**.** - M Pitteri and G Zanzotto *(Dept of Math Methods and Models for Appl Sci, Univ of Padova, Italy)*. Chapman and Hall/CRC, Boca Raton FL. 2003. 385 pp. ISBN 0-8493-0327-3. $99.95. (Under review)

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. (Under review)

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). (Under review)

VII. EARTH SCIENCES

3N53. Atmosphere-Ocean Interactions: Volume 1. - Edited by W Perrie *(Bedford Inst of Oceanog, Dartmouth, NS, Canada)*. WIT Press, Southampton, UK. Distributed in USA by Comput Mech, Billerica MA. 2002. 312 pp. ISBN 1-85312-892-9. $215.00.

This book presents a survey of several of the key mechanisms that are important for marine storms and their development. The chapters are self contained and focus on basic considerations of marine storms in atmosphere ocean systems, coupled model simulations of marine storms, and longer time scales, including climate change scenarios.

The individually-authored chapter titles are as follows: Review of the sea spray generation function for the open ocean; Extratropical transformation: A scientific challenge; Tropical cyclone ocean interactions; Storm simulations using a regional coupled atmosphere ocean modeling system; Impact and feedback of ocean waves on the atmosphere; Regional atmosphere wave ocean impacts; Boundary layer models for the ocean and the atmosphere; Influence of air sea interaction on tropical cyclones; Impact of climate change on tropical cyclones.

3N54. Atmospheric Modeling. - Edited by DP Chock *(Ford Res Lab, Dearborn MI)* and GR Carmichael *(Univ of Iowa, Iowa City IA)*. Springer-Verlag, New York. 2002. 352 pp. ISBN 0-387-95497-X. $79.95.

This volume contains refereed papers submitted by international experts who participated in the Atmospheric Modeling workshop in March 2000 at the Institute for Mathematics and Its Applications (IMA) at the University of Minnesota.

3N55. Computational Structural Dynamics. Proc of Int Workshop, IZIIS, Skopje, Macedonia, Feb 2001**.** - Edited by K Talaganov. Balkema Publ, Rotterdam, Netherlands. 2002. 240 pp. ISBN 90-5809-368-9. $79.00.

Most of the contributions deal with demonstration of the possibilities offered by computational technology as to finding better solutions to problems in different fields of structural dynamics. A special emphasis was put on earthquake structural dynamics because Southeast Europe is exposed to a huge seismicity and is characterized by occurrence of strong earthquakes.

3N56. Dynamics of Earth's Fluid System. - Edited by SN Rai, DV Ramana, A Manglik. Balkema Publ, Rotterdam, Netherlands. 2002. 304 pp. ISBN 90-5809-236-4. $115.00.

This work describes several geological processes such as the lithospheric deformation, evolution of groundwater resources, hydrothermal circulation, mantle convection, and generation of the earth's magnetic field *etc*, which are directly or indirectly influenced by the movements of subsurface fluids from crustal level to the earth's core. This book attempts to bridge the gap between theories and their applications to understand the geological processes.

3N57. Porous Media: Theory, Experiments, and Numerical Applications. - Edited by W Ehlers *(Inst fur Mechanik, Univ Stuttgart, Lehrstuhl II, Pfaffenwaldring 7, Stuttgart, D-70569, Germany)* and J Bluhm *(Inst fur Mechanik, Univ Essen, Universitatsstr 15, Essen, D-45141, Germany)*. Springer-Verlag, Berlin. 2002. 459 pp. ISBN 3-540-43763-0. $119.00.

The present volume offers a state-of-the-art report on the various recent scientific developments in the Theory of Porous Media comprehending the basic theoretical concepts in continuum mechanics on porous and multiphasic materials as well as the wide range of experimental and numerical applications. It addresses the sophisticated reader, as well as the interested beginner in the area of porous media by presenting a collection of articles written by experts in the field, which concern the fundamental approaches to multiphasic and porous materials as well as various applications to engineering problems.

3N58. Seismic Engineering - 2002, Volume 1. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by SC Lu, A Martelli, ME Nitzel, GC Slagis, CS Tsai. ASME International, New York. 2002. 272 pp. ISBN 0-7918-4656-3. ASME Book No H1243A. $110.00. (ASME members $55.00).

This collection of 35 full-length, peer-reviewed technical papers covers seismic design criteria, design code, and failure analysis of piping systems and high pressure gas facilities; large scale ongoing R&D projects on seismic engineering; seismic evaluation of systems, structures, and components; seismic structures response and interaction; and high-level seismic response of piping. This volume, combined with its companion volume, covers the broad range of topics within this area of seismic engineering.

3N59. Seismic Engineering - 2002, Volume 2. Proc of ASME 2002 Pressure Vessels and Piping Conf, August 2002, Vancouver, Canada**.** - Edited by SC Lu, A Martelli, ME Nitzel, GC Slagis, CS Tsai. ASME International, New York. 2002. 232 pp. ISBN 0-7918-4656-3. ASME Book No H1243B. $110.00. (ASME members $55.00).

This collection of 29 full-length, peer-reviewed technical papers covers large scale ongoing R&D projects on the innovative technologies for seismic isolation and vibration control of structures; international symposium on seismic, shock, and vibration isolation; and technologies for seismic mitigation. This volume, combined with its companion volume, covers the broad range of topics within this area of seismic engineering.

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. (Under review)

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. (Under review)

IX. BIOENGINEERING

3N60. Microfluidics and BioMEMS Applications. - Edited by FEH Tay *(Dept of Mech Eng, Natl Univ of Singapore, Singapore)*. Kluwer Acad Publ, Norwell MA. 2002. 300 pp. ISBN 1-4020-7237-6. $125.00.

The central idea of this book is on microfluidics, a relatively new research field which finds its niche in biomedical devices, especially on lab-on-a-chip and related products. Being the essential component in providing driving fluidic flows, an example micropump is chosen to illustrate a complete cycle in development of microfluidic devices which include literature review, designing and modeling, fabrication, and testing. A few articles are included to demonstrate the idea of tackling this research problem; they cover the main development scope discussed earlier as well as other advanced modeling schemes for microfluidics and beyond.

X. GENERAL & MISCELLANEOUS

3N61. Applied Functional Analysis. - DH Griffel *(Sch of Math, Univ of Bristol, University Walk, Bristol, BS8 1TW, UK)*. Dover Publ, Mineola NY. 2002. 390 pp. Softcover. ISBN 0-486-42258-5. $18.95.

This is a Dover (2002) slightly corrected republication of the edition published by Ellis Horwood Limited, Chichester, UK, in 1985.

3N62. Geometry, Mechanics, and Dynamics. Special Volume in Honor of the 60th Birthday of JE Marsden**. -** Edited by PK Newton *(Univ of Southern California, Los Angeles CA)*, P Holmes *(Princeton Univ, Princeton NJ)*, A Weinstein *(Univ of California, Berkeley)*. Springer-Verlag, New York. 2002. 580 pp. ISBN 0-387-95518-6. $79.95.

This volume aims to acknowledge JE Marsden's influence as a teacher, propagator of new ideas, and mentor of young talent. It presents both survey articles and research articles in the fields that represent the main themes of his work, including elasticity and analysis, fluid mechanics, dynamical systems theory, geometric mechanics, geometric control theory, and relativity and quantum mechanics. The common thread throughout is the use of geometric methods that serve to unify diverse disciplines and bring a wide variety of scientists and mathematicians together in a way that enhances dialogue and encourages cooperation. This book may serve as a guide to rapidly evolving areas as well as a resource both for students who want to work in one of these fields and practitioners who seek a broader view.

3N63. Nonlinear Partial Differential Equations and Their Applications. College de France Seminar Volume XIV. (French, English)**. -** Edited by D Cioranescu *(Centre Natl de la Recherche Sci, Lab JL Lions, Univ Pierre et Marie Curie, Paris, France)* and J-L Lions *(College de France, Paris, France)*. Elsevier Sci BV, Amsterdam, Netherlands. 2002. 654 pp. ISBN 0-444-51103-2. $135.00.

This volume is the last in the series *Nonlinear Partial Differential Equations and their Applications, College de France Seminar*, which published the texts of the lectures given at the seminars organized by Jacques-Louis Lions, from his election at the College de France in 1973 until his retirement in 1998. The 27 papers in this volume cover nonlinear PDEs and their applications.

3N64. Thermal Properties of Metals. ASM Ready Reference. - ASM Int, Materials Park OH. 2002. 300 pp. ISBN 0-87170-768-3. $155.00**.**

This reference is a quick and easy-to-use source for qualified thermal properties of metals and alloys. The data tables are arranged by material hierarchy, with summary tables sorted by property value. Values are given for a range of high and low temperatures. Short technical discussions at the beginning of each chapter are designed to refresh the reader's understanding of the properties and units covered in that section.

This volume presents a comprehensive listing of thermal properties of metallic materials. Data was collected from more than 80 sources and includes values for both ferrous and nonferrous metals and alloys. Sources and qualifiers are listed for all values. Values are listed in the preferred (SI) units and alternate (customary) units. Data were reviewed by the ASM Materials Properties Database Committee. The contents include Introduction, Thermal expansion, Heat capacity, Thermal Conductivity, Melt Properties, Thermal emittance, and Density.

Author Index for March 2003

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