

# BOOK REVIEWS

Items with a reviewer byline (coded R) are by AMR's corps of dedicated outside volunteer reviewers. AMR will attempt to get critical reviews of all relevant textbooks, reference works, and monographs. Items without a reviewer byline (coded N) are prepared by AMR in-house staff and are largely based on material such as a book's table of contents and editor's preface or foreword. In the interest of timeliness, most conference proceedings and multi-author contributed volumes will receive descriptive notes in this fashion. Books deemed to be somewhat peripheral to AMR's basic scope may simply be listed by title. Also listed by title when first received are books under review. [DOI: 10.1115/1.1523350]

## I. FOUNDATIONS & BASIC METHODS

**IR1. Boundary Element Programming in Mechanics.** - Xiao-Wei Gao (Dept of Mech and Aerospace Eng, Arizona State Univ, Tempe AZ) and TG Davies (Glasgow Univ, UK). Cambridge UP, Cambridge, UK. 2002. 254 pp. (CD-Rom included). ISBN 0-521-77359-8. \$69.95.

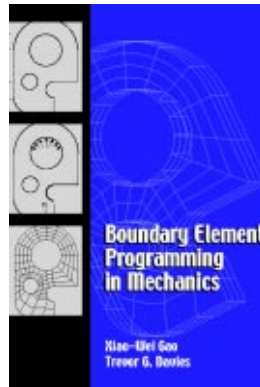
Reviewed by DE Beskos (Dept of Civil Eng, Univ of Patras, Patras, GR-26500, Greece).

This is a really excellent textbook as well as a reference book on the numerical implementation and computer programming of the direct boundary element method as applied to two and three-dimensional problems of linear elasticity and nonlinear elastoplasticity. The book is aimed at both graduate students and researchers as well as practicing engineers in mechanical, aeronautical, and civil engineering fields.

The book consists of 254 pages plus a CD-Rom with the computer programs described. The whole book can be divided in two main components: The first one dealing with linear problems (elasticity) and the second one with nonlinear problems (time independent elastostoplasticity). In both parts, the chapter breakdown is the same and consists of the theory (of elasticity or plasticity), the corresponding boundary integral formulation of the problem, the numerical implementation, the detailed (subroutine by subroutine) description of the computer program and a number of applications—numerical examples to illustrate the code and demonstrate its accuracy. The book is completed by an introduction and an epilogue, eight appendices, a list of references, and a subject index.

The figures and tables are of very good quality. The list of references is comprehensive, but selective, and the subject index is informative, but somewhat short. The unusual features of this book, in order of importance, are the following: the book is very clearly written and the English lan-

guage is not just correct and easy to understand, but lively and enjoyable. The authors have proved they are not just very good on technical matters, but they also know to handle the English language superbly. The various computational aspects of the boundary element method, such as singular integration, treatment of edges and corners, computation of boundary stresses, solution of systems of linear equations, return mapping algorithms in plasticity, etc, are all treated in detail. In particular, the authors in every case, first discuss the problem, mention the work of others, and then offer their solution which they consider to be the most effective.



The computer programs are explained in detail on a subroutine-by-subroutine basis and serve to illustrate the implementation of the method in the best possible way. In addition, they can be modified by the user, if he wishes to add or replace things. There is an emphasis on three-dimensional problems both in elasticity and plasticity, which cannot be found in other books on the subject.

The book succeeds completely relative to the author's stated aims and the subject matter. As a matter of fact, the book can be the ideal vehicle to teach the boundary element method to engineers who want the theory to go hand-in-hand with the numerical implementation and are not so much interested in mathematical details. Thus, the book can be used either as an ideal introductory text on boundary elements, in general, or as a specialized book on boundary element methods in plasticity. There are many introductory books available on boundary elements, but most of them deal with potential theory and elasticity, and they do not emphasize either the numerical implementation of the method nor 3D problems. This reviewer predicts that this book will prove to be, for boundary element programming, what has been the case with the two texts by Hinton and Owen on finite elements. The only slightly negative about this book has to do with the title, which

employs the general and misleading term mechanics instead of the more appropriate term *solid mechanics*, which would more exactly reflect the contents of the book.

*Boundary Element Programming in Mechanics* is highly recommended for purchase by both individuals and libraries.

**IR2. Classical and Computational Solid Mechanics.** - YC Fung (Univ of California, San Diego CA) and Pin Tong (Hong Kong Univ of Sci and Tech, Hong Kong, China). World Sci Publ Co Pte Ltd, River Edge NJ. 2001. 952 pp. ISBN 981-02-3912-2. \$98.00.

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

This book is intended as a concise account of many of the important concepts and methods of classical and computational solid mechanics, for what the authors term engineering scientists. It largely succeeds toward that goal—this is a good, comprehensive, unified presentation of much of the field of solid mechanics, written by two well-regarded researchers in that field.

The classical part of the book (the first 16 chapters) is mainly a re-issue of YC Fung's *Foundations of Solid Mechanics*, with major additions to the theories of plasticity and a major revision of finite-deformational elasticity. The computational part is new and constitutes the last five chapters (roughly one-third of the book), which focus on numerical methods to solve many linear and nonlinear boundary value problems in solid mechanics.

The book covers a great deal of material in a concise, dense style, with general, unified notation, and as such is a slow read. It will perhaps be most useful for readers who already have some familiarity with solid mechanics. The book contains sufficient material in Chapters 2–14 to serve as a linear elasticity textbook. The book covers concepts from strength of materials, continuum mechanics, viscoelasticity, plasticity, and finite-deformational elasticity, but probably not sufficiently to serve as the primary text for courses in these areas. It will serve as a good review and unifier of these subjects.

Chapter 1 presents prototypes (mostly 1D) of the theories of linear elasticity, viscoelasticity, and plasticity, vibratory and wave motions, and a brief historical overview. Chapter 2 is a complete development of the tensor analysis in general curvilinear coordinates that would serve as a good introduction to the subject. The bulk of Chapters 3–16 is concerned with the theory of linear elasticity, but with some discussion

of plasticity, thermodynamics, thermoelasticity, viscoelasticity, and finite deformations. Variational calculus is emphasized, to connect with the computational methods to follow.

Chapters 17–21 discuss computational methods applied to linear, nonlinear, and nonhomogeneous problems in solid mechanics. Chapter 17 develops the incremental approach to problem solving. Chapters 18–20 focus on finite element methods applied to linear elasticity problems. Chapter 21 discusses, in less depth, the finite element modeling of nonlinear elasticity, viscoelasticity, plasticity, viscoplasticity, and creep.

In many sections, there are worked examples, and in all chapters, there are problems, ranging in number from 33 in Chapter 2 to one in Chapter 21. These problems are mostly of the show, prove, or verify formats, with hints provided. *Classical and Computational Solid Mechanics* has an extensive and complete bibliography, with references arranged by the chapter and section to which they are relevant.

One criticism: There are far too many English language usage errors in the book, most often subject/verb disagreement, incorrect tenses, and strange word choices. These errors are especially numerous in the last five chapters. Fortunately, they do not interfere with the understandability of the presentation.

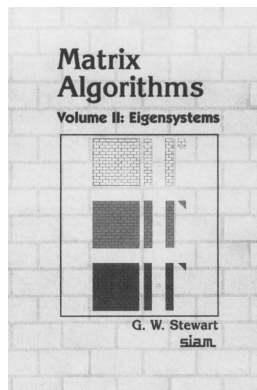
**1R3. Matrix Algorithms, Volume II: Eigensystems.** - GW Stewart (*Dept of Comput Sci, Univ of Maryland, College Park MD*). SIAM, Philadelphia. 2001. 469 pp. (Softcover). ISBN 0-89871-503-2. \$50.00.

Reviewed by A Mahajan (*Dept of Mech Eng and Energy Processes, S Illinois Univ, Carbondale IL 62901*).

This book contains a comprehensive presentation of computations involving the eigenvalues and eigenvectors of a matrix. It is the second volume in a projected five-volume series on matrix algorithms. The first volume was about basic decompositions. The second volume (this book) presents eigensystems. The next three books are projected to treat iterative methods for linear systems, sparse direct methods, and special topics, including fast algorithms for structured matrices. The author has managed to keep this volume fairly independent of the first volume, hence a basic knowledge of linear algebra is sufficient to understand most topics in the book is necessary. The book is really intended to be a reference book for scientists and engineers who need tools to solve problems in eigensystems. According to the author, the intended audience is the nonspecialist whose needs cannot be satisfied by black boxes. The book does live up to the author's stated aim. The author gives detailed derivations that will help anyone who wants to adapt the methods to particular problems. The book

really is not intended to be a textbook due to the lack of extensive solved and unsolved problems, but can be used as a self study by graduate students or even undergraduate students in honors programs.

The book is divided into two parts: Dense Eigenproblems and Large Eigenproblems. The book has six chapters, a reference list of over 300 references, and an excellent subject index. The first chapter presents the underlying theory for eigensystems. The second chapter describes the widely used QR algorithm. Chapter 3 deals with symmetric matrices and the singular value decomposition. The fourth chapter deals with large matrices for which the computation of a complete eigensystem is not possible, hence an algebraic and analytic theory of eigensystems is presented. The fifth chapter deals with the Krylov sequence methods, in particular the Arnoldi and Lanczos methods. The sixth chapter presents alternative methods such as subspace iteration and the Jacobi-Davidson method.



The book provides pseudo codes for many algorithms. The author does admit that the pseudo codes are for illustration only and should not be regarded as finished implementations, and it is difficult to verify their correctness. He also mentions that wherever possible he has checked the algorithms against MATLAB implementations. If there is a weakness in the book, it is right here, for the author could have provided these MATLAB programs on disk, or at the very least, made them available on a website. The reviewer did implement some of the algorithms in MATLAB, and it did take some time to develop the implementation. Of course, this in no way impacts the significance of the material to the serious reader who is looking for a detailed treatise on the subject, but does impact a student or practicing engineer who could be looking for a quick implementation of a particular algorithm. A recommendation to the author and publisher would be to make these MATLAB programs available on a website so that they can be easily downloaded.

*Matrix Algorithms, Volume II: Eigensystems* is an excellent treatise on eigensystems. It should be purchased by all libraries and any individuals who make extensive use of computations in eigensystems.

**1N4. Computational Fluid Dynamics in Practice.** - Edited by N Rhodes. Professional Eng Publ, Suffolk, UK. Distributed in USA by ASME, New York. 2001. 200 pp. ISBN 1-86058-352-0. \$124.00.

This work explores the current and future developments in CFD, with the authors detailing advanced applications and case studies to demonstrate successes, illustrate the limitations, and identify methods for good practice. The book offers new ideas and applications.

**1N5. Innovative Tools for Scientific Computation in Aeronautical Engineering.** - Edited by J Periaux, P Joly, O Pironneau, E Onate. CIMNE, Barcelona. 2001. 772 pp. ISBN 84-89925-77-1.

This book contains original contributions of international experts in the field of scientific computation in aerospace engineering. The methodologies and their associated tools described in this volume aim at presenting the state of the art of mathematical and computational sciences. These methodologies are said to be critical to the advanced technologies needed to meet the future challenges in aerospace engineering design. Readers will find insights to help them solve the modern design challenges faced by aeronautics, such as aircraft efficiency, reliable design, environmental, and safety concerns.

**1N6. Physics of Ice.** - VF Petrenko (*Dartmouth Col*) and RW Whitworth (*Retired Reader in Crystal Phys*). Oxford UP, New York. 2002. 392 pp. Softcover. ISBN 0-19-851894-3. \$65.00.

Ice is one of the most abundant and environmentally important materials on Earth, and its unique and intriguing physical properties present fascinating areas of study for a wide variety of researchers. This book is about the physics of ice, by which is meant the properties of the material itself and the ways in which these properties are interpreted in terms of water molecules and crystalline structure.

The physical principles underlying the properties of ice are carefully developed at a level aimed at pure and applied researchers in the field. Topics like current understandings of the electrical, mechanical, and surface properties, and the occurrence of many different crystalline phases are developed in a coherent way for the first time. An extensive reference list and numerous illustrations are also provided.

**1N7. Trends in Computational Structural Mechanics.** - Edited by WA Wall, KU Bletzinger, K Schweizerhof. CIMNE, Barcelona. 2001. 772 pp. ISBN 84-89925-77-1.

In this book, a number of renowned scientists discuss different aspects and most recent developments in the broad field of computational structural mechanics. It provides insight into the state of the art and indicates new trends in this field.

**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. (Under review)

**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. (Under review)

## II. DYNAMICS & VIBRATION

**1R8. Dynamical Contact Problems with Friction: Models, Methods, Experiments and Applications.** Lecture Notes in Ap-

plied Mechanics, Vol 3. - W Sextro (*Inst of Mech, Univ of Hannover, Applestr 11, Hannover, 30167, Germany*). Springer-Verlag, Berlin. 2002. 159 pp. ISBN 3-540-43023-7. \$79.95.

Reviewed by C Poli (*Mech and Indust Dept, Univ of Massachusetts, Amherst MA 01003*).

This 157-page reference book describes the results of the author's research carried out at the University of Hannover in Germany at the Institute of Mechanics. The audience for the book is other researchers working in the same general area. The book's goal is to describe, as the author states, "an efficient procedure to model dynamical contact problems with friction." The author does this by developing an alternative method to investigate the dynamical contact problems applicable to elastic bodies.

The book is divided into seven chapters. The first chapter gives a nice general overview of the roll of friction in both transmitting forces and in dissipating energy. Several examples of where friction is used to transmit forces and/or dissipate energy are included in this chapter. Chapter 1 also includes an excellent review of past work in the area.

In the second chapter, the author discusses the governing equations of motion assuming linear elasticity and concludes with a section that deals with the modal description of elastic bodies. In the next chapter, which is the longest chapter in the book, the author describes the point contact model and derives the corresponding equations. The effects of temperature and the development of wear are also included. Chapter 4 describes the experimental setup used to verify the point contact model developed in the previous chapter. Chapter 5 deals with analytical and experimental methods applied to bladed disc assemblies in turbomachinery. Chapter 6 deals with the rolling contact that occurs in wheel-track systems such as in railways, while the final chapter provides a summary and conclusion for the work presented in the previous chapters.

Although the English used in *Dynamical Contact Problems with Friction: Models, Methods, Experiments and Applications* may not be perfect, it is certainly more than adequate. While the figures could be improved, they too are more than adequate considering both the aims of the book and the intended audience. This reviewer would recommend this reference book to anyone working in this same area.

**1R9. Mathematical Control Theory of Coupled PDEs.** - I Lasiecka (*Univ of Virginia, Charlottesville VA*). SIAM, Philadelphia. 2002. 242 pp. Softcover. ISBN 0-89871-486-9. \$60.00.

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

The mathematics of control theory for a single Partial Differential Equation has been studied for some time. However, for

more complex systems governed by systems of coupled PDEs, the available works are fewer. The tools developed for single PDE systems are usually inadequate for the analysis of coupled systems. New questions have been formulated, including how can one take advantage of the coupling in the model to improve the system performance? The propagation of some components of a system into some other, originate new phenomena via the coupling.

The present book describes classes of coupled PDE models displaying the above-mentioned coupled properties and presents tools to analyze the resulting control problems. The ultimate goal of the book is said to be to provide a mathematical theory to guide the solution of three main problems: a) well-posedness and regularity, b) stabilization and stability, and c) optimal control and existence and uniqueness of some associated Riccati equations.

The structural acoustics model is used toward the end of the book as the choice "example" to illustrate various coupling phenomena that appear in interconnected systems. There are wave equations in an acoustic medium that appear coupled to the plate or shell equations from which they are separated by an interface that is part of the boundary for the acoustic medium.

The book has six chapters. It is only possible here to give their titles. The analysis starts with the well-posedness of 2nd-order nonlinear equations with boundary damping. It continues with a study of the stabilizability of nonlinear waves and plates. There is then a chapter on the uniform stability of structural acoustic models and another on Semi Group and PDE models for structural acoustic control problems. The final two chapters deal with feedback noise control for finite and infinite time-horizon problems. This results in detailed studies of certain pertinent Riccati equations.

*Mathematical Control Theory of Coupled PDEs* has 242 pages, with no figures and no computed results. This is a pure mathematical treatment full of theorems, lemmas, assumptions, propositions, and countless corollaries. It is the author's stated hope that it will be of use to applied acousticians and theoretical engineers, but this is an unrealistic expectation. The connection to structural acoustics is buried in a sea of theorems with little applicability. There are over 200 references, but about half are by the author herself and one of her associates. The couple of works mentioned which are authored by well-known acousticians, such as C Fuller and the textbook by P Morse and U Ingard, are the only ones that come from the regular acoustic literature. Therefore, this mathematical document will be mostly of interest to other mathematicians carrying on research on these obscure topics. This is certainly not a textbook, but perhaps could be a reference mathematics book for some institutional libraries. With the current emphasis on relevance required

by the Army Research Office (ARO), now a part of the Army Research Lab, this reviewer was surprised to learn that they sponsored this work.

**1R10. Ocean Waves and Oscillating Systems: Linear Interactions Including Wave-Energy Extraction.** - J Falnes (*Dept of Phys, Norwegian Univ of Sci and Tech NTNU, Trondheim, Norway*). Cambridge UP, Cambridge, UK. 2002. 275 pp. ISBN 0-521-78211-2. \$75.00.

Reviewed by M Perlin (*Dept of Naval Architect and Marine Eng, Univ of Michigan, 208 NAME Bldg, Ann Arbor MI 48109*).

This book is focused on linear theory and interactions of ocean waves and oscillating systems as its title implies. In general, the text is well written, the topics considered are appropriate for the subject, and the text construction is of high quality (recently, several books this reviewer has purchased have literally self-destructed, and hence the last comment). The presentation of the material is rapid in Chapter 2 (mechanical oscillations, state space, and Fourier treatment is considered—a nice review of the material, but too brief for initial exposure). Chapter 3 is a brief discussion of waves including some basics, and a terse discussion of waves and oscillators. Chapter 4 is a detailed discussion of energy and momentum (including irregular ocean waves) of linear surface gravity waves in two dimensions, both plane and circular, derived from the equations of conservation of mass and momentum. Interaction between waves and floating and submerged bodies is the subject of Chapter 5. Chapters 6 and 7 are a discussion of wave energy absorption/interactions by oscillating bodies and fixed-cavity chambers. One absent topic that would have enhanced the coverage of the text is examples/case studies of actual energy extracting devices and their success or failure and in situ efficiency, for example.

For researchers, the text is suitable for reference, however, it is more suitable as a textbook for graduate instruction. Although not numerous, the figures and tables are fine and used where necessary; the equations are formatted nicely and appear to have been thoroughly proofed; and the index is adequate. Although the author's first five chapters represent a credible undertaking, much of this material is already available in course-text form (eg. in the texts by Dean and Dalrymple, by Newman, and by Mei). On the other hand, as the discussions are subject appropriate and high quality, and Chapters 6 and 7 are somewhat unique in their coverage, at only \$75, *Ocean Waves and Oscillating Systems: Linear Interactions Including Wave-Energy Extraction* is worth purchasing.

**1R11. Qualitative Methods in Nonlinear Dynamics: Novel Approaches to Lipunov's Matrix Functions.** Pure and Ap-

plied Mathematics, Vol 246. - AA Martynuk (*Stability of Processes Dept, Inst of Mech, Natl Acad of Sci, Kiev, Ukraine*). Marcel Dekker, New York. 2002. 301 pp. ISBN 0-8247-0735-4. \$150.00.

Reviewed by RA Ibrahim (*Dept of Mech Eng, Wayne State Univ, 5050 Anthony Wayne Dr, Rm 2119 Engineering Bldg, Detroit MI 48202*).

This addition to the series of pure and applied mathematics monographs deals with the modern theory of dynamics of continuous, discrete-time, and impulsive nonlinear systems using Liapunov matrix-valued functions. It is known that this theory is originally rooted in the developments of Poincaré's and Liapunov's ideas for treating nonlinear systems of differential equations. The book is devoted to introduce mathematical theorems for analyzing Liapunov matrix-valued functions in five chapters.

The first chapter introduces the mathematical statements of qualitative methods of the general equations of continuous nonlinear systems. The definitions of various types of stability are introduced for nonlinear non-autonomous systems. Scalar, vector, and matrix-valued Liapunov functions, and the comparison principle were introduced to allow the estimation of the distance from every point of the system integral curve to the origin when the time changes from the fixed value. Other stability theorems, based on the work of the author and others, are stated with their proofs.

Some methods for analyzing continuous nonlinear systems of hierarchical structure are presented in Chapter 2. These methods are supported by an example of third-order systems. Some stability theorems of systems with regular hierarchy subsystems, large systems, and their extension to overlapping decomposition are discussed. The problem of poly-stability of nonlinear systems with separable motion is analyzed as an application of the matrix-valued function. Chapter 2 includes the concepts of integral and Lipschitz stability based on the use of the principle of comparison with a matrix-valued Liapunov function. Chapter 3 presents the qualitative analysis of discrete-time systems that model mechanical systems with impulse control, digital computing devices, population dynamics, chaotic dynamics of economical systems, and many others. These systems are usually described in terms of difference equations whose stability conditions are defined in terms of the matrix-valued functions method.

Chapter 4 introduces the stability of nonlinear dynamical systems subjected to impulsive perturbations. The impulsive system of differential equations are stated for general class of dynamical systems. The stability definitions presented in Chapter 2 for ordinary differential equations are adapted for the impulsive systems. Conditions and definitions of uniqueness, conti-

nity, boundedness, and stability of solutions of impulsive systems are presented.

Chapter 5 culminates the theorems and general results presented in the first four chapters by introducing some applications. They include numerical algorithms of constructing a point network supported by illustrative examples. The oscillations and stability of coupled mechanical systems are demonstrated for three pendulums through elastic springs and coupled two non-autonomous parametric oscillators.

*Qualitative Methods in Nonlinear Dynamics: Novel Approaches to Liapunov's Matrix Functions* is recommended to researchers who are studying the mathematical stability theory of dynamical systems. The author is commended for introducing illustrative examples from different applications to support the idea of Liapunov's matrix functions.

**IN12. Astrodynamics 2001, Volume 109, Parts I-III.** Proc of AAS/AIAA Astrodynamics Conf, July 2001, Quebec, Canada. - Edited by DB Spencer, CC Seybold, AK Misra, RJ Lisowski. AAS, San Diego, CA 92198. 2002. 2568 pp. 3-Vol Set. ISBN 0-87703-488-5. \$450.00.

This proceedings contains all of the available papers from the conference. A chronological index and an author index are appended to Part III.

The papers in Part I: Advances in the Astronautical Sciences are divided into the following sections: Librations Point I, Attitude Determination, Geo Collocation, Libration Point II, Orbit Determination, Constellations and Clusters, Earth and Lunar missions, and Collision Avoidance and Tracking.

Part II: Advances in the Astronautical Sciences includes Control, Attitude Dynamics and Control, Mars Missions I, Neutral Density, Tethers, and Mars Missions II.

Part III: Advances in the Astronautical Sciences includes Guidance, Navigation and Control, Orbital Mechanics, Interplanetary I, Trajectory Design and Optimization, Formation Flying, Interplanetary II, Low-Thrust Trajectory Optimization, and Relative Motion and Rendezvous.

**IN13. Formulas of Acoustics.** - Edited by FP Mechel. Springer-Verlag, New York. 2002. 1198 pp. ISBN 3-540-42548-9. \$199.00.

This collection of formulas has been written by applied scientists and industrial engineers for design professionals and students who work in engineering acoustics. It is subdivided into the most important fields of applied acoustics, each dealing with a well-defined type of problem. It provides easy and rapid access to profound and comprehensive information. In order to keep the text as concise as possible, the derivation of a formula is described only as far as necessary for its understanding. The interested reader can refer to the original source of the result. In addition to formulas, useful principles and computational procedures are given. Topics covered include general linear fluid acoustics, equivalent networks, reflection of sound, scattering of sound, radiation of sound, porous absorbers, compound absorbers, sound transmission, duct acoustics, acoustic mufflers, capsules and cabins, room acoustics, flow acoustics, analytical and numerical methods in acoustics, variational principles in acoustics, elasto-acoustics, ultrasound absorption in solids, and nonlinear acoustics.

**Analytical Mechanics.** Foundations of Engineering Mechanics Series. - AI Lurie (*Saint-Petersburg Polytechnic Inst, Russia*). Springer-Verlag, Berlin. 2002. 864 pp. ISBN 3-540-42982-4. \$139.00. (Under review)

**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. (Under review)

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

**Mechanical Shock.** Mechanical Vibration and Shock Series, Vol II. - C Lalanne (*French Atomic Energy Authority, France*). Hermes Sci Publ, Paris. Distributed in USA by Taylor & Francis Publ, New York NY. 2002. 320 pp. ISBN 1-56032-986-6. \$150.00. (Under review)

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

### III. AUTOMATIC CONTROL

**IN14. Climbing and Walking Robots (CLAWAR 2002).** Proc of 5th Int Conf. - Edited by P Binaud. Professional Eng Publ, Suffolk, UK. Distributed in USA by ASME, New York. 2002. 980 pp. ISBN 1-86058-380-6. \$720.00.

CLAWAR is an EC thematic network on climbing and walking robots including the support technologies for mobile robotic vehicles. The network has been established to bring together core research groups, industrial users, and robot manufacturers who are engaged in work on climbing and walking robots and associated technologies.

This proceedings has a number of significant applications including: General indoor and outdoor operations; Nuclear, underwater, and space; Petrochemical, pipes, and duct inspection; Construction; Humanitarian demining; and Medical rehabilitation and helping disabled people.

Topics covered include theory, simulation, and design of CLAWAR; control of CLAWAR; locomotion algorithms; innovative actuators; sensors and sensor fusion; design modularity and system architecture; micro-machines; autonomous and tele-operated CLAWAR; human-machine interfaces for CLAWAR; biological systems and solutions; and co-operative CLAWAR machines.

**IN15. Iterative Identification and Control: Advances in Theory and Applications.** - Edited by P Albertos and A Sala (*Dept of Syst Eng and Control, Polytechnic Univ of Valencia, C Vera s/n, Valencia, Spain*). Springer-Verlag London Ltd, Surrey, UK. 2002. 309 pp. ISBN 1-85233-509-2. \$129.00.

An exposition of the interplay between the modeling of dynamic systems and the design of feedback controllers based on these models is the main goal of this book. The subject matter includes

- new approaches to understanding how to effect the fit of dynamical models to physical processes through the choice of experiments, data pre-filtering, and model structure;
- connections between robust control design methods and their dependency on the quality of model fit;

- experimental design in which data collected in operation under feedback can reveal areas that limit the performance achieved;
- iterative approaches to link these model-fitting and control design phases in a cogent manner so as to achieve improved performance overall.

## IV. MECHANICS OF SOLIDS

**1R16. Analysis of Composite Structures.** - C Decolon (*Dept of Mech, Conservatoire Natl des Arts et Metiers, France*). Hermes Sci Publ, Paris. Distributed in USA by Taylor & Francis Publ, New York NY. 2002. 336 pp. ISBN 1-56032-982-3. \$135.00.

*Reviewed by E Armanios (Sch of Aerospace Eng, Georgia Inst of Tech, Atlanta GA 30332-0150).*

This book, comprising three parts and four appendices, provides a mathematical presentation of the governing equations for laminated composite plates and beams. The first part is devoted to the anisotropic constitutive relationships with emphasis on orthotropic materials. Hygrothermal effects are covered. Maximum stress and strain failure criteria are presented as well as Tsai-Hill, Tsai-Wu, and Hoffman polynomial based criteria.

The second part treats laminated plates. The governing equations for thin plates based on the Kirschhoff-Love assumptions are presented first. Symmetric orthotropic plates are studied for the cases of bending, vibration, and buckling. The stiffness coefficients for asymmetrical cases are presented as well. Bending, vibration, and buckling is presented for thin plates with asymmetric cross-ply as well as asymmetric balanced stacking sequences. Thermoelastic behavior is considered through the derivation of the 3D and plane stress constitutive relationships for orthotropic off-axes layups. Applications to balanced and symmetric laminates are presented. Moderately thick orthotropic symmetric plates are analyzed using Reissner-Mindlin assumptions. Cylindrical bending of thin and moderately thick laminated plates is presented for the cases of bending, vibration, and buckling.

The third part considers symmetrical beams starting with axial loading and followed by bending, including transverse shear strain effects. Applications to bending, vibration, and buckling are provided. Four appendices are devoted to the derivation of the governing equations for laminated plates. In the first two appendices, the governing equations of small and large transverse displacements of plates are derived by integrating the equations of motion. The third and fourth appendices use a variational formulation to obtain the governing equations for laminated plates based on Kirchoff-Love and Reissner-Mindlin assumptions, respectively.

The book aims at presenting the basis for the analysis of composites structures. As such, minimum derivation of equations is provided mainly in appendices. The focus is on the mathematical presentation of governing equations and closed-form solutions. The book is suited as a reference for graduate students and practitioners of mechanics of laminated composites. Its appealing feature is the systematic and compact presentation of the governing equations of beams and laminated composite thin and moderately thick plates including small and large transverse displacements, into a single reference. The figures adequately illustrate the boundary and loading conditions associated with the development of the governing equations. None of the equations are numbered making it difficult at times to follow the mathematical presentation sequence across sections and chapters. The inclusion of references to specific works by some investigators would enhance the author's presentation and comments within the text of the book.

*Analysis of Composite Structures* should be a good reference for purchase by graduate students and practicing scientists and engineers.

**1R17. Buckling Experiments: Experimental Methods in Buckling of Thin-Walled Structures.** Shells, Built-up Structures, Composites and Additional Topics, Volume 2. - J Singer (*Technion - Israel Inst of Tech, Haifa, Israel*), J Arboz (*Delft Univ of Tech, The Netherlands*), T Weller (*Technion - Israel Inst of Tech, Haifa, Israel*). Wiley, New York. 2002. 1732 pp. ISBN 0-471-97450-1. \$275.00.

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

This book is the second volume of the two-volume book, *Buckling Experiments*, a handbook assessing the state of the art of experimental methods and results in the buckling of thin-walled structures from the point of view of the research scientist. The two volumes are closely related and interconnected.

Volume 1 addresses the basic concepts, columns, beams, arches, and plates, while Volume 2 considers shells, stiffened plates and shells, composite structures, plastic buckling, cutout and damage effects, dynamic loads, thermal buckling, non-destructive tests, and measurements.

This book, Volume 2, as in the first volume, presents selected typical experiments often described in great detail, with some comments focusing on questions raised during the test, the methods employed, and the actual test atmosphere. Though fairly extensive (over 1800 references), the lists of experimenters are by no means inclusive. Also, certain topics are not covered; for example, the buckling of thin-walled buried pipes.

In contrast to columns, which have a neutral post-buckling path, and plates, which

exhibit a stable postbuckling behavior, shells usually have a very unstable post-buckling behavior, which strongly influences their buckling characteristics. Thin shells, however, are very efficient structures that can support very high buckling loads and hence their buckling and post-buckling behaviors have presented scientific and engineering challenges for decades.

Extensive theoretical studies connect initial post-buckling behavior with imperfection sensitivity. Unfortunately these methods have not yet been incorporated in engineering practice, and knock-down factors are still relied on primarily in the design of buckling-critical shells. One of the reasons for this slow and incomplete technology transfer from researcher to designer is probably due to the relative complexity of the analysis, as well as the difficulty encountered in correlating theory with experimental results. Another reason may have been the lack of experimental investigations that closely coordinated with theoretical studies, though thousands of shell-buckling tests have been carried out.

A final chapter covers comments on measurements. Since some excellent texts and handbooks on measurement techniques in structural and material testing have been published in recent years, a detailed general discussion of the subject is not included. The text does, however, catalog the types of strain sensors, displacement sensors, data acquisition systems, force transducers, pressure transducers, temperature measurements, accelerometers, vibration measurements, and acoustic and thermal emission sensors that are in common use in the field. The list is far from complete, but provides an overview and some guidelines to sources of more information.

*Buckling Experiments: Experimental Methods in Buckling of Thin-Walled Structures* (along with Volume 1) provides a remarkable compilation of experimental results previously published in the engineering literature from 1845 to the present day. It will be invaluable to any new experimenter in the field to lay the background for future experimental work. This reviewer believes the book is a must for technical libraries and, most likely, would be a welcomed presence in an experimenter's laboratory in the field of structural stability.

**1R18. Deformation and Fracture Behaviour of Polymers.** Engineering Materials Series. - Edited by W Grellmann (*Dept of Eng Sci, Martin-Luther-Univ of Halle-Wittenberg, Halle, D-06099, Germany*) and S Seidler (*Inst of Mat Sci and Testing, Vienna Univ of Tech, Favoritenstr 9-11, Vienna, A-1040, Austria*). Springer-Verlag, Berlin. 2001. 599 pp. ISBN 3-540-41247-6. \$99.00.

*Reviewed by GI Barenblatt (Dept of Math, UCB, Evans Hall, Berkeley CA 94720-3840).*

The book under review is composed of lectures presented at the Merseburg Discussion Conference with several additional contributions which the editors considered of special importance to the book's integrity. The majority of participants were from Germany and Austria.

To explain the idea of the book as the present reviewer sees it, let us imagine for a moment that structural materials are ideal quasi-brittle bodies. The material constants: Young's modulus, Poisson's ratio, and fracture toughness (cohesion modulus) can be determined rather easily by experiment using solutions to certain special problems. In this imaginary situation, all problems of structural design would be reduced to computing the solutions of well-defined, generally speaking, nonlinear problems of elasticity theory. (The problems are nonlinear free-boundary problems due to the specific conditions at the unknown beforehand crack contours.) These problems present, of course, some computational difficulties, but in principle there is no significant difficulty in their solution.

The present book shows that such an idyllic picture is very far from reality even for such pleasant (for the illustration of the basic ideas of fracture mechanics) materials as polymers. Nevertheless, the intention of the editors and authors is to show to practical engineers who use polymeric materials in their work that fracture mechanics even in its modern state (with certain hélas incomplete corrections for overall plasticity) can be a useful framework for guidance. The authors had no such intention, but the book could be also useful for theoreticians working in fracture mechanics showing them real problems arising, with necessary modifications of the basic models.

A remarkable property of the book is also that it shows, sometimes implicitly, how incomplete is our knowledge of fracture even for most favorable materials, and so emphasizes the directions of further investigations. Also very important is that the book presents problems arising in real testing of real polymeric materials widely used in industry following existing standards, in particular of the European Structural Integrity Society (ESIS). The basic weakness of today's testing procedures, which the authors recognize and demonstrate very clearly, is: It is unclear what universal properties of materials can be "extracted" and learned from these tests and then used in quantitative design of real structures.

There are several examples: the very instructive paper by Ramsteiner *et al.*, "Concepts of fracture mechanics for polymers," Section 4: Nonlinear fracture mechanics. The authors propose a self-similar relation  $J = C_1(\Delta a)^{C_2}$  instead of two straight lines. First of all, this reviewer does not think that this relation is "more realistic" as the authors claim: there are definitely two phases of the crack extension—blunting and stable crack propagation, and the process is defi-

nately not self-similar as it would be dictated by the power law. Furthermore, what are the "fitting parameters"  $C_1$  and  $C_2$ ? It is clear that they are not universal. What to do with them in this case? That is, how does one use them?

In the previous section, page 31, discusses the fatigue test (Fig. A18): a rather long rectilinear part of the dependence of logarithm of crack propagation speed versus the logarithm of cyclic stress intensity factor, similar to the Paris-Erdogan power law. Again the same question: Are the coefficients of this power law universal, or do they depend on the specimen size? The answer is of crucial importance because these coefficients determine the lifetime of the structure!

The same question can be asked about the relation (F3) in the very interesting paper by W Grellman, his colleagues, and B Michel:  $da/dN = C(\Delta T)^\beta$ . The authors claim that  $\beta$  is a "material-specific exponent." Are they sure that these parameters will be the same for specimens of a different size? If not, how does one determine the lifetime? Reading this book presents many such challenges, and it is very good.

The list of problems considered in the book is impressive, although this reviewer would be interested to see some fresh ideas concerning the neck propagation, in particular in nylon, and also unsteady and thermal vibrocreep, both phenomena characteristic of polymers. Therefore, the present book is definitely a reference book. This reviewer sees two different audiences to which the book will be of interest—practical engineers designing and researching structures using polymeric materials, and theoreticians working in fracture mechanics. Both will find in this book many challenging problems. The quality of publication is good, especially the quality of the figures; the publication corresponds to the standards of good old Springer. *Deformation and Fracture Behavior of Polymers* is recommended to all large technical libraries.

**IR19. Introduction to Tribology.** - B Bhushan (*Nanotribology Lab for Info Storage and MEMS/NEMS (NLIM), Ohio State Univ, Columbus OH 43210*). Wiley, New York. 2002. 732 pp. ISBN 0-471-15893-3. \$120.00.

*Reviewed by Pak Lim Ko (Integrated Manuf Tech Inst, W Lab, NRC, 3250 E Mall, Vancouver BC, V6T 1W5, Canada).*

In the Preface, the author states that this book is intended as a broad-based textbook for post-graduate students. Judging by its contents and the comprehensiveness in discussion, this book has succeeded amply in fulfilling the author's claim. It can be used as a stand-alone reference book for both researchers and practicing engineers. Despite its title, which seems to suggest that this book is an introductory text, the scope of the topics that are covered is, indeed, very broad. With the exception of one significant

omission, topics that are directly or indirectly concerned with the engineering and science of tribology, from friction, wear, and lubrication to surface characterization, contacting surfaces, test methods and applications, are dealt with comprehensively. The contemporary topic of micro/nanotribology is also given a prominent position in this book. The author also describes the book as a condensed version of his other comprehensive book titled *Principles and Applications of Tribology*. With a few minor differences, such as the omission of an important topic on coatings and surface treatments, the present version is in every aspect just as excellent a reference volume as the earlier version and a worthy alternative.



The book is well organized with a very descriptive table of contents. Each chapter contains an introduction, a closure, and a comprehensive list of references and suggested reading. The author has provided many examples to illustrate the application of some of the equations and principles in the text. The book has 12 chapters spanning 720 pages. The graphs and figures are clearly presented, and the reproduction of photo-micrographs is reasonably good.

The book starts with a chapter that briefly describes the history and industrial significance of tribology. This first chapter also reviews and describes the significance of the emerging field of micro/nanotribology. The second and third chapters provide a detailed discussion on topics involving solid surfaces and their contacts, such as, physico-chemical characteristics of surface layers, the analyses and measurement techniques for surface roughness, and elastic and plastic contacts. Several illustrative examples are presented to help the reader better comprehend the analyses involved. Chapter 4 describes the adhesion mechanisms of solid-solid and liquid-mediated contacts. The following chapter on friction, like the one on adhesion, is also divided into solid-solid and liquid-mediated contacts. There is also a short discussion on static friction and *stick-slip*. Unfortunately, it would require a more in-depth discussion for frictional vibration and the associated

friction characteristics to be properly explained. The section on friction of materials describes the friction characteristics of a broad range of materials and their combinations.

The interface temperature rise due to frictional heating is discussed in Chapter 6. The analysis, which follows the fundamental heat conduction solutions and takes into consideration the partition of heat, is divided into frictional contacts that are subjected to high stress conditions or low stress conditions. Although there are two numerical examples to help illustrate the application of the derived equations, some readers may find it difficult to comprehend the concept of heat partition and the development of the temperature rise equations between two bodies in relative motion for the two stress conditions. This would be particularly true for practicing engineers who may not be familiar with this topic. Chapter 7 provides a general description of several types of commonly known wear mechanisms and types of wear particles that are the consequence of different wear mechanisms and wear processes. The section on wear of materials helps to further illustrate the wear processes and wear mechanisms involved.

Chapters 8 and 9 are devoted to fluid film and boundary lubrication. The various regimes of lubrication, the theories of hydrostatic, hydrodynamic and elastohydrodynamic lubrication, as well as bearing designs are reviewed in Chapter 8, whereas in Chapter 9, the mechanisms of boundary lubrication, various liquid lubricants and additives, and greases are presented. The surface force apparatus (SFA), the scanning tunneling microscopes (STM), and the atomic force and friction force microscopes (AFM and FFM) are relatively modern devices developed in the last 40 years. They are widely used for studies of interfacial phenomena on a small scale, such as those in magnetic storage systems and microelectromechanical systems (MEMS). Chapter 10 provides a comprehensive description of these devices and their applications in tribology. Chapter 11 discusses some friction and wear test methods. The last chapter describes a number of tribological components, such as, bearings, seals and gears; and microcomponents, such as MEMS, as well as tools used in material processing operations.

In summary, *Introduction to Tribology* is a broad-based reference book which covers nearly every aspect of tribology from the fundamentals of friction, wear, lubrication, and surface contacts to the emerging field of micro/nanotribology. It is, as the author intended, an excellent text for post-graduate and senior-level undergraduate courses, and a useful reference for researchers and practicing engineers who are involved in tribology related studies or projects.

**1R20. Mechanics of Periodically Heterogeneous Structures.** Foundations of Engineering Mechanics. - Edited by LI Manevitch, IV Andrianov, VG Oshmyan (*Inst of Chem Phys, 4 Kosygin St, Moscow, 117977, Russia*). Springer-Verlag, Berlin, 2002. 264 pp. ISBN 3-540-41630-7. \$89.95.

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

This book, written by three members of the Institute of Chemical Physics in Moscow, Russia, is dedicated to the application of the Mathematical Homogenization Theory (MHT). As indicated in the preface, many publications provide a rigorous presentation of the theory. Instead, these authors decided to focus on applications to composite materials and heterogeneous plates and shells. In their introduction, the authors state that "researchers often restrict their study to the proof of the solution existing" and that to solve practical problems effective analytical or numerical procedures are needed. The authors have made many contributions in this area as indicated by the 50 articles listed in the list of references for which one of them is listed as author or co-author.

The first chapter presents basic definitions and results from homogenization theory as it applies to heterogeneous solids with periodic microstructure. The following chapters deal with applications to composite materials, beams with concentrated masses and discrete elastic supports, reinforced plates, reinforced shells, corrugated plates, perforated plates and shells, and other periodic structures. A list of 218 references is also provided. As indicated in the introduction, the MHT was developed by many researchers in France, Italy, Russia, the USA, and the Ukraine. Contributions from Russian and Ukrainian scientists are featured prominently in this book, but contributions from other researchers are cited as well. A systematic approach is taken throughout the book to show how the MHT is used to study many problems through examples. The major steps are clearly explained, and major results are usually presented in graphical form. The book is well written and provides an uncluttered view of how homogenization theory can be applied to mechanics problems. The book is well produced and easy to read, but the quality of some of the figures is lacking.

The authors do not define the intended audience for this book. It can be said that it is not written as a textbook or as a reference for experienced researchers in that field, but rather as an introduction for new researchers. There are several well-known books in this area: Bensoussan *et al* (1978), Sanchez Palencia (1980, 1987), Kalamkarov (1992), and Lewinski and Talega (2000). In comparison, the present text purposely skips mathematical considerations that can be overwhelming and focuses more on appli-

cations via examples. The result is a concise presentation that is much more accessible. The background required to appreciate this book includes calculus, partial differential equations, theory of elasticity, theory of beams, plates, and shells. *Mechanics of Periodically Heterogeneous Structures* should be of interest to researchers wanting to familiarize themselves with the MHT and could serve as a basis for a course for advanced graduate students.

**1R21. Thermoelastic Fracture Mechanics using Boundary Elements.** Topics in Engineering, Vol 39. - Edited by DN dell'Erba (*Wessex Inst of Tech, Southampton, SO40 7AA, UK*). WIT Press, Southampton, UK, 2002. 146 pp. ISBN 1-85312-849-X. \$109.00.

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

This book comprises eight chapters, a bibliographical section, but no index. Its contents may be roughly divided into three parts: introduction and thermoelasticity and fracture mechanics background (Chapters 1 and 2, 22 pages); thermoelastic dual BEM formulation (Chapters 3 and 4, 38 pages); thermoelastic fracture mechanics computations (Chapters 5-7, 66 pages), with conclusions provided in Chapter 8. The goal of the book is to describe the formulation and implementation of the dual BEM (DBEM), which is a variant of the displacement discontinuity method (DDM), in the context of 3D thermoelastic crack problems. The dual BEM for crack problems has been investigated for a long time by the author's advisor and other collaborators, and the main contribution of the work under review is the treatment of thermoelasticity.

Chapter 1 is a general introduction to the work, allowing the author to highlight the rest of the book contents and put it all in perspective, and Chapter 2 reviews the necessary background on thermoelasticity and fracture mechanics.

Chapter 3 reviews classical material concerning BEM formulations for thermoelasticity and its standard implementation. Traction boundary integral equations are introduced as well, as they are needed for the dual BEM formulation. The latter is expounded in detail in Chapter 4, together with implementation details such as the handling of the strongly and hypersingular integrals by the direct method of Guiggiani *et al* [1] involved in the dual BEM.

Special crack front elements and techniques for the numerical evaluation of stress intensity factors (SIFs) are presented in Chapter 5, together with several numerical examples demonstrating the accuracy of SIF evaluation for thermoelastic crack problems by the dual BEM. Chapter 6 is devoted to the formulation and implementation of  $J$ -integral for 3D thermoelastic crack problems, and the application of a de-

composition technique similar to that of Rigby and Aliabadi [2] or Huber, Nickel, and Kuhn [3]. Several supporting numerical examples are also presented. Chapter 7 is devoted to the incremental simulation thermal fatigue crack propagation, under Paris law. Several 3D simulations are presented, whose results are physically reasonable, but are not quantitatively compared to other sources.

Generally speaking, this book is a clear and readable account of the research undertaken over several years by the author. It is in fact a published version of his doctoral research work, prepared at the Wessex Institute of Technology, to which WIT Press, the publisher of this book, is closely associated. As such, although the research work reported is interesting in itself, the book is very much focused on the particular line of investigation followed and lacks the completeness and perspective which would be expected of a good reference text.

The overall presentation is of good quality. The book is hardbound. The typesetting, done with LaTeX, is clear even for the most complex mathematical expressions inherent with the subject matter; the figures are also of good quality.

In conclusion, this reviewer expects *Thermoelastic Fracture Mechanics using Boundary Elements* to be useful mostly to researchers and engineers working in the same general area, and more as a detailed account of recent research than as a reference text. This reviewer strongly objects to the editorial policy behind this book, however, for several reasons: *i*) \$109 (US) for 146 pages, advertisements not included, is a much too expensive price, especially since *ii*) much of the work is available in archival journal publications by the author and his advisor [4–7]; besides *iii*) the potential buyer is not informed that the book is based on a PhD thesis dissertation, and finally *iv*) many books in this series, including the one under review, substantially overlap each other simply because they are published versions of several PhD theses on computational fracture mechanics by BEM made in the same research group. Therefore, this reviewer advises against purchase of the book. On the other hand, the work itself is good, and its young author is not responsible for the mercantile editorial policy, so this reviewer instead encourages readers to read the papers [4–7].

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- [8] Dell'Erba DN, Aliabadi MH, and Rooke DP (1998), Dual boundary element method for three-dimensional thermoelastic crack problems, *Int. J. Fract.*, **94**, 89–101.

### 1N22. Handbook of Composite Fabrication.

- Edited by G Akovali (*Dept of Polymer Sci and Tech and Dept of Chem, Middle East Tech Univ*). Rapra Tech Ltd, Shropshire, UK. 2001. 190 pp. ISBN 1-85957-263-4. \$150.00.

This volume is a concise reference book for someone who has just started working in the composites field to gain instant knowledge, as well as to pass contemporary information to technologists already active in the area. Moreover, the succinct, well-structured format of the handbook enables it to be employed as an educational resource.

The chapters in this handbook have been written by experts in their fields (the chapter authors are all senior academics/research directors). Each chapter is fully referenced, illustrated, and includes case studies and applications of polymer composite fabrications.

Topics covered include matrix polymers, reinforcing agents, fiber form processes, molding compounds, prepegs, hand lay-up/spray-up method, automated tape-laying method, bag molding process, autoclave molding, compression molding, transfer molding, injection molding, wet winding, dry winding, post-impregnation, pultrusion/pullforming, continuous laminating, centrifugal casting, cutting/joining processes, and surface finish processes.

### 1N23. Interfaces, Adhesion and Processing in Polymer Systems. From 2000 MRS Spring Meeting, San Francisco.

- Edited by SH Anastasiadis (*Found for Res and Tech, Hellas Inst of Electron Struct and Laser*), A Karim (*Natl Inst of Standards and Tech*), GS Ferguson (*Lehigh Univ*). Mat Res Soc, Warrendale PA. 2001. 203 pp. ISBN 1-55899-537-4. \$77.00.

This volume focuses on addressing both the fundamental scientific aspects and the advances in applications of polymers at surfaces, interfaces, and thin films, and the effects of the interfaces on processing and adhesion. Topics covered in 29 papers include thin films; polymer-polymer and polymer-wall interfaces; polymer interface and its effect on processing; polyelectrolytes and proteins at surfaces; nanostructures—from thin films to bulk; mechanical aspects of soft biomaterial interfaces; polymer adhesion; and polymer surfaces and surface modification.

### 1N24. LIA Handbook of Laser Materials Processing.

- Edited by JF Ready and DF Farsion. Laser Inst of Am, Orlando. 2001. 715 pp. ISBN 0-912035-15-3. \$240.00.

This comprehensive handbook provides extensive data and practical guidance on laser materials processing procedures, equipment, systems, and results.

**1N25. Mechanical Properties of Structural Films.** (STP 1413). - Edited by CL Muhlstein (*Univ of California, Berkeley CA 94720*) and S Brown (*Exponent Failure Analysis Assoc*). ASTM, W Conshohocken PA. 2001. 340 pp. ISBN 0-8031-2889-4. \$100.00.

This is a collection of 22 papers on the characterization of the mechanical properties of structural films available to date. In the rapidly developing field of structural films, this publication covers four major areas of structural films characterization: fracture and fatigue; elastic behavior and residual stress; tensile testing; thermomechanical, wear, and radiation damage.

### 1N26. Nondestructive Evaluation: Theory, Techniques, and Applications.

- Edited by PJ Shull. Marcel Dekker, New York. Distributed in USA by ASME, New York. 2002. 848 pp. ISBN 0-8247-8872-9. ASME Book No 801853. \$195.00. (ASME members \$195.00).

This comprehensive volume, containing over 300 references, describes the NDE issues associated with real-world applications. Each chapter details a different NDE method and includes an overview of the NDE method; an explanation of the fundamental physical laws governing the method; the inspection techniques and typical equipment used in the method's application; final system integration of transducers, supporting instrumentation, and commonly practiced procedures necessary for viable NDE inspection; examples of how the method can be applied; and end-of-chapter problems.

### 1N27. Particle Adhesion: Applications and Advances.

- Edited by DJ Quesnel (*Univ of Rochester NY*), DS Rimai (*NexPress Solutions LLC*), LH Sharpe (*AT&T Bell Labs*). Taylor & Francis Publ, New York NY. 2001. 511 pp. ISBN 90-5699-725-4. \$80.00.

This book documents the use of particle adhesion concepts in a variety of disciplines. Fields as varied as the cleaning of semiconductors, to the controlling of cancer metastasis, to the abatement of environmental pollution all benefit from applications of particle adhesion concepts. From the use of single particles as probes of material properties to the finite element computation of interaction energetics, this book offers a variety of perspectives on research in particle adhesion. It is a repository of practical concepts and a source of new ideas and techniques. The cross-pollination of concepts from one field with ideas from another is highlighted by an annotated description of contents within the Preface.

### 1N28. Practical Design of Ships and Other Floating Structures, Volumes 1 and 2.

Proc of 8th Int Symp, PRADS 2001. - Edited by Wei-Cheng Cui (*Sch of Naval Architec and Ocean Eng, Shanghai Jiao-Tong Univ, Shanghai, 200030, China*), You-Sheng Wu (*China Ship Sci Res Center, PO Box 116, Wuxi, Jiangsu, 214082, China*), G-J Zhou. Elsevier Sci Ltd, Kidlington, UK. 2001. 1400 pp. ISBN 0-08-043950-0. \$254.00.

This proceedings contains the papers presented at the symposium. Volume I covers design synthesis, production, and part of hydrodynamics. Volume II contains the rest of hydrodynamics, and structures and materials. The overall aim of these symposia is to advance the design of ships and other floating structures as a professional discipline and science by exchanging knowledge and promoting discussion of relevant topics in the fields of naval architecture and marine and offshore engineering. About 170 papers were accepted for presentation.

### 1N29. Smart Structures: Applications and Related Technologies.

CISM Courses and Lectures No 429. - Edited by A Suleman (*Inst Superior Technico*). Springer-Verlag, New York. 2001. 358 pp. (Softcover). ISBN 3-211-83681-0. \$79.95.



This book covers the fundamentals in smart structures, materials, systems, and related technologies, and it provides a comprehensive overview of the current state of the art in the field. The mathematical foundations, engineering design tools, and experimental techniques illustrated with practical applications are presented in five individually-authored chapters.

**IN30. Strong Discontinuity Approach in Finite Deformation Settings: Theoretical Aspects and Numerical Simulation.** - J Oliver, A Huespe, D Pulido, E Samaniego. CIMNE, Barcelona. 2001. 69 pp. ISBN 84-89925-89-5.

This book presents its contents in two parts:

**Part 1: Theoretical aspects**—Taking the strong discontinuity approach as a framework for modeling displacement discontinuities and strain localization phenomena, Part 1 extends previous results of the authors, from infinitesimal strain settings to finite deformation scenarios.

**Part 2: Numerical simulation**—Devoted to developing the large strain counterpart of the non-symmetric finite element with embedded discontinuity, frequently considered in the strong discontinuity approach, and to performing numerical experiments to display the theoretical aspects tackled in Part 1, this part emphasizes the role of the large strain kinematics in the obtained results.

**IN31. Superplasticity and Superplastic Forming.** Proc of Int Symp, Nov 2001, Indianapolis. - Edited by DG Sanders and DC Dunand. ASM Int, Materials Park OH. 2002. 220 pp. ISBN 0-87170-758-6. \$123.00.

This proceedings addresses recent advancements in superplastic material science and related technology transfer to new industrial applications. Papers have been contributed by researchers and manufacturing technologists. Industrial applications of superplastic forming that are discussed include commercial airframes, aerospace and defense, automotive, architecture, rail, and consumer goods.

**IN32. Thin-Walled Structures: Advances and Developments.** Proc of 3rd Int Conf, June 2001, Cracow, Poland. - Edited by J Zaras, K Kowal-Michalska (Dept of Strength of Mat and Struct, Tech Univ, U1 Stefanowskiego 1/15, Lodz, 90-924, Poland), J Rhodes (Dept of Mech Eng, Univ of Strathclyde, Glasgow, G11 1XQ, UK). Elsevier Sci Ltd, Kidlington, UK. 2001. 780 pp. ISBN 0-08-043955-1. \$204.00.

This volume includes the Keynote Papers and also covers analysis, design, and manufacture; bridge structures; cold-formed sections; composites; dynamic loading (cyclic, impact; and vibration); finite element analysis; laminate and sandwich structures; optimization and sensitivity analysis; plate structures; shell structures; and ultimate load capacity.

**IN33. Topics in Finite Elasticity.** CISM Courses and Lectures No 424. - Edited by M Hayes (Univ Col Dublin) and G Saccomandi (Univ of Lecce). Springer-Verlag, New York. 2001. 244 pp. Softcover. ISBN 3-211-83336-6. \$64.95.

Devoted to both theory, experiment, combined standard basic material, and new results, the 34 lectures (delivered in six courses) covered in this book sought to provide a comprehensive foundation and detailed account of selected contemporary developments. They present the following: Elements of the theory of finite strain, by Ph Boulanger and M Hayes; Seven lectures on finite elasticity, by MF Beatty; Universal solutions and relations in finite elasticity, by G Saccomandi; Finite-amplitude waves in Mooney-Rivlin and Hadamard materials, by Ph Boulanger and M Hayes; Elements of elastic stability theory, by RJ Knops; and Story of  $f$ : the driving force on a phase boundary, by R Abeyaratne.

**IN34. Tribological Limitations in Gas Turbine Engines: A Workshop to Identify the**

**Challenges and Set Future Directions.** Proc of ASME Turbo Expo, June 2002, Amsterdam. - Edited by C Dellacorte, O Pinkus, H Heshmat. ASME, New York. 2002. 68 pp. ISBN 0-7918-1690-7. \$70.00. (ASME members \$35.00).

This volume reports on a workshop co-sponsored by NASA (Glenn Research Center), ASME (Tribology Division), and industry (Industrial Tribology Institute and Mohawk Innovative Technology) that was convened to consider the tribological limitations that inhibit progress in present-day and future turbomachinery, particularly gas turbine engines. Presentations were delivered by participants from industry, government agencies, and research organizations. Five subgroups focused on the following specialized areas: rolling element bearings together with the required materials, lubricants, and seals; magnetic bearings plus back-up systems; compliant foil bearings including required materials and coatings; modeling of bearing performance and integration into the overall system; and advanced monitoring and predictive tools to serve present and new technologies. Five panels evaluated the range of available innovations against the existing tribological needs and prepared a list of development programs aimed at advancing the design of high performance turbomachinery.

**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. (Under review)

**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. (Under review)

**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. (Under review)

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

**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. (Under review)

**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. (Under review)

**1R35. Building Aerodynamics.** - T Lawson (Univ of Bristol). Imperial Col Press, London. Distributed in USA by World Sci Publ, River Edge NJ. 2001. 286 pp. ISBN 1-86094-187-7. \$66.00.

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

In the Preface, the author defines the purpose of his book quite clearly:

“This book is written specifically for the practicing Architect and Engineer. The various interactions of the wind with buildings are considered in their separate chapters, each of which has an Introduction in which the interaction is explained in general terms. Detailed data are presented in the rest of each chapter explaining the extent of quantifiable information which can be made by the Wind Engineer to the Design Team so that the best compromise between the requirements of wind and all other competing considerations can be made. Typical Tables and Figures from real situations are presented as illustrations of all measurements and calculations. Theory has been kept to a minimum, and is only presented when, in the author’s opinion, the analysis is not well known or is central to the argument.”

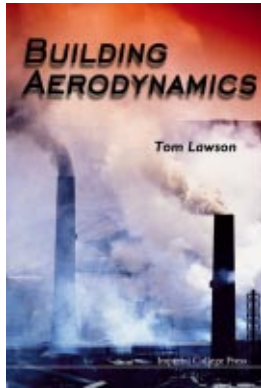
The contents are as follows: Summaries, The Wind (Ch 1), Flow around bluff bodies in turbulent flow (Ch 2), Wind loading (Ch 3), Wind environment (Ch 4), Rain and snow (Ch 5), Ventilation (Ch 6), Fire (Ch 7), Emissions from buildings; (Ch 8), Sailing (Ch 9), Experimental methods (Ch 10), Necessary statistics (Ch 11). The Summary is an interesting section of the book. It contains the author’s view of the responsibilities of the Wind Engineer and the Architect. In as much as the author is a well-known authority in the Wind Engineering field, one can’t help but wonder if this division of responsibilities is accepted by the Architects as well.

Generally speaking the book is well done, as might be expected from an author of his stature. Not surprisingly, the author depends heavily on the results from his laboratory at the University of Bristol. This has two consequences. The first is that the author knows whereof he writes. The second implies universal agreement by all members of the community, which may or may not be the case since this discipline is still in development. Chapter 3 has a good section on wind driven dynamic motion of buildings, as well as low order approximations. Chapter 4 has an interesting section called *Pitfalls*. Chapter 5 discusses the problems caused by rain and snow, and Chapter 6 deals with ventilation. (This reviewer feels that readers in the US would be well served by using the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbooks.) Chapter 9 treats sailing in what may be termed *urban waters*, though the description can be applied to sailing in straits and regions with many islands, though the wind statistics are less likely to be available in the latter case.

The main topic in Chapter 10 is the use of wind tunnels and is a good introduction to

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that experimental discipline. The author notes that he is not an advocate of this application of Computational Fluid Dynamics (CFD), particularly since CFD is still in the early stages of development. This reviewer shares the author's lack of enthusiasm for this application for technical reasons, namely unsteady, separated flow remains one of the most challenging phenomena to be simulated by CFD. Chapter 11 is important since the natural winds are not steady and thus knowledge of statistics is essential.



This reviewer feels the author has satisfied his goal. An interested reader should keep in mind the book is written in the UK for practitioners in the UK. So, the author explains the climate in terms of an Icelandic low, a Siberian high, and a subtropical high-pressure cell over the Azores. Further, there are references to standards and data sources that may not be generally available in the US. Other sources like the ESDU information may only be available at specialized libraries. Readers in the US may wish to supplement this book with ASCE Memoranda and Reports on Engineering Practice #67, "Windtunnel Studies on Buildings and Structures."

This reviewer notes the author's familiarity with the subject occasionally leads to overlooked details. For example Figure 1.02 on p 11 refers to "Southwest" Trade Winds when he should have used "Southeast" Trade Winds. On p 18 the legend below Figure 1.07 refers to frequency (Hz in wind tunnel time without defining wind tunnel time any where in the book. On p 29 the author states, "The opposite to a bluff body is a plate," which is true if the plate is lined up with the relative wind, not normal to it. The pictures of surface streamline on pages 50, 51, and 53 could use a little more explanation.

While it may be a matter of local usage, this reviewer found the implied definition of dynamic pressure (pp 34 and 35) as " $1/2\rho V^2$ " to be ambiguous. The definition would be clearer if the author had written " $(1/2)\rho V^2$ ." This issue appears from time to time throughout the book in different forms (see the middle of p 63 for example). This reviewer feels this ambiguity is unfortunate since one purpose of the book is the education of architects and students. This reviewer is an engineer

who feels the ability to do "back of the envelope calculations" to obtain a rough idea of the size of effects is often a useful skill during team interactions. As such, the ambiguity detracts from learning to estimate accurately.

*Building Aerodynamics* fills a need, but its general applicability is reduced somewhat by its understandable focus on the weather and standards used in Great Britain. A Professor of Wind Engineering or librarian at a British Institution of higher education may well want to acquire this book either as a text or for reference purposes. Serious research Wind Engineers in the US may want to purchase the book, if they are not already with Lawson's work.

**1R36. Capillary Surfaces: Shape, Stability, Dynamics, in Particular Under Weightlessness.** Tracts in Modern Physics, Vol 178. - D Langbein (*Univ Bremen, Am Fallturm, Bremen, 28359, Germany*). Springer-Verlag, Berlin. 2002. 364 pp. ISBN 3-540-41815-6. \$219.00.

*Reviewed by KJ Ruschak (Manuf Res and Eng Organization, Eastman Kodak, 2/35 Kodak Park, Rochester NY 14652-3701).*

This book is a monograph on capillary hydrostatics and hydrodynamics treating liquid/air or liquid/liquid interfaces at small Bond number: a condition of near weightlessness, of nearly identical liquid densities, or of such small extent that surface energy effects dominate. Consideration is limited to pure liquids with constant and uniform surface tension. The book is predominantly theoretical and mathematical, but presents results for several experiments performed in spacecraft such as European Spacelab, in aircraft in parabolic flight, or in drop towers. Applications such as the design of liquid containers for spacecraft or the growth of large, high-quality crystals are mentioned, but not considered in detail. A solid background in the physics of capillary phenomena and in applied mathematics, including the calculus of variations, are requisites for the reader. The typically concise development at a high level makes the book unsuitable as a textbook or as an introduction to the subject matter.

The book primarily treats, usually from the perspective of minimization of free energy, equilibrium meniscus shapes and their stability according to the Gauss-Laplace (or Young-Laplace) differential equation of capillary hydrostatics. Stability is determined by variation of energy to verify a minimum or by the sufficient, but non-essential condition for instability of a minimum in volume as an independent parameter such as pressure is varied. The specific problems treated include liquid bridges between parallel plates that may be rotating; two liquid bridges between three colinear plates where the center plate floats between fixed-end plates; liquid shapes determined by wetting barriers arising from sharp edges or abrupt changes in the surface energy of

the solid surface (canthotaxis or contact line pinning); partially filled containers of cylindrical and polygonal cross section; and menisci in wedges and corners. Some problems in capillary hydrodynamics, where pressure is modified by flow, are treated as well. These include flow into tubes and wedges driven by capillarity and the forced oscillation of liquid columns. Topics that are not covered in any depth include surfactants, non-ideal surfaces, dynamic contact angles, gradients in surface tension, and numerical methods of solution (although some results of numerical computations are presented).

The many photographs of static and dynamic menisci from ingenious experiments conducted in spacecraft, aircraft, and drop towers are effective at stimulating interest. Nonetheless, the solid geometry, advanced mathematics, and typically concise development make for challenging reading.

The book has an extensive table of contents and four-page subject index. The last chapter is a listing of experiments, including those not directly related to the subject matter of the book, that have been conducted in sounding rockets, Spacelab, and satellites. The graphics are generally clear and effective, although some photographs are so small that interpretation is difficult, and some plots are so busy that individual curves are difficult to identify and track.

The author has produced an in-depth review and synthesis of results on the mathematical modeling of the equilibrium and dynamic shapes of menisci of pure liquids that have been observed experimentally under conditions of weightlessness. Readers interested in applications of this modeling or in physicochemical hydrodynamics will find the material limited. *Capillary Surfaces: Shape, Stability, Dynamics, in Particular Under Weightlessness* will be valuable to those working or having applications in this specialized area and useful as a reference to those with broader interests in capillary phenomena. The book is not recommended to those lacking significant background in fluid physics and applied mathematics.

**1R37. Hydraulics of Stepped Chutes and Spillways.** - H Chanson (*Dept of Civil Eng, Univ of Queensland, Brisbane, Australia*). Balkema Publ, Rotterdam, Netherlands. 2002. 384 pp. ISBN 90-5809-352-2. \$105.00.

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

This book provides a comprehensive coverage of most of the engineering topics in the hydraulic design of stepped chutes and spillways. The stepped channels and chutes have been in use for more than 3500 years, but there is no publication on the hydraulic design of these structures. Since 1980s, there has been a renewed interest in these structures for water and wastewater treat-

ment plants and flood control facilities due to development of new construction techniques and materials. This book fulfills the need for presenting the state of the art in the stepped chute hydraulics. It helps students as well as practicing engineers and researchers get a *feel* for various aspects of the stepped chute hydraulics.

The book is organized in ten chapters and nine appendices. The chapters provide an orderly development of the subject. Chapter 1 gives a brief introduction of the subject and discusses the organization of the book. A stepped chute is defined as a channel with a series of drops in the channel bed. The flow in this channel is classified based upon the geometry of steps and flow rate. Three regimes of flow are defined, they are: nappe flow regime at low flow rates, transition flow regime at intermediate flow rate, and skimming flow regime at large flow rates. Chapter 2 provides a brief history on the development of the design and construction methods and materials for stepped chutes and spillways. The stepped cascades have been in use for aqueducts and fountains since historic times.

Chapter 3 deals with the hydraulics of nappe flow regime. The nappe flow is defined as a succession of free falling sheets of water with the jet impinging on the next lower step. On the lower step, either the flow is supercritical, or a full or partial hydraulic jump is formed. The energy is lost in impact and in hydraulic jump. Chapter 4 is concerned with transition flow regime that is defined as transition from nappe flow regime to skimming flow regime. This regime is associated with the severe hydrodynamic fluctuations and is, therefore, avoided in the design. Chapter 5 discusses the skimming flow regime, in which the flow skims over the steps with the external edges of the steps forming a virtual-channel bed. The energy is dissipated due to vortices that are formed in each corner.

As the dissolved oxygen concentration is a prime indicator of the quality of water, Chapter 6 discusses the aeration and de-aeration characteristics of cascading water. The cascades are very efficient means of aeration due to turbulent mixing and air entrainment.

In Chapter 7, new design methods and guidelines are presented for various applications of stepped chutes. The design procedures for stepped spillways, stepped channels at the toe of the chute, stepped fountains, and water staircases are discussed in detail with a number of examples.

Historic accidents and failures of hydraulic structures with stepped chutes and channels are discussed in Chapter 8. Recommendations are formulated for safe and efficient design. The author recommends avoiding transition flow regime as hydrodynamic fluctuations are inherent in this flow regime. Quality of construction methods and materials, and good maintenance practices are also emphasized.

Chapter 9 deals with the flow instabilities and unsteady wave phenomena that occur in the stepped channels and spillways. Basic theory is provided for the wave phenomena, and the documented experiences are reviewed.

Chapter 10 provides a summary and makes recommendations for future research on the air-water gas transfer process in nappe and skimming flow regimes, hydraulic characteristics of transition and skimming flow regimes, and hydrodynamic loads on the steps.

There are nine appendices. Appendix 1 gives a list of physical and chemical properties of fluid in SI units, while Appendix 2 provides a table for unit conversions. A method for computing nappe trajectory is given in Appendix 3, and Appendix 4 explains a procedure for computing bubble rise velocity. A method for modeling form drag and resistance to flow is given in Appendix 5, and void fraction distribution in chute flow is discussed in Appendix 6. A method of computing the flow in stepped chute for skimming flow regime is given in Appendix 7, and a procedure for modeling air-water gas transfer in skimming flow regime is presented in Appendix 8. Appendix 9 provides a procedure for reporting errors and omissions in the book.

A list of symbols, a comprehensive glossary of technical terms, and a list of references are also included in the book.

The hydraulics of stepped chutes differs from the classical hydraulics of smooth channels and is not usually taught in schools. The books on classical hydraulics do not cover this topic either. The purpose of the book has been to provide basic hydraulic theory related to designing stepped chutes and spillways. The book is based on a state-of-the-art-review of literature and research reports. The book is very well illustrated with a large number of charts and photographs. The photographs show hydraulic structures built over the years that incorporate stepped chutes for energy dissipation, flood control, and aesthetics (landscaping).

*Hydraulics of Stepped Chutes and Spillways* is a useful contribution to the field of hydraulics. The book may be used as a text for an undergraduate (elective) or a graduate course in the hydraulics of stepped chutes. The book will be useful for engineers working in the area of design and research.

**1R38. Mechanics of Turbulence of Multicomponent Gases.** Astrophysics and Space Science Library, Vol 269. - Edited by MYA Marov and AV Kolesnichenko (*MV Keldysh Inst of Appl Math, Russian Acad of Sci, Moscow, Russia*). Kluwer Acad Publ, Dordrecht, Netherlands. 2001. 375 pp. ISBN 1-4020-0103-7. \$134.00.

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

This book provides both a valuable historical perspective and a comprehensive review of the theoretical considerations, model and procedural refinements, and illustrative computational results developed in Russia for analysis of terrestrial upper atmospheric physics and that of the atmospheric mantles surrounding the outer Solar System planetary giants. These planetary atmospheres are described as subject to nearly continuous molecular compositional, thermodynamic state and thermophysical phase changes as the result of, at least, the driving influences of: multi-spatial scale, compressible turbulent mixing; molecular mass, momentum, and energy transport processes; solar radiation absorption and transfer; buoyancy driven convective heating, ionosphere level electromagnetically driven charged particle accelerations; planetary atmospheric rotation, coupled global scale and local scale wind shear; and chemical reactions. The book is a monograph emphasizing nearly 30 years of the authors' theoretical research and computational procedural development systematically combining these influences. Research was conducted by the authors, senior scientists and numerical procedure innovators, while at the MV Keldysh Institute of Applied Mathematics, Russian Academy of Sciences in Moscow.

The substantial reference list (over 350 sources) is usefully comprehensive particularly with respect to current published Russian work. Inadvertently, a few key non-Russian references outlining some important advances over the last 20 years in turbulence theory and simulation in the presence of reactive multicomponent species together with some information on high energy density experiments for astrophysical research applications are missing. Without implied criticism for the authors' admirable and remarkable efforts in preparing this otherwise comprehensive book, but in the spirit of providing completeness for the reader, this reviewer has added some representative references to this later work in this review, specifically identifying the references, when added, with the reader's attention drawn to a list of publications appearing at the end of this review. The cross index is useful, but somewhat sparse for the abundant topics and material developed. In particular, the reader may miss the inclusion of a combined topic and individual author cross-reference index with multiple entries.

The book is non-pedagogical in content, style, and organization. Consequently, it appears to have little use or appeal for student instruction. Its most probable appeal would be to specialists with interests in numerical modeling for analysis and evaluation of upper planetary atmospheric composition variation and dynamic structure. Another category of interested reader might be found in the non-specialist in atmospheric physics and fluid dynamics. This individual

might be more fascinated with points made about the relative magnitude of the influence of the variety of physical processes, taken independently or in combination, that are considered in studies of the dynamics, thermodynamics and component composition of planetary atmospheres, or in chemically reactive compressible turbulent flows, generally.

The book is divided into two parts. The first part, consisting of five chapters, contains well over half of the book's total content. It begins with an introduction and concise summary of the basic statistical fluid mechanics foundation of turbulence theory. The influence of turbulence is a central issue in its enhancement of molecular heat, mass and momentum transport processes in addition to its acceleration of molecular compositional changes through chemical reactions. The authors next move to discuss simplifications for modeling. This is in response to the need for practical emphasis on developing a simple closure model based on mean properties and localized in space; a model useful for evaluating the average influence of turbulence on the evolution of a concomitant physical process, rather than focusing on a deeper understanding of the nature of turbulence, a pursuit which while having academic appeal is fraught with potential disappointment.

First a single-point gradient transport level of modeling is adopted and the closure problem is systematically expanded and tested at the first order, algebraic level specifically limited for later comparison to a simple mixing length model. The next level of closure applied and tested involves what is called Reynolds stress closure. At this (2nd order) level, integral moment modeling is imposed. The undetermined correlations are linked (coupled) with transfer relations in the form of evolutionary (growth) differential equations, commonly identified as *prognostic equations*. These are numerically integrated in incremental steps over time to update the growth linkage variables to the next time interval. Emphasis is placed on the simultaneous upgrading of state and transport properties associated with the new time interval. Entropy balance and implicit Onsager reciprocity are imposed as constraints to insure both equilibrium and irreversible thermodynamic consistency. Essentially, the authors develop and systematically describe the coupling of turbulent and background flow motion to underlying kinetic theory transport processes together with species production and phase changes. The unresolved turbulent scales of motion are determined using mean averaged single point turbulent gradient transport level modeling. Chemical reaction kinetics, driving species production and annihilation, are combined with kinetic theory considerations on the influence of diffusive transport, thermal conduction, and momentum transport (viscosity). The state dependent transport properties are de-

veloped separately from a kinetic theory approach (both the Chapman-Enskog expansion procedure and evaluated Boltzmann equation collision integral procedure are reviewed for developing the appropriate property values and thermodynamic state dependence).

As an added note, the reader's attention is drawn to some substantial advances in more general turbulence closure theory and more detailed description of the turbulent small scale structure dynamics of direct interest in sub-grid scale modeling for recent progress in more detailed information using large eddy simulation (LES) procedures (Leslie [1]), modeling the influence of turbulence at an average mean property level. Many new developments have appeared with respect to both theoretical and numerical investigations of the influence of compressibility on turbulence, an important component of generalized turbulent reacting flows. See for example the experimental and theoretical developments for free shear layer mixing and bounded shear layer mixing in quasi stationary turbulent supersonic flows (Smits and Dussauge [2]). A good general review of compressibility influences on turbulence is also currently available for the reader (Lele [3]). Considerable development in numerical simulations of turbulent reacting compressible flows is linked to the Beta probability density functional distribution for the reactive components in LES sub-grid scale modeling procedures simulating the influence of unresolved small scale turbulent mixing and coupled species production (Pope [4,5]; Cook and Riley [6,7]). While the importance of ocean-atmospheric coupling in the *heat engine* is a basic and as yet incompletely understood process in near surface atmospheric fluid dynamics studies (weather and climate modeling), attention in this book has been focused, necessarily on upper atmosphere and outer planetary mantle gas dynamical processes. However, for completeness the reader should be aware of some primary experimental and numerical studies in the terrestrial surface boundary layer and near surface atmosphere. For example, see Deardorff and Willis [8,9] as well as the recent review by Wyngaard [10].

The second part of the book is devoted to several illustrative applications of the computational procedures and comparison (where available) with experimental observations. The authors first present results and comparison of modeling coupled diffusive and photo chemical reactive species distribution and production in the upper atmosphere. Equivalent turbulent transport and scalar transfer coefficients for turbulent thermal diffusivity and dissipation are examined in conjunction with other turbulent parameter profiles from 90 to 120 km altitude. Presented results in the next chapter include comparing upper atmospheric turbulence generation with apparent fluctua-

tions of the refractive index (observed as stellar light pulsations or *scintillation* and radio signal pulsations from distant space target sources. Planetary evolution processes for dust planetary disc coagulation undergoing turbulent heat and mass transfer are examined in the final chapter of the book.

Minor criticisms include finding a number of quite noticeable text typographical errors that slipped by in publication. For example, the fundamentally important Karman-Howarth equation of turbulent fluid dynamics which describes the growth, dissipation, and redistribution of turbulent kinetic energy over all spatial and temporal scales of motion appears as "Karman-Howart." The unfamiliar label "balance" equations replaces the commonly accepted label "conservation" equations, and descriptive nouns and verbs such as "turbulization" and "turbulize" for the state and development of turbulence and "inviscous" for "inviscid" remain uncorrected or undefined in the text. A few errors of dimensional inconsistency (obviously typographical) may be found in the equations, such as that expressing the influence of the Lorentz Force in the upper atmospheric electromagnetic field.

Again, for completeness, the reader should be aware of recent work using a different approach (vortical dynamics) which seems to provide quite plausible atmospheric dynamic predictions for the Jupiter upper atmosphere mantle (Dowling [11]). Stellar evolutionary processes with special attention to supernova events are receiving both numerical turbulent simulation and experimental attention currently. Here core radiation driven shock induced unstable mixing transition to turbulence and spatial development have also been addressed in experimental high energy density pulsed laser target interaction experiments, numerical simulation and theoretical scaling studies (Remington *et al* [12], Robey *et al* [13], Zhou [14]).

The authors have written what should be an influential and certainly interesting chronicle summarizing almost three decades of theoretical model and numerical procedure development for use in basic upper atmospheric planetary research as well as use in evaluation and analysis of experimental evidence gathered for terrestrial and solar system investigations. The authors provide a systematic review of the mathematical foundation for their developments and an explicit derivation path to model assembly. They provide a lucid description of the physics issues that must be considered in providing a generally useful numerical model procedure for planetary atmospheric analysis. A major outcome and contribution is the development and illustrative test of a computational model for fully compressible turbulent, multi-phase, multi-component, chemically reactive flow. *Mechanics of Turbulence of Multicomponent Gases* is a tribute to the authors' insight, innovativeness,

and diligence as well as that of their Institute colleagues. The book also frames a moving memorial dedication to first author's late wife who was also a principle scientific colleague and contributor, Senior Oceanographer, Natasha Marov. The book should prove to be a very desirable personal and library acquisition for atmospheric fluid dynamics and physics.

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**1R39. Origin of Turbulence in Near-Wall Flows.** - AV Boiko, GR Grek, AV Dovgal, VV Kozlov (*Inst of Theor and Appl Mech, Siberian Branch, Russian Acad of Sci, Novosibirsk, 630090, Russia*). Springer-Verlag, Berlin. 2002. 267 pp. ISBN 3-540-42181-5. \$89.95.

Reviewed by DR Dowling (Dept of Mech Eng, Univ of Michigan, 2019 W.E. Lay Automotive Lab, Ann Arbor MI 48109-2121).

In seven chapters, this focused monograph offers a wide-ranging review of theoretical, numerical, and experimental investigations of incompressible near-wall flows in the parametric region that lies between fully-laminar and fully-turbulent conditions. Although the text and figures fill only 217 pages, the topic coverage is excellent while the bibliography spanning 45 pages supplies the interested reader with abundant opportunity to locate additional material on the topics covered. The book is clearly intended for a sophisticated audience having considerable prior exposure to flow stability. The coverage of some topics—the mathematical ones in particular—might be impenetrable to those with only cursory prior knowledge of these subjects.

The first chapter is a highly condensed review of linear stability theory of parallel flows. It provides definitions of various

critical parameters and adequately covers the concepts of convective and absolute instability, and the differences in spatial and temporal development of instabilities. The classical field equations (Orr-Sommerfeld and Rayleigh) are derived, and the form of their solutions is discussed. This chapter also covers the lift-up effect, the flow-perturbation equivalent of Reynolds shear stress.

The second chapter is a survey of near-wall, nearly parallel stability results. A full presentation of Blasius boundary layer stability is provided including comparisons between experiments and theory. Non-parallel flow effects and experimental difficulties are discussed. Results from plane Poiseuille and 3D (swept wing) boundary layers are included, too.

The third chapter covers the receptivity of boundary layers to free-stream disturbances. Here, the requisite matching of both the spatial scale and the frequency of external disturbances to potential instability waves is discussed. Both localized spatial (eg surface roughness) and extended temporal (eg acoustic wave) excitations are considered as are both 2D and 3D boundary layers.

The fourth chapter presents the phenomenology of the later stages of boundary layer transition after the main instability waves have arisen. The K and N regimes of Tollmien-Schlichting (T-S) wave breakdown into lambda-vortices are discussed along with quantitative wave amplitude predictions from the Ginzburg-Landau equation and for secondary-flow Floquet-type instabilities. This chapter closes with a discussion of the characteristics of turbulent spots and instabilities in streamwise and cross-flow vortices.

The fifth chapter covers laminar to turbulent transition when the free-stream turbulence level is greater than 1%. Attention is focused primarily on the formation and characteristics of streamwise streaks that form in a Blasius boundary layer at high free-stream turbulence levels. The origin of these streaks is tied to free-stream vortical structures. The text discusses investigations of such streaks and structures when spawned by unsteady blowing and small airfoils located just upstream of the leading edge of a flat plate. The second half of the chapter discusses transition mechanisms including T-S wave growth and the interaction of streaks and turbulent spots.

The sixth chapter discusses transition to turbulence in separation bubbles and initially presents results for 2D disturbance waveforms, growth rates, and phase velocities. The discussion is extended to include axisymmetric separation bubbles where the additional curvature tends to make separated flows more stable, and also to stability and separation in 3D boundary layers where 2D and cross-flow instabilities may interact. The final sections of the chapter address excitation of separation bubbles, the effects of

increased forcing levels, the upstream influence of fluctuations occurring near-flow reattachment, the formation of coherent vortices, and the potential for instability and separation control.

The final chapter presents an overview of transition prediction and control. Naturally, the e-to-n method is covered first and is followed by individual discussions of potential active-surface (suction and blowing, heating and cooling, vibration) and passive-surface (body shaping, riblets) transition control techniques.

Overall, the monograph provides a thorough yet compact review of wall-bounded flow stability drawn from the extensive modern literature in both Russian and English language publications. Unfortunately, it is somewhat marred by poor original figures and terse figure captions. In addition, many important mathematical details are often not specified, and the text jumps back and forth between dimensionless and dimensional presentations of equations and results. The written English is understandable, and its deviations from standard usage are usually benign. However, on rare occasions, typographical errors confuse the intended discussion, such as in the material on adjoint operators and their use in receptivity calculations.

Because of its compact content, this reviewer recommends *Origin of Turbulence in Near-Wall Flows* for technical libraries. It should also be considered by specialists in shear flow and boundary layer stability.

**1R40. Spectral Methods for Incompressible Viscous Flow.** Applied Mathematical Sciences, Vol 148. - Edited by R Peyret (*Lab JA Dieudonne, Univ de Nice-Sophia Antipolis, Parc Valrose, Nice, 06000, France*). Springer-Verlag, New York. 2002. 432 pp. ISBN 0-387-95221-7. \$59.95.

Reviewed by G de Vahl Davis (*Sch of Mech and Manuf Eng, Univ of New S Wales, Sydney, 2052 NSW, Australia*).

The foundations of spectral methods are not new. They lie in the use of series expansions, typically a Fourier series, to attack problems in mathematical physics, and especially fluid mechanics, and have so done since the 19th century. However, computational limitations in the BC (before computer) era—and even in the early AC years—limited their application. It was not until the 1970s, as Peyret points out, that a revival of the Fourier method was applied to the direct simulation of turbulence. Historically, spectral methods have formed the cornerstone of numerical methods used to study the physics of turbulence. Their resurgence can be attributed to the continually increasing power of computers and to the development of the fast Fourier transform.

Three principal methods are available for the solution of a system of coupled nonlinear partial differential equations such as those which describe fluid motion: finite

difference (FD), finite element (FE), and spectral. FD and FE methods are based on a subdivision of the solution region into a number of small elements or control volumes, within which *local* representations of functions, usually by low-order polynomials, are made. Spectral methods, on the other hand, use *global* representations—now, typically, Fourier series and Chebyshev polynomials—which cover the entire computational domain.

FDM and FEM generally require fine grids and, therefore, a greater computational effort than spectral methods to achieve a given accuracy. To increase accuracy, both FDM and FEM use global or local grid refinement. Spectral methods (as well as some FEM) achieve increased accuracy by using higher order polynomials.

FDM and FEM lead to matrix equations which are sparse because of the local nature of the basis functions. Spectral methods lead to algebraic equations with full matrices.

FDM and FEM have little difficulty in handling conditions at the boundaries of the solution region. Spectral methods, in contrast, often suffer from stability problems which demand much smaller time steps to overcome, especially in two and three dimensions. They are most useful when the geometry of the solution region is fairly smooth and regular.

Spectral methods are usually more difficult to program, certainly in comparison with FDM. They are more costly, per degree of freedom, and they accommodate irregular geometries less happily. They thus enjoy some advantages, and suffer from some disadvantages, in comparison with FD and FE methods. Trefethen has stated that “difficulties with boundaries . . . are probably the primary reason why spectral methods have not replaced their lower-accuracy competition in most applications.”

In summary, spectral methods constitute a class of highly accurate numerical techniques generally only suitable for simple geometries. In this book, the author sets out “to provide a comprehensive discussion of Fourier and Chebyshev spectral methods for the computation of incompressible viscous flows, based on the Navier-Stokes equations.” He has succeeded admirably. The book encompasses the necessary mathematical background, provides a clear exposition of the associated computational techniques, and gives information on the implementation of these techniques.

This book, like Peyret's *Gaul*, is divided into three parts. The first part (four chapters and almost 150 pages) discusses basic spectral methods: fundamentals, the Fourier method, the Chebyshev method, and time-dependent equations. Part II (three chapters and about 140 pages) covers the Navier-Stokes equations (in both velocity-pressure and vorticity-streamfunction formulations) and spectral methods for their solution in each formulation. Details such as the

Boussinesq approximation and possible treatments of a semi-infinite domain are examined. Examples are given of the solution of Rayleigh-Bénard convection, axisymmetric flow in a rotating annulus and three-dimensional flow in a rotating annulus. Part III (90 pages) has chapters on stiff and singular problems, and on domain decomposition (or spectral element methods). Short appendices cover formulas on Chebyshev polynomials, an algorithm for the solution of a quasi-tridiagonal system, and theorems on the zeros of a polynomial.

There are about 300 references; Peyret is author or co-author of some 10% of these, unquestionably establishing his credentials on this subject.

*Spectral Methods for Incompressible Viscous Flow* is an advanced text. It will appeal to applied mathematicians and CFD-oriented engineers at the post-graduate level and to anyone teaching or undertaking research on problems described by the Navier-Stokes equations. This book is highly recommended.

**1N41. Advances in Fluid Mechanics IV.** Proc of 4th Intl Conf, Ghent, Belgium, May 2002. - Edited by M Rahman (*Dalhousie Univ, Canada*), R Verhoeven (*Univ of Ghent, Belgium*), CA Brebbia (*Wessex Inst of Tech, Southampton, UK*). WIT Press, Southampton, UK. Distributed in USA by Comput Mech Publ, Billerica MA. 2002. 760 pp. ISBN 1-853-12910-0. \$382.00.

This book contains the papers presented at the conference. The papers cover developments in fluid research from basic mathematical formulations of fluid mechanics to computer modeling of fluid dynamic applications. A wide range of topics is included; particular emphasis is placed on new applications and research currently in progress. Topics covered include experimental versus computational methods; numerical methods in fluid mechanics; BEMs for fluids; inverse fluid mechanics problems; fluid-structure interaction; heat and mass transfer; bio-fluid mechanics; geophysical fluid dynamics; environmental fluid mechanics; hydrodynamics; aerodynamics; river, lake, and estuary dynamics; coastal sea modeling; nonlinear ocean waves; air-sea coupling dynamics; wave propagation and scattering; non-Newtonian fluids; and constitutive relationships.

**1N42. Advances of CFD in Fluid Machinery Design.** - Edited by R Elder, M Yates, A Tourmidakis. Professional Eng Publ, Suffolk, UK. Distributed in USA by ASME, New York. 2002. 224 pp. ISBN 1-86058-353-9. \$150.00.

Over the past few years, there has been a rapid increase in the availability of Computational Fluid Dynamics (CFD) software. This accessible technology offers the capability of analyzing flows in complex industrial equipment such as compressors, turbines, fans, pumps, ductwork, pipework, and valves.

This volume is a source of material for users of CFD for the design of fluid machinery together with designers and researchers working in the field of industrial flows.

**1N43. Drag Reduction by Shock and Boundary Layer Control: Results of the Project EUROSHOCK II Supported by the European Union 1996-1999.** Notes on Numerical Fluid Mechanics and Multidisciplinary Design, Vol 80. - Edited by E Stanewsky (*DLR Inst of Aero and Flow Tech, Bunsenstr 10, Göttingen, D-37073, Germany*), J Delery (*Aerodyn Dept, ONERA Fundamental/Exp, 8, rue des Vertugadins, Meudon, F-92190, France*), J Fulker (*QinetiQ Ltd, Cen of Aerospace Tech, Bedford, MK41*

*6AE, UK*), P de Matteis (*CIRA Exp Aerodyn Labs, Via Maiorise, Capua (CE), I-81043, Italy*). Springer-Verlag, Berlin. 2002. 449 pp. ISBN 3-540-43317-1. \$249.00.

This volume contains a description of the EU-supported project EUROSHOCK II concerned with the investigation of active shock and boundary layer control to improve aircraft performance. Discussed are basic experiments, supplemented by Navier-Stokes computations, to improve and validate physical models relevant to control and the extension, validation, and application of various computational methods to airfoil and wing flows with control. Furthermore, described are experiments on airfoils and wings carried out to assess the aerodynamic benefits of control and to provide data for validation purposes. Finally, control applications to real aircraft and the corresponding installation penalties and mission benefits are addressed. This volume is a sequel to NNFM 56 on passive shock control.

**1N44. Laser Techniques for Fluid Mechanics.** Proc of 10th Int Symp, Lisbon, July 2000. - Edited by RJ Adrian (*Dept of Theor and Appl Mech, Univ of Illinois, Urbana IL 61801*), DFG Durao (*Dept of Mech Eng, Inst Superior Tecnico, Av Rovisco Pais, Lisboa Codex, 1049-001, Portugal*), M Maeda (*Dept of Mech Eng, Keio Univ, 1-14-1 Hiyoshi, Kohoku, Yokohama, 223-8522, Japan*), C Tropea (*Inst fur Stromungslehre und Aerodynamik, Tech Univ Darmstadt, Fb 16 Maschinenbau, Petersenstr 30, 64287, Germany*), JH Whitelaw (*Dept of Mech Eng, Imperial Col, Exhibition Road, London, SW7 2BX, UK*). Springer-Verlag, Berlin. 2002. 566 pp. ISBN 3-540-42837-2. \$159.00.

This volume includes revised and extended versions of 33 selected papers presented at the symposium. The papers are divided into the following five chapters: Velocity, Scalar, Multi-Phase, Turbulent Flows, and Combustion and Engines. The prime objective of the symposium was to provide a forum for the presentation of the most advanced research on laser techniques for flow measurements and to communicate significant results to fluid mechanics.

**1N45. Optical Methods and Data Processing in Heat and Fluid Flow.** - Edited by C Greated and J Cosgrove. Professional Eng Publ, Suffolk, UK. Distributed in USA by ASME, New York. 2002. 304 pp. ISBN 1-86058-281-8. \$188.00.

This book presents new developments in optical diagnostic techniques in heat and fluid flow and offers an opportunity for industrialists and academic researchers to exchange ideas.

The scope of this volume covers laser anemometry; liquid crystal thermography; particle image velocimetry; Doppler global velocimetry; holographic interferometry; tomography and related techniques; and light-induced fluorescence.

**1N46. Proceedings of the 10th International Conference on Nuclear Engineering-ICONE10, Print Version, Volume 3.** Held April 2002, Arlington VA. - ASME, New York. 2002. 1172 pp. ISBN 0-7918-3597-9. ASME Book No I00566. \$250.00. (ASME members \$125.00).

This printed conference proceedings contains 123 full-length, peer-reviewed technical papers on thermal hydraulics that were presented at the conference.

**1N47. TRANSAERO - A European Initiative on Transient Aerodynamics for Railway System Optimization.** Notes on Numerical Fluid Mechanics and Multidisciplinary Design, Vol 79. - Edited by B Schulte-Werning (*Deutsch Bahn AG, DB Systemtechnik, Volckerstr 5, Munchen, D-80939, Germany*), R Gregoire (*Direction de la Recherche et de la Technologie, Soc Nat de Chemin de Fer Francais, 45 rue de Londres, Paris Cedex 08, F-75379, France*), A Malfatti (*FS-Trenitalia Spa, Unita Tecnologie Materiale*

*Rotabile, Viale S Lavagnini, 58, Florence, I-50129, Italy*), G Matschke (*Deutsch Bahn AG, DB Systemtechnik, Volckerstr 5, Munchen, D-80939, Germany*). Springer-Verlag, Berlin. 2002. 377 pp. ISBN 3-540-43316-3. \$249.99.

This volume contains the results obtained in the BRITE/EURAM project TRANSAERO. The project bundles the expertise of three railway companies and eight universities and research institutions in Europe to improve the physical understanding of the time-dependent effects of side-wind forces, train passing, and pressure waves in tunnels. The goal was to find efficient and economically satisfying solutions to these problems by simultaneously regarding high-speed rolling stock, infrastructure, and operating conditions.

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

## VI. HEAT TRANSFER

**1R48. Radiation Heat Transfer: A Statistical Approach.** - JR Mahan (*Dept of Mech Eng, VPI, Blacksburg VA*). Wiley, New York. 2002. 482 pp. CD-Rom included. ISBN 0-471-21270-9. \$120.00.

Reviewed by JD Felske (*Dept of Mech and Aero Eng, SUNY, 330 Jarvis Hall, Buffalo NY 14260-4400*).

The topics covered in this graduate text are mostly the same as in other texts on thermal radiation heat transfer. What differs are the emphases given to the various subjects and the style of the written presentation.

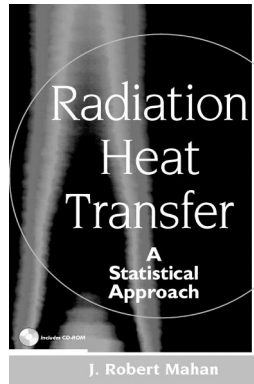
The text is divided into three approximately equal-size parts: Part I, *Fundamentals of Thermal Radiation*; Part II, *Traditional Methods of Radiation Heat Transfer Analysis*; and Part III, *The Monte Carlo Ray-Trace Method*. There are also four Appendices: A) Atomic dipole radiation; B) Use of the (CD-ROM) Mie scattering code; C) Use of the (CD-ROM) FELIX ray-trace program; and D) Random number generation and autoregression.

Part I treats the physics and thermodynamics of electromagnetic radiation plus the definitions used in thermal transport analysis. Two features distinguish the presentation in this text: the detailed discussion devoted to electromagnetic dipole radiation and the consideration of radiation pressure in the context of the seminal thermodynamic "thought experiments" of Bartoli and Boltzmann. On the other hand, it was surprising that the topic of optically thin films was not included, particularly since there is an entire chapter devoted to *wave phenomena*.

Particularly in Part I, but also throughout the entire text, two other distinctive aspects of this text are seen. One is the style of the prose with which it is written. The narrative is generally a bit *softer* than the usual stark presentation found in most advanced scientific monographs. Using this style, concepts

are discussed in ways that engage the reader.

As a consequence, descriptions turn out to be lengthier, but also *friendlier*, and probably clearer to the student first encountering these topics. The other distinguishing feature is the end of chapter applications suggested for enhancing understanding. These are always divided into three categories: Team Projects, Discussion Points, and Problems. The applications usually involve analysis of radiative transport phenomena in actual engineering/scientific devices and systems. Students should find them interesting.



In Part II, enclosure theory is discussed in the traditional way. However, only the radiosity formulation is given. The practically useful *heat flux-temperature* form is not, nor is the *absorption factor* formulation, which is particularly useful in thermal design. The discussion of configuration factors also omits some useful approaches: the crossed-string method, the unit-sphere method, and the cylinder/sphere *source* rules.

This abbreviated Part II presentation is consistent with the author's enthusiasm for the Monte Carlo Ray-Trace (MCRT) approach, which is the subject of Part III, two appendices and part of the CD). Unlike other introductory radiation textbooks which give, at most, a cursory presentation of MCRT, this text gives considerably more detail. A number of problems are formulated in detail in order to illustrate the concepts upon which this approach is based.

Overall, this reviewer found *Radiation Heat Transfer: A Statistical Approach* to be an interesting presentation of this topic—one which students will probably enjoy. As the author says in the Preface: it "is a book written for students rather than for professors."

**1N49. Shape Memory Alloys: Advances in Modelling and Applications.** - Edited by F Auricchio, L Faravelli, G Magonette, V Torra. CIMNE, Barcelona. 2001. 432 pp. ISBN 84-89925-82-8.

Presenting a behavior which fascinates common people as well as scientists and engineers, this publication drives the reader from the concepts to their explanations, based on the experience of some internationally recognized research teams.

This collection of six monographs presents the involved expertise as a readable text. Contents include: Thermomechanical aspects in meso and micro scale, *V Torra*; Moving from micro-scale to macro-scale, *L Faravelli*; Considerations on the constitutive modeling of shape-memory alloys, *F Auricchio*; Experiments on SMA rods under dynamic loading and numerical simulation, *L Faravelli*; Shape memory alloys RF in civil engineering with particular regard to old structures, *G Magonette*; and Shape memory actuators for automotive applications, *F Butera*.

**1N50. Thermal Management of Microelectronic Equipment: Heat Transfer Theory, Analysis Methods, and Design Practices.** ASME Press Series on Electronic Packaging. - Lian-Tuu Yeh and RC Chu. ASME, New York. 2002. 440 pp. ISBN 0-7918-0168-3. ASME Book No 801683. \$95.00. (ASME members \$76.00).

With an increased demand on system reliability and performance combined with the miniaturization of devices, thermal consideration has become a crucial factor in the design of electronic packaging, from chip to system levels. This new book emphasizes the solving of practical design problems in a wide range of subjects related to various heat transfer technologies. While focusing on understanding the physics involved in the subject area, the authors have provided substantial practical design data and empirical correlations used in the analysis and design of equipment. This reference volume provides the fundamentals along with a step-by-step analysis approach to engineering. The authors present a comprehensive convective heat transfer catalog that includes correlations of heat transfer for various physical configurations and thermal boundary conditions. They also provide property tables of solids and fluids.

## VII. ENERGY & ENVIRONMENT

**1N51. Environmental Geomechanics.** CISM International Center for Mechanical Sciences, Vol 417. - Edited by BA Schrefler (*Dept of Struct and Transportation Eng, Univ of Padua, Via Marzolo 9, Padova, 35131, Italy*). Springer-Verlag, New York. 2001. 356 pp. ISBN 3-211-83680-2. \$79.95.

Environmental Geomechanics covers a broad class of problems where deforming geomaterials are involved, usually coupled with fluid flow and transport of some substance. Transport of contaminants and other substances may occur in the fluids, eg water, water vapor and air, filling the pores of geomaterials as happens in waste disposal problems or durability problems. Mass transport also takes place in reservoir engineering problems, where the fluids involved are oil, water, and gas. All these aspects are addressed in this book together with a theoretical framework. Contents include Theoretical and numerical methods in environmental continuum mechanics based on the theory of porous media (W Ehlers and P Ellsiepen); Isothermal flow (HR Thomas and SW Rees); Non-isothermal flow (HR Thomas, MR Sansom, and SW Rees); Computational plasticity (R de Borst and OM Heeres); Numerical analysis for radioactive waste disposal (A Gens and S Olivella); Modeling of subsidence due to water or hydrocarbon withdrawal from the subsoil (BA Schrefler); and Environmental chemomechanics of concrete (FJ Ulm and O Coussy).

**Numerical Models in Groundwater Pollution.** - K Kovaric (*Fac of Civil Eng, Univ of Zilina, Komenského 52, Zilina, 01026, Slovakia*). Springer-Verlag, Berlin. 2000. 221 pp. CD-ROM included. ISBN 3-540-66792-X. \$79.95.

## VIII. BIOENGINEERING

**IN52. Biomaterials.** - Edited by SV Bhat (*Dept of Chem, Indian Inst of Tech, Bombay, India*). Kluwer Acad Publ, Dordrecht, Netherlands. 2002. 250 pp. ISBN 0-7923-7058-9. \$87.00.

As biomaterials are used in medical devices, meeting needs in such diverse surgical disciplines as ophthalmology, cardiology, neuromuscular surgery, orthopaedics, dentistry, etc, they must have intimate contact with patient's tissue or body fluids, providing a real physical interface which seriously restricts developments.

This book is written for those who would like to advance their knowledge of biomaterials. The

subject matter of the book is divided into 12 chapters dealing with the structure and relationship of biological and man-made biomaterials. The application of these materials for various medical devices, and recent developments in tissue engineering, are also discussed.

## IX. GENERAL & MISCELLANEOUS

**IN53. Mechanics for a New Millennium.** Proc of Int Congress, ICTAM 2000, August 2000, Chicago. - Edited by H Aref (*Dept of Theor and Appl Mech, Univ of Illinois at*

*Urbana-Champaign*) and JW Phillips (*Dept of Theor and Appl Mech, Univ of Illinois, Urbana IL*). Kluwer Acad Publ, Norwell MA. 2001. 664 pp. ISBN 0-7923-7156-9. \$196.00.

Full text of invited lectures is included in this work along with a full-program listing and the names of all delegates. Also included are major portions of the speeches given at the opening and closing ceremonies and the full text of the play performed during the opening. Comprehensive statistics on papers submitted, accepted, and presented by nation are given. The book captures a snapshot view of the state-of-the-art in the field of mechanics.

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