BOOK REVIEWS

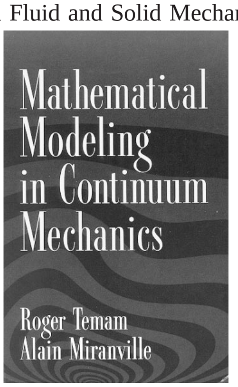
Items with a reviewer byline (coded R) are by AMR's corps of dedicated outside volunteer reviewers. AMR will attempt to get critical reviews of all relevant textbooks, reference works, and monographs. Items without a reviewer byline (coded N) are prepared by AMR in-house staff and are largely based on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

I. FOUNDATIONS & BASIC METHODS

7R1. Mathematical Modeling in Continuum Mechanics. - R Temam *(Univ Paris-Sud, Orsay, France)* and A Miranville *(Univ de Poitiers, France).* Cambridge UP, Cambridge, UK. 2001. 288 pp. ISBN 0-521-64362-7, $54.95.

Reviewed by P Gremaud (Dept of Math, N Carolina State Univ, Rayleigh NC 27695-8205).

This textbook is intended as an introduction to Continuum Mechanics at the advanced undergraduate and beginning graduate level. The authors aimed at breaching the gap that too often exists between engineering and example-oriented textbooks on the one hand, and needlessly abstract mathematical formulations on the other. A wide variety of subjects are briefly discussed from both Fluid and Solid Mechanics.



The book is well written and, for obvious reasons, is strongly influenced by the French school of Applied Mechanics. The point of view taken here, rigorous presentation without excessive formalism, is however nonstandard. The approach is somewhat reminiscent of the classic *A Mathematical Introduction to Fluid Mechanics*, by Alexandre Chorin and Jerrold Marsden (Springer Verlag, 1979), although Temam's and Miranville's book is much broader in scope.

The book is divided into four parts: Part One - *Fundamental Concepts in Continuum Mechanics* (1. Describing the Motion of a System: Geometry and Kinematics, 2. The Fundamental Law of Dynamics, 3. The Cauchy Stress Tensor - Applications, 4. Real and Virtual Powers, 5. Deformation Tensor, Deformation Rate Tensor, Constitutive Laws, 6. Energy Equations and Shock Equations); Part Two - *Physics of Fluids* (7. General Properties of Newtonian Fluids, 8. Flows of Inviscid Fluids, 9. Viscous Fluids and Thermohydraulics, 10. Magnetohydrodynamics and Inertial Confinement of Plasmas, 11. Combustion, 12. Equations of the Atmosphere and of the Ocean); Part Three - *Solid Mechanics*. (13. The General Equations of Linear Elasticity, 14. Classical Problems of Elastostatics, 15. Energy Theorems - Duality: Variational Formulations, 16. Introduction to Nonlinear Constitutive Laws and to Homogenization); and Part Four - *Introduction to Wave Phenomena* (17. Linear Wave Equations in Mechanics, 18. The Soliton Equation: The Korteweg-de Vries Equation, 19. The Nonlinear Schrödinger Equation).

It is unusual to include this many topics in an introductory textbook of less than 300 pages. The aim of the authors is to give as comprehensive a presentation of the field of Continuum Mechanics as possible. In that sense, they largely succeed. The book is lively and pleasant to read, and the pace is brisk. The price to pay for the breadth of the book lies in the amount of information that can be provided for each subject. As a typical example, let us for instance consider Chapter 12, Equations of the Atmosphere and of the Ocean, a topic to which one of the authors has made significant contributions. First, the equations are briefly derived using principles introduced in the first two parts of the book. The constitutive relations are given, although not fully discussed. Eventually, a complete system of equations is derived. A couple of useful mathematical facts, such as the description of differential operators on the sphere in this chapter, are also discussed.

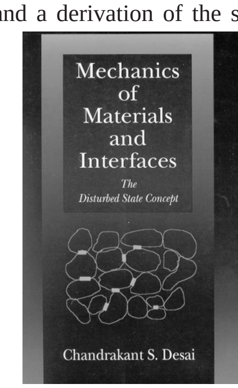
The approach provides the potential instructor with a rich selection of material. After having covered the Fundamentals, essentially Part One, he/she should probably focus on a couple of selected topics from the rest of the book. As illustrated by the previous example, each chapter is relatively complete with respect to the derivation of the equations. However, one might have wished for some comments past the pure modeling stage. The above Chapter 12 for instance ends with the resulting system of equations without discussing what can be learned from such a system. Additional references could have been useful, especially with respect to the use of such models.

In conclusion, the authors have succeeded in providing a useful and elegant introductory textbook to Continuum Mechanics. The strengths of *Mathematical Modeling in Continuum Mechanics* lay in its mathematical rigor without excessive formalism and the broad overview it provides. On the down side, more references could have been given to ease access to complementary material such as pointers to the important numerical and computational aspects of most of the problems discussed.

7R2. Mechanics of Materials and Interfaces: The Disturbed State Concept. - CS Desai *(Dept of Civil Eng and Eng Mech, Univ of Arizona, Tucson AZ).* CRC Press LLC, Boca Raton FL. 2001. 698 pp. ISBN 0-8493-0248-X. $99.95.

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

The book contains 14 chapters and two appendices. Chapter 1 discusses introductory topics such as local and global states, engineering materials, and the disturbed state concept. Chapter 2 discusses preliminaries pertaining to the disturbed state concept. Chapter 3 introduces the reader to relative intact, fully adjusted states, and disturbance that results in damage or degradation. Chapter 4 provides formulations to the disturbed state concept including discussions to the classical continuous damage model and a derivation of the strain equations.



The theory of elasticity in the disturbed state concept is the subject of Chapter 5, while Chapter 6 does the same for the theory of plasticity. In the latter chapter, topics such as the Mohr-Coulomb yield criterion and continuous yielding or hardening models are covered. Chapter 7 provides coverage for single-surface plasticity models including topics such as repetitive loading, elastoplastic equations, thermoplasticity, and drift correction procedures.

Creep behavior as it applies to viscoelastic and viscoplastic models is the subject of Chapter 8, while the disturbed state concept for saturated and unsaturated materials is the theme of Chapter 9. A similar discussion of the disturbed state concept for structured and stiffened materials is carried out in Chapter 10 and for interfaces and joints in Chapter 11. Chapter 12 covers localization and instability at the microstructure level including discussion of topics such as microcrack interaction models, rate dependent models, the continuum damage model, and strain and energy-based models. Implementation of the disturbed state concept in computer procedures is the topic of Chapter 13. The book ends with a short conclusion Chapter 14. This chapter is followed by two appendices dealing with the critical state and self organized criticality concepts (Appendix I) and optimization and sensitivity analyses pertaining to the disturbed state concept (Appendix II).

Throughout the book, several numerical examples are provided in key places in the different chapters to illustrate how a specific concept is to be applied. Numerous references are also provided at the end of each chapter.

All in all, *Mechanics of Materials and Interfaces: The Disturbed State Concept* is very well written despite the difficulty of the subject matter at hand. The author is obviously very knowledgeable about the subject, and he very cleverly conveys his knowledge to the reader in a clear and methodical way. The book certainly serves as a valuable reference in the area of mechanics of materials and may even serve as a textbook for advanced graduate work if problems are added at the end of the different chapters. The objectives stated by the author in the ''Preface'' are served well by the coverage of the different topics. The book does not have any weaknesses that this reviewer can detect.

7R3. Méthode des Éléments Finis en Mécanique des Structures. Finite Element Methods in the Mechanics of Structures. (French). - T Gmur. Presses Polytech et Univ Romandes, Lausanne. 2000. 252 pp. ISBN 2-88074-461-X.

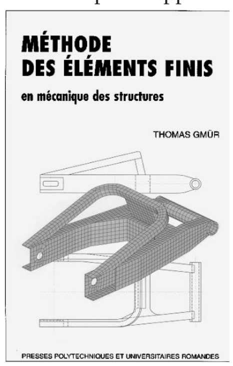
Reviewed by VD Radulescu (Dept of Math, Univ of Craiova, 13, St AI Cuza, Craiova, 1100, Romania).

This textbook deals with the study of some elementary basic problems raised by Applied Mechanics. The book is intended for a large audience: students in Applied Sciences, researchers, engineers, etc.

Let Ω be a smooth bounded domain in $\mathbf{R}^N$. The problems studied in the present work are of the following (weak) form: find a vector field $\mathbf{u}$ such that

$$\int_\Omega \mathbf{v}^T[D(\mathbf{u}\text{-}\mathbf{f})]d\Omega = 0 \ \forall \mathbf{v},$$

where D is a certain linear differential operator and $\mathbf{f}$ is a given vector field. Throughout the work, the study is limited to the case of linear elliptic partial differential equations of second order. In many cases, the exact solution of this problem (if it exists!) cannot be found explicitly. That is why several methods have been developed in Numerical Analysis in order to approximate the solutions of wide classes of differential equations. The Finite Element Method was introduced in the 50s, and it can be viewed as an extension of the classical Galerkin Method. The Finite Element Method consists in the decomposition of Ω into a finite number of subdomains, called *finite elements*. The solution of the initial problem is then found as an assemblage of functions with compact support.



After a short introduction, the author introduces in Chapter 2 the strong and the weak mathematical formulation in the one-dimensional case. This elementary framework enables the author to explain carefully how numerical methods can be applied for approximating the solution. The Finite Element Method is based in this simple case by an integral approach.

In the next chapter, the weak formulation of the approached problem is developed, and one-dimensional linear finite problems of second degree are considered.

Chapter 4 is devoted to the presentation of the weak formulation to linear bidimensional problems of the second degree. The study is developed on the model of the heat-transfer equation. In this case, the approach is based on planar finite elements. The author develops the mathematical treatment of the problem, which includes convergence and numerical integration. A general situation is treated in Chapter 5, which includes applications in Linear Elasticity for two or three dimensions.

The last chapter is devoted to some applications of the Finite Element Method. Here, the numerical solutions are confronted to experimental results. In this chapter, but also throughout the book, the exposition simplifies many results that have so far only been accessible in several journal articles.

In short, there is an enormous wealth of content provided by the author, much of it cannot be found in any single source. Certainly, many techniques related to the Finite Element Method are discussed, so the title is unquestionably appropriate. The book and its extensive bibliography (100 titles strictly related to the subject) should serve as a tremendous reference for all researchers in the field and certainly belongs on the bookshelf next to other references on the Finite Element Method.

One of the reasons why the author is able to cover such vast material in the book is that he tends to develop the main ideas exactly to the right degree of generality that he needs. Moreover, the treatment is always done by progressing from the special to the general case, essentially avoiding pedantic verifications. Sometimes the proof is even given through the right picture. In this case, the author has really saved the reader from a lot of unnecessary heavy notation. Moreover, the notation is not only simple, but also everywhere consistent.

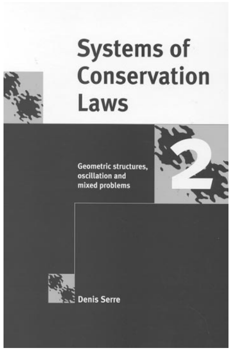
One basic question this reviewer would like to answer is whether this book is meant for students. My feeling is that, first of all, it is very nice for students to see so many concrete examples and pictures. The reader here is well motivated by simple, but illuminating examples before being faced with general notions. This is due quite systematically in the book, where examples and pictures always precede the proofs and allow those to be easily stated and easily understood.

This reviewer concludes that *Méthode des Éléments Finis en Mécanique des Structures* is an attractive book, full of concrete information, which gives a clear and lucid view of the current knowledge on the resolution of differential equations with the Finite Element Method.

7R4. Systems of Conservation Laws 2: Geometric Structures, Oscillations and Mixed Problems. - D Serre *(Ecole Normale Superieure, Lyon, France).* Cambridge UP, Cambridge, UK. 2000. 269 pp. ISBN 0-521-63330-3. $74.95.

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

Conservation laws arise in many areas of continuum physics or mechanics and are described by certain types of nonlinear partial differential equations. Solving these PDEs for non-dissipative systems with appropriate initial and boundary values is known as the Cauchy problem or the mixed problem. This two-volume set of books is concerned with the modern mathematical treatment of the mixed problem. According to the author, the coverage of the book is comparable to that of Majda, *Compressible Fluid Flow and Systems of Conservation Laws in Several Space Variables* (Springer, Berlin, 1984), but the subject matters are dealt with ''with more detail, but less animation.'' Though important, the phenomenon of relaxation and kinetic formulation are not included.



Volume 1 dealt with the fundamentals, including such topics as hyperbolicity, Lax shock, the Glimm scheme, and viscosity solution. The second volume, consisting of Chapters 8 through 15, is concerned with questions such as: the convergence of the viscosity method, stability for the Cauchy problem, admissible boundary conditions, and the multi-dimensional mixed problem. But the author cautions that "the materials in the second volume represent a significant part of the active research in the last fifteen years in the field, and are intended more for research workers and less for students." Whether dealing with fundamentals or the state-of-the art research, this book is definitely written for post-graduate students and active researchers in mathematics. All the basic ideas are discussed fully, but for nonspecialists guiding from well-versed instructors may be helpful to wade through the materials. The readers are expected to have a good mathematical background in contemporary functional analysis. Keywords such as hyperbolic systems, shock waves, viscosity, and initial and boundary value problems are familiar to physical scientists and engineers, but the questions treated in the book are primarily mathematical: existence, uniqueness, convergence, stability, and consistency, etc.

The book, however, has something illuminating to offer even to those who may not have the appetite or requisite mathematics to follow theorems and lemmas in depth. It shows what it means to think with the equations from the mathematical point of view. Half-baked knowledge is always dangerous, but this reviewer, who is not a mathematician, was still able to gain new appreciation of and fresh insight into the kinds of questions he does not normally worry about. Good examples are the treatment of stability types and admissible boundary conditions on a finite domain in mathematical terms. His formal training ends at the level of classic books by such people as Courant and Friedrichs, Whitham, and Courant and Hilbert, but he could not help wonder at the mathematical transformation of the questions one used to think intuitively about on a physical basis. At the same time, as marked by Courant (*Methods of Mathematical Physics, Volume 1*), one fears an increasing gap between contemporary mathematics and the interest of many scientists and engineers.

Systems of Conservation Laws 2 is primarily for researchers in mathematics who are interested in the current state of knowledge and students in advanced graduate courses in PDEs. The book is also recommended to non-mathematicians as a means of getting a broad brush view of the conservation equations, nonlinear wave propagation, and shock waves from the mathematical point of view. The book is definitely recommended for university libraries.

7N5. Mathematics of Finite Elements and Applications X. - Edited by JR Whiteman. Elsevier Sci BV, Amsterdam, Netherlands. 2000. 450 pp. ISBN 0-08-0435688. $89.00.

This book includes 26 pages from the conference held at Brunel University in June 1999. It highlights certain aspects of the state-of-the-art theory and applications of finite element methods of that time.

Finite elements have always been interpreted in a broad and inclusive manner, including techniques such as finite difference, finite volume and boundary element methods as well as actual finite element methods. The increasing importance of modeling, in addition to numerical discretization, error estimation, and adaptivity was also studied.

7N6. Matrix Diagonal Stability in Systems and Computation. - A Bhaya and E Kaszkurewicz *(Fed Univ, Rio de Janeiro, Brazil).* Birkhauser Boston, Cambridge MA. 2000. 282 pp. ISBN 0-8176-4088-6. $69.95.

This book addresses the matrix-stability concept and its applications to the analysis and design of several types of dynamical systems, both discrete-time and continuous-time.

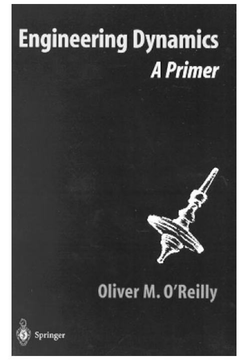
The comprehensive presentation begins with an introductory chapter surveying applied examples from diverse fields, such as robust stability analysis, asynchronous iterative computation, neural networks, and variable structure dynamical systems. The next few chapters develop the theory and include a unified presentation of results in the area of matrix-diagonal stability and D-stability. The remaining chapters examine the various applications in greater detail. Both classical and new results are discussed, and the overall treatment is self-contained, only requiring linear algebra, difference equations, and differential equations. Diverse applications are presented with minimum of technical prerequisites. A guide to current literature and discussion of open problems are also included.

II. DYNAMICS & VIBRATION

7R7. Engineering Dynamics: A Primer. - OM O'Reilly *(Dept of Mech Eng, UCB, 6137 Etcheverry Hall, Berkeley CA 94720-1740).* Springer-Verlag, New York. 2001. 203 pp. Softcover. ISBN 0-387-95145-8. $29.95.

Reviewed by M Pascal (Lab de Modelisation en Mec, Univ Pierre et Marie Curie, Tour 66, 4 Place Jussieu, Paris, 75252 Cedex 05, France).

This book is a standard elementary book aimed at providing an initial background on dynamics of particles and rigid bodies. It is intended for undergraduate students taking an engineering dynamics course. The book is a rather small one (203 pages), divided into ten chapters, followed by two Appendices and a reference list. Each chapter is followed by a summary and several exercises. The book also includes several figures. The topics originate from a course taught by the author at the University of California at Berkeley.



The main part of the book (Chs 1–6) is concerned with the dynamics of one single particle, including kinematics, dynamics, friction forces, spring forces, work and energy, conservative forces, linear and angular momenta. Chapter 7 is devoted to systems of particles, while in Chapters 8 and 9, elementary motions of rigid body (pure translational motion, rotational motion around a fixed axis) are presented. At last, in Chapter 10, the dynamics of material systems composed of a set of particles and rigid bodies is briefly investigated.

The author presents the fundamental laws of the mechanics (balance of the linear momentum, law of action and reaction) without reference to the concept of absolute reference frame (Galilean frame). When the definition of velocity and acceleration is introduced, it is not underlined that all these concepts are relative to the choice of a reference frame: nothing is mentioned about relative and absolute velocities, relative, Coriolis and absolute accelerations. The author provides a systematic approach in four steps to solve dynamical problems. Unfortunately in this method, one of the most important steps involving the determination of the number of degrees of freedom and the choice of the parameters is missing. Another unusual presentation is that for each example, the motion equations are not solved, even for the elementary problem of the motion of a particle under the influence of gravity: the motion equations are solved in this case, but the kind of trajectory (indeed a parabola) is not given.

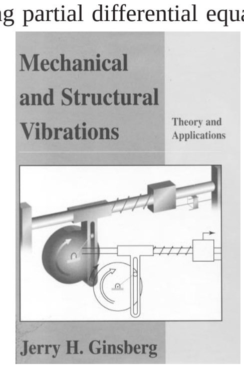
On the other hand, the book includes several interesting topics, such as Serret-Frenet triad and related formulas, Coulomb friction forces, and collision of particles with several definitions of the restitution coefficient. The kinematics of rolling and sliding of a rigid body in contact with another body is also explained. Interesting illustrative examples like four bar linkage or unbalanced rotor are presented. A set of footnotes provides a short biography of well-known scientists like Euler, Newton, Coulomb, Hook, and so on. As a remark, the author regrets that the works of the Russian scientist Chaplygin have not been translated into English. Obviously, the author did not know that many studies from the work of Chaplygin in the field of non-holonomic systems have been performed and are now available in English!

In conclusion, *Engineering Dynamics* can provide a first insight about dynamics of particles and rigid bodies to undergraduate students. However, among the numerous textbooks related to the same topics, this reviewer is not convinced that it is the best one. Perhaps, this book can be used as a complement to other more extended texts mainly for the great amount of exercises and also for specific topics like friction problems or rolling and sliding of rigid bodies.

7R8. Mechanical and Structural Vibration: Theory and Applications. - JH Ginsberg *(Georgia Inst of Tech, Atlanta GA 30332).* Wiley, New York. 2001. 692 pp. ISBN 0-471-12808-2.

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

Congratulations to the author for writing this textbook for undergraduate and graduate students. This book may serve as an excellent basis for courses on linear vibration of one-dof systems, discrete systems, and one-dimensional continua. Especially, the introduction to vibrations of beams and continua is different from the approach normally found in textbooks. Therefore, undergraduate students may get an idea of vibrations of beams without having the necessity of solving partial differential equations.



The first chapter gives an introduction into the derivation of the equations of motion for discrete systems. The equations for planar systems are derived by Newton-Euler's equations. As a second possibility, the Power Balance Method is presented for time-invariant systems. In addition, Lagrange's Equations are shown in the appendix. The second chapter deals with harmonic functions, free vibration, and with forced vibration to basic excitations like step function or impulse. Chapter 3 treats steady-state response to harmonic excitation. In this chapter, expressions like complex notation, resonance, frequency response, quality factor, structural damping, force transmission, and complex Fourier series for periodic excitations are explained. This leads to the discrete Fourier transform (DFT), the inverse discrete Fourier transform (IDFT), and to the Fast Fourier Transform (FFT). For the solution of transient excitations, the convolution integral and FFT are used. Difficulties arising with FFT like sampling, aliasing, as well as windowing are addressed. The fourth chapter introduces modal analysis and leads to expressions like eigenfrequencies, modes, orthogonality and normalization, modal transformations and modal damping. Both zero eigenvalues and rigid body modes as well as multiple eigenvalues are discussed. Chapter 5 is a short introduction to harmonic excitation of multi-degree-of-freedom systems with an application in vibration absorbers. The next chapter deals with vibrations of bars based on discretization methods so that they can be solved by the methods developed in the previous sections. The Rayleigh ratio is introduced which serves as a basis for several approximation methods. Something normally not found in standard textbooks is a method which allows one to solve problems with time dependent boundary conditions. Chapter 7 is dedicated to the field description for vibrating bars leading to eigenvalue problems with a characteristic equation involving transcendental functions. Also the wave character of the motion is derived. Orthogonality of the modes yields modal analysis and thus steady and transient responses of such systems. The difference between Bernoulli-Euler and Timoshenko beam theory is shown. The following chapter introduces the finite element method. Chapters 9 and 10 show substructuring and the state space formulation. Chapter 11 presents the modal analysis for gyroscopic and circulatory systems in which the matrices are unsymmetric. Therefore, right and left eigenvectors are used for decomposition and questions of dynamic stability are discussed. The last chapter gives an introduction to rotor dynamics covering topics like internal and external damping as well as orthotropic bearings, orthotropic shafts, and gyroscopic effects.

Being aware of many other textbooks dealing with vibration, it was a pleasure to read *Mechanical and Structural Vibration*, and this reviewer highly recommends the book for instructors and students. The large number of examples and exercises which are given within the text or at the end of each chapter allow the student to check if the theory is understood well. The way modern software like MATLAB and MATHCAD are frequently used to solve the examples makes the book valuable for lecturers and students and is an advantage compared to standard textbooks. Though this reviewer knew all the methods presented in this book, he profited from the didactically excellent way the methods are presented. As it is a book for use in classes, it is not a drawback that topics like nonlinear vibration or vibration of plates and other complicated structures are not treated in this monograph, because otherwise the volume of material covered in the book would be too large and the reader would be lost. On the contrary, someone who wants to find a special topic covered by the book will find it very quickly. In this reviewer's opinion, only the first chapter could be enhanced in which the equations of motion are derived. For example having Lagrange's equations in this chapter instead of showing them in an appendix would be better. In addition, the title of Chapter 11 is misleading as not only gyroscopic systems are covered, but also circulatory systems and moving continuous systems. A guideline for a first-level semester course and a senior-level semester course is given on the front inside cover.

7R9. Nonlinear Interactions: Analytical, Computational, and Experimental Methods. - AH Nayfeh *(VPI, Blacksburg VA).* Wiley, New York. 2000. 782 pp. ISBN 0-471-17591-9. $110.00.

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

Professor Ali Nayfeh is a well-known authority in the area of nonlinear dynamics and has an impressive record of research monographs and hundreds of published papers. This book comes as a result of the growing research interest in the nonlinear modal interaction in dynamical systems under various types of excitations and resonance conditions. The book presents the-state-of-the-art in eight chapters supported by an extensive bibliography. Chapter 1 serves as an essential foundation and presents basic ingredients of analyzing nonlinear-coupled differential equations.

The analysis of coupled systems with two-to-one internal resonance (essentially dictated by quadratic nonlinearity) under external or parametric excitation is outlined in Chapter 1. It describes some physical systems that may possess 2-1 internal resonance such as a double pendulum, a planar elastic pendulum, autoparametric vibration absorber, ships constrained to pitch and roll interaction, parametric excitation of liquid sloshing modes, cylindrical shells, and other systems. The free oscillations of coupled undamped and damped nonlinear modes are described using multiple scales method. The concept of autoparametric vibration absorber, and the associated saturation phenomenon, is used to establish a specific control strategy. The second and first mode excitations, when the second mode frequency is close to twice the first mode frequency, are then examined for the solution and stability of fixed-point solution. The existence of multiple solutions in the form of jump and hysteresis is discussed in parallel to experimental results in terms of response amplitude dependence on excitation amplitude, and in the frequency domain. The chapter is extended to include simultaneous parametric and internal resonance conditions. Three cases of parametric excitation that include the second, first, and combination modes are considered. The last two sections of this chapter treat the influence of nonlinear damping and cubic nonlinearity on the saturation response characteristics of two-to-one internal resonance.

Chapter 3 presents the problem of one-to-one internal resonance encountered in nonlinear systems with symmetry such as the spherical pendulum, taut strings, axisymmetric shells, surface liquid sloshing in near-circular or near-square tanks, beams with near-circular or near square cross-sections, and near-circular or near-square plates and membranes. The analytical modeling of such systems is first developed then the work systematically proceeds by analyzing the response characteristics. The analysis includes primary resonance excitation in the time and frequency domains and the associated limit cycles represented in the phase plane. The fundamental parametric resonance in two- and three-degree-of-freedom, non-semi-simple, systems possessing quadratic and cubic nonlinearities is treated in the neighborhood of one-to-one internal resonance. Bifurcation diagrams indicating the dependence of different equilibrium solutions on the system quadratic and linear parameters are presented for different nonlinear systems. The chapter is closed by treating the case of combined parametric and external excitations of a taut string oscillating in the transverse planes for the periodic solutions which correspond to fixed-point solutions of the modulated equations. While nonlinear systems with cubic nonlinear coupling can experience one-to-one internal resonance, they also can exhibit three-to-one internal resonance. This case is considered in Chapter 4, which introduces some physical classical systems such as a double pendulum with a moving support, a hinged-fixed beam, rods subject to longitudinal excitation, and clamped-clamped buckled beams. The modulated equations using different techniques are derived for each system. The equilibrium solutions of the modulated equations are obtained and represented in the frequency domain for different values of system and external excitation parameters. The bifurcation diagrams demonstrating the relative locations of different fixed-points are plotted for specific system parameters. The corresponding phase portraits and time history records for different response regimes are presented and discussed in a coherent format. The studies include different cases of external and parametric excitations of different modes.

Chapter 5 deals with nonlinear modal interactions resulting from combination parametric, external, or internal resonances. Different classifications of combination resonances considered in the literature are reviewed. Experimental observations of selected two-, three-, and four-degree-of-freedom systems are then described in terms of frequency and excitation amplitude domains. The analyses of combination parametric, external sub-combination, combination internal, sub-combination internal resonances of selected systems are presented for the modulated equations, fixed points, and their stability.

The case of nonlinear modal interaction in the form of energy transfer from high-frequency to low-frequency modes is considered in Chapter 6. The mechanism responsible for this energy transfer is neither an autoparametric resonance, an external combination resonance, nor a parametric combination resonance. The mechanism is rather due to the interaction between slow dynamics of the high-frequency mode, represented by its amplitude and phase, with the dynamics, which is slow, of the low-frequency mode. This mechanism may be viewed as a one-to-zero internal resonance. The experimental evidence of this type of interaction is demonstrated for the cases of a parametrically excited cantilever beam, a transversely excited cantilever beam, frames, composite plates, and an externally excited circular rod. The analyses of these systems are then presented using different methods to derive the modulated equations, which are studied for fixed points and their stability. The response characteristics are presented in the frequency domain together with the boundaries between constant and oscillatory motions. The dynamics of the system in the neighborhood of unstable foci are considered for some cases. Typical and selected nonlinear phenomena, such as period-doubling bifurcations culminating in chaos, symmetry breaking bifurcations, the coexistence of multiple attractors, and the merging of attractors are included in this chapter.

Chapter 7 presents a more complicated form of nonlinear modal interaction which occurs when simultaneous internal resonances exist in the system dynamics. The treatment includes multiple two-to-one internal resonances in three-degree-of-freedom systems with quadratic nonlinearities, and four simultaneous internal resonances in suspended cables. The modulated equations of such systems are solved for fixed points and their stability. The bifurcation analysis of the fixed-point solutions is presented in terms of internal detuning parameters and excitation amplitude.

Chapter 8 addresses the problem of nonlinear normal modes and modal localization. The basic concepts of nonlinear normal modes according to RM Roenberg, and others, are introduced. Basically, nonlinear normal modes may be viewed as synchronous periodic solutions of the system nonlinear equations of motion. The estimation of nonlinear normal modes of different multi-degree-of-freedom and continuous systems constitutes the main theme of this chapter. Nonlinear normal modes of systems with geometric nonlinearities in the presence of internal resonance are analyzed using the complex-variable form of the invariant-manifold approach. The author documents those methods recently developed by others and reported in the literature.

Having read this review, this reviewer realized that the author has written not a book or a reference, but an encyclopedia on nonlinear modal interactions. *Nonlinear Interactions: Analytical, Computational, and Experimental Methods* serves both beginners and specialists in the area of nonlinear dynamics. The book is well written, self-contained, and coherent.

7R10. Strain Solitons in Solids and How to Construct Them. Monographs and Surveys in Pure and Applied Mathematics, Vol 117. - AM Samsonov *(Theor Dept, Ioffe Physico-Tech Inst, Russian Acad of Sci, St Petersburg, Russia).* Chapman and Hall/CRC, Boca Raton FL. 2001. 230 pp. ISBN 0-8493-0684-1. $69.95.

Reviewed by GA Maugin (Lab de Modelisation en Mec, Univ Pierre et Marie Curie, Tour 66, 4 Place Jussieu, Case 162, Paris Cedex 05, 75252, France).

Within an interval of three years, five books have been published that refer to the propagation of localized nonlinear waves in deformable solids. These are the books by J Engelbrecht (*Nonlinear Wave Dynamics, Complexity and Simplicity*, Kluwer, Dordrecht, 1997), LA Ostrovsky and AI Potapov (*Modulated Waves*, Johns Hopkins University Press, Washington DC, 1999), GA Maugin (*Nonlinear Waves in Elastic Crystals*, Oxford University Press, Oxford, UK, 1999), AM Kosevich (*Solitons*, VCH-J Wiley, 1999), and the present book by Professor AM Samsonov from the celebrated Ioffe Physico-Technical Institute of the Russian Academy of Sciences in St Petersburg. What is remarkable in this instance is that all these authors are interrelated via co-operative European research programs. In particular, the undersigned shares publications with members of the other four groups. In spite of what could have been considered a friendly competition at a time when a domain of knowledge reaches an evident maturity, each of the authors has succeeded in producing a book with his own interests, style, and idiosyncrasies. This means that while Engelbrecht's book gave a general background of the field of nonlinearity, the Ostrovsky-Potapov book is more an advanced textbook borrowing examples from both fluid and solid mechanics. Kosevich's book gives the view point of a condensed-matter physicist in the Landau-Lifshitz tradition, and Maugin's book is more focused on the case of ordered solid media such as crystals and the natural output of physical modeling, that is, *nonex-*

actly integrable systems of equations, in contradistinction with traditionally examined classical models. The present book by Samsonov offers still another and complementary vision and focus of interest in that, in spite of its general title, is devoted to the mathematical study, experimental observation, and numerical simulation of so-called solitons in quasi-one-dimensional models of propagation issued from the modeling of elastic rods. This is a very specific subject matter of which the author, a long-time researcher in the field, expands all facets in a rather concisely written book.

In effect, basic definitions such as those pertaining to wave terminology and nonlinear elasticity are first reminded in a brief Chapter 1. Chapter 2 presents a first derivation for the basic coupled equations that govern elastic longwave propagation in a rod. Depending on the approximation made regarding the lateral behavior and the type of embedding in the external environment (Winkler, Pasternak, or Kerr "foundations"), a series of more or less complex one-dimensional quasi-hyperbolic equations is deduced in this chapter. The basic characteristic instrument for further studies is a so-called doubly-dispersive equation (for short DDE) which contains two wave operators with different characteristic speeds. This is the main ingredient combined with the nonlinearity which is mostly of physical origin. At this stage, one may envisage two direct analytical methods to obtain solutions of the various DDE. One method has become traditional and consists of effecting a standard reduction to a nonlinear evolution equation by means of asymptotics (method of reductive perturbation). The final reasoning for integration is then made on a one-directional equation. The author prefers to consider a direct integration of the DDE by considering general traveling wave solutions in terms of the Weierstrass elliptic complex-valued function (Ch 3). This is somewhat technical, but the author shows well (basing on his own original research) the fruitfullness of the method even for dissipative equations such as those obtained in biophysics (FitzHugh-Nagumo equation). The solutions obtained are not exactly solitons in the mathematical sense. They are solitary waves of different shapes that do not accept the "superposition principle" of solitons' mathematics, as the systems considered are not exactly integrable. The book's title, therefore, contains a slight abuse of language. Then come two of the most interesting and original chapters of the book, those expanding the original experimental works of Samsonov's team. At this point, it should be noted that while solitons in fluid mechanics (shallow channel flow), in physical systems such as ferromagnets and Josephson junctions, and in nonlinear optics are supported by direct physical evidence and even industrial applications, the objective existence of soliton-like signals in solids is a more touchy matter. Thanks to the exploitation of sophisticated methods such as schlieren photography and laser shadowgraphy, interferograms are produced which allow one to exhibit transients, longwave solitons, their reflection at boundaries, and to measure their essential characteristic parameters in transparent materials. In nonuniform rods of varying cross section (eg, tapered rod) or varying elasticity coefficients, the experiments exhibit the phenomenon of focusing of longitudinal strain solitons, and effect similar to the self-focusing of modulated solitons in nonlinear optical fibers. Some of these properties can also be shown in elastic plates, and the effect of the environment by accounting for the direct interaction of the lateral faces with a substratum is also demonstrated (Ch 5). For a layer sitting on an elastic half space, the quasi-one-dimensional equation obtained is of the nonlinear integro-differential type (Benjamin-Ohno equation including Hilbert-transforms of the longitudinal signal). Some numerical simulations accompany the presented results. The final Chapter 6 deals more properly with this, exhibiting some interactions, formations of trains of solitons from a point-like source, head-on collision, passing over, attenuation, and focusing in various specific cases. The whole is completed by a rich bibliography (214 items) which nonetheless misses some of the important related works done in the West. The subject index is rather poor.

Samsonov's book, *Strain Solitons in Solids and How to Construct Them*, is an original one. It clearly deserves to be on the shelves of all researchers interested in the nonlinear dynamical elasticity of structures. It could have received more attention in so far as editing is concerned, but it does transmit a message in a clear and efficient way.

7N11. Aeroelasticity in Axial-Flow Turbomachines. - von Karman Inst Fluid Dyn, Belgium. 1999.

Market forces continuously drive turbomachines towards weight reduction and increased efficiency, as well as an increase of the already high reliability and safety of these machines. To meet these challenges the designer pays increased attention to the occurrence of unsteady flow phenomena. After the recent course on "Blade Row Interference Effects in Axial Turbomachinery Stages," the present notes go one step further and discuss, in detail, the fundamental principles of turbomachinery unsteady aerodynamics, structural aerodynamics and aeroelastic design starting at basic and ending at advanced level. The emphasis is on providing a sound understanding of the physical and mathematical aspects of unsteady aerodynamics and structural dynamics, as well as on applying this understanding in practical aeroelastic design situations. The latest research results are also discussed.

7N12. Emerging Technologies in Fluids, Structures, and Fluid/Structure Interactions, Volume 1. Proc of ASME Pressure Vessels and Piping Conf, July 2000, Seattle. - Edited by M Souli ASME, New York. 2000. 380 pp. ISBN 0-7918-1895-0. ASME Book No H1182A. $130.00. (ASME members $65.00).

This volume of 43 full-length, peer-reviewed technical papers addresses the development of new techniques used to solve complex experimental and numerical problems in fluid, structure, and fluid-structure interaction domains and industrial applications. In this first volume of a two-part set, the papers deal with structures under extreme loading conditions.

7N13. Emerging Technologies in Fluids, Structures, and Fluid/Structure Interactions, Volume 2. Proc of ASME Pressure Vessels and Piping Conf, July 2000, Seattle. - Edited by I Shigeru. ASME, New York. 2000. 228 pp. ISBN 0-7918-1895-0. ASME Book No H1182B. $100.00. (ASME members $50.00).

This volume of 31 full-length, peer-reviewed technical papers addresses the development of new techniques used to solve complex experimental and numerical problems in fluid, structure, and fluid-structure interaction domains and industrial applications. Sampling of contents of this second volume in this two-part set includes: Numerical calculation of fluid-forces in different types of stirring apparatus with CFD; Operating deflection shape analysis of large agitators - A powerful tool to increase plant reliability and availability; Coherent structure of drag reducing solution flow in a cylindrical pipe; Analysis of underwater sympathetic detonation of high explosive; Fluid structure interaction for nuclear spent fuel racks; and Probabilistic treatment of parametric uncertainty in dynamic behavior of industrial piping systems.

7N14. Encyclopedia of Vibration. - Edited by SG Braun *(Technion-Isarel IT, Haifa, Isarel),* DJ Ewins *(Dept of Mech Eng, Imperial Col of Sci and Tech, London, UK),* SS Rao *(Dept of Mech Eng. Univ of Miami, Miami FL).* Academic Press Ltd, London. 2001. 3-Vol set. ISBN 0-122-27085-1. $925.00.

This encyclopedia provides an authorative and comprehensive reference on vibration for practicing and research mechanical, aeronautical, and civil engineers and high-level students. The content of the encyclopedia covers the field from basic vibration theory to ultrasonics, with topics covered from both fundamental and applied standpoints. Topics are covered in alphabetically arranged entries, with broad topics comprising two or more component articles.

Key features include over 170 different articles; complete subject index in each volume; extensive cross-referencing; further reading lists at the end of each article allow further, in-depth study; numerous figures and tables illustrate the text; and important information such as material properties, for example, included as appendices. An on-line version, initial access to which is included in the price, offers extensive hypertext linking and advanced search tools, including a searchable index. Ongoing access is available for a small annual fee.

7N15. Wind and Structures for the 21st Century. Proc of 1st Int Symp, Cheju, January 2000. - Edited by Chang-Koon Choi, G Solari, J Kanda, A Kareem Techno-Press Ltd, Taejon, Korea. 499 pp. ISBN 89-950042-9-0. $47.00.

This proceedings offers current research results on the following topics: bridge, building, wind climate, computational wind engineering, bluff body aerodynamics, code and regulations, and civil engineering.

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

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

Modeling and Simulation of Aerospace Vehicle Dynamics. Education Series. - PH Zipfel *(Univ of Florida, Gainesville FL).* AIAA, Reston VA. 2000. 551 pp. ISBN 1-56347-456-5. $79.95. (Under review)

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

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

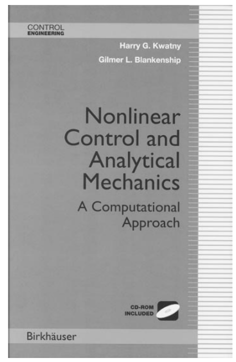
III. AUTOMATIC CONTROL

7R16. Nonlinear Control and Analytical Mechanics: A Computational Approach. - HG Kwatny *(Dept of Mech Eng and Mech, Drexel Univ, Philadelphia PA 19104)* and GL Blankenship *(Dept of Elec and Comput Eng, Univ of Maryland, College Park MD 20742).* Birkhauser Boston, Cambridge MA. 2000. 317 pp. CD-ROM included. ISBN 0-8176-4147-5. $59.95.

Reviewed by SC Sinha (Dept of Mech Eng, Auburn Univ, 202 Ross Hall, Auburn AL 36849-5341).

This book is intended for graduate students, faculty, and researchers in engineering and applied mathematics who are interested in the computational aspect of nonlinear dynamics and control algorithms developed via geometric theory in the past two decades. Readers with a background in second level ordinary differential equations, nonlinear dynamics, and a second course in control engineering should have no trouble following the material. Familiarity with *Mathematica* would be helpful but not necessary because the book comes with a CD-Rom containing the software called *ProPac* that uses *Mathematica.*

After a brief discussion of the scope of the book and the contents of the *ProPac* software in Chapter 1, the authors present an introduction to the geometrical dynamical systems; stable, unstable, and center manifolds; and Lyapunov stability in Chapter 2. Chapter 3 deals with an introductory material on differential geometry. Basic computations using *ProPac* are introduced. Kinematics of multibody mechanical systems represented by tree and/or chain structure is discussed in Chapter 4. The systems considered here consist of rigid bodies connected by joints. The computations are implemented through the software. The authors developed the dynamics of such systems in Chapter 5 using the Poincaré's form of Lagrange's equations. Algebraic, holonomic, or nonholonomic differential constraints can be included in the model. Equation derivation and applications to some typical systems such as undersea/ground vehicles and robots are demonstrated via the *ProPac* software.



In Chapter 6, the basic concepts of controllability and observability for a smooth affine nonlinear control system are discussed. Computations are presented for several examples. The emphasis is on feedback linearization and dynamic inversion. State (exact) as well as input-output linearizations are discussed in detail. Once again computations are carried out using *ProPac.* The last two chapters (7 and 8) deal with the design of robust controllers. In Chapter 7, perturbations of both SISO and MIMO feedback linearizable systems are presented. The problems of Lyapunov redesign and robust stabilization via backstepping are discussed. Methods of adaptive control and adaptive tracking are described, and suitable algorithms are included. The example problems help one to understand the applicability of the software package. Variable structure control is the subject of discussion in Chapter 8. The idea is presented as a nonsmooth, robust class of controllers designed via input-output linearization technique. After a discussion of basic properties of discontinuous systems, methods of sliding mode and reaching control designs are described. Chattering reduction using regularization and a backstepping procedure for SISO variable structure control design in the presence of uncertain, nonsmooth nonlinearities are discussed in detail. The application of the software package is demonstrated through examples.

In this reviewer's opinion, the authors have succeeded in presenting an integrated approach to nonlinear dynamics and control mostly based on geometrical methods. This book should be appealing to engineers due to the fact that the computational aspects are included in every section and solutions of examples are demonstrated through the use of fine software package called *ProPac.* Additional problems and references are included at the end of each chapter. The writing style is clear and concise, the figures are clearly drawn, and the book has a nice appearance. *Nonlinear Control and Analytical Mechanics* is recommended for individuals including graduate students and libraries.

7N17. 2000 5th International Workshop on Advanced Motion Control. - IEEE, New York. 2000. 650 pp. ISBN 0-7803-5976-3. $178.00.

Topics covered include High accurate positioning/tracking control; Intelligent identification, observation, and control of complex nonlinear systems in motion system; Advanced control in robot manipulator including redundant degree of freedom arms; Control of biped walking robots; Advanced traction control of electric vehicles and trains; Visual servo system and image processing in motion control; Soft computing (artificial intelligence, evolutionary computation); Applications to motion control; Actuators and sensors, system integration, communication technology in motion control; and Motion control.

7N18. 2000 American Control Conference. - IEEE, New York. 2000. 4000 pp. 4-Vol set. ISBN 0-7803-5519-9. $488.00. (also available on CD, ISBN 0-7803-5522-9, $488).

Topics covered include Introduction to nonlinear systems and control; Biological approaches to control system problems; Practical techniques for control engineering; Bridging the gap between theory and practice; Basic principle with control and monitoring applications; Process and control system performance monitoring and trend analysis; An optimization based approach; and Control and signal processing design optimization using genetic search methods.

7N19. 2000 IEEE International Conference on Robotics and Automation. - IEEE, New York. 2000. 4384 pp. 4-Vol set. ISBN 0-7803-5886-4. $556.00. (also available on CD, ISBN 0-7803-5889-9, $556).

Topics covered include range sensing, part feeding and fixturing, protoyping design and automation, robot control, dexterous manipulation, robot learning, cooperative robots, mechatronics, motion planning, human augmentation and assist devices, medical robotics, micro robots, space and underwater robots, neural network systems, teleoperation, manufacturing scheduling, haptic interface, robotics in medicine, flexible assembly systems, collision detection and distance computation, novel sensing devices, dynamics and optimization, and bipedal and climbing robots.

7N20. 2000 IEEE International Conference on Control Applications. - IEEE, New York. 2000. 1010 pp. ISBN 0-7803-6562-3. $232.00. (also available on CD, ISBN 0-7803-6565-8, $232).

Topics covered include applications of adaptive and robust control; sensor based control; nonlinear control; sliding mode control; modeling and system identification; fuzzy logic and control; neural control; expert systems; distributed systems; discrete event systems; manufacturing systems; mechatronics; motion control; robotics; vibration control; structural control; flexible systems; fault detection and fault tolerant control; man/machine interface; aeronautical, aerospace and space systems; automotive systems; vehicle control; Traffic and network control; chemical and steel process control; biomedical systems; data fusion; and power electronics systems.

7N21. 2000 International Symposium on Computer-Aided Control Systems Design. - IEEE, New York. 2000. 310 pp. ISBN 0-7803 6566-6. $152.00.

Topics covered include Symbolic and numerical analysis and synthesis algorithms; Soft computing algorithms in control engineering; Standardization of information exchange (models and design data); Computer-supported cooperative work (CSCW); Control-problem solving environments (including toolboxes); Open frameworks including architecture for internet/intranet computing; Hybrid systems and physical/discrete event plant modeling and more.

7N22. 2nd International Conference Control of Oscillations and Chaos. - IEEE, New York. 2000. 700 pp. 3-Vol set. ISBN 0-7803-6434-1. $184.00.

Control of oscillations and chaos is an emerging field. This proceedings is from the second international conference focusing on the subject of controlling complex oscillatory dynamic systems, with an emphasis on both theory and applications.

Introduction to Fuzzy Sets, Fuzzy Logic, and Fuzzy Control Systems. - Guanrong Chen *(Univ of Houston, Houston TX)* and Trung Tat Pham *(Univ of Houston, Clear Lake, Houston TX)* CRC Press LLC, Boca Raton FL. 2001. 316 pp. ISBN 0-8493-1658-8. $89.95. (Under review)

IV. MECHANICS OF SOLIDS

7R23. Boundary Element Method in Contact Problems for Elastic Spatial-and-Nonhomogeneous Bases. (Russian). - SM Aleinikov *(Dept of Math, Voronezh State Academy of Construction and Architecture, ul Kirova 3-75, Voronezh, 394018, Russia).* Publ House of Civil Eng, Moscow. 2000. 754 pp. ISBN 5-93093-053-8.

Reviewed by RO Simionescu-Panait (Dept of Mech, Univ of Bucharest, Str Academiei nr 14, Bucharest, 70109, Romania).

This book deals with the numerical modeling of contact interaction of rigid foundations with soil bases *via* the boundary element method (BEM). It presents a systematic approach for a wide range of spatial contact problems arising in geotechnics. New numerical techniques and the corresponding computing algorithms are developed, their implementation leads to the design of complex shaped foundations, subject to spatial loadings, resting on an elastic soil.

The book is divided in six chapters, eight appendices, and an extensive reference list, containing 819 titles, which focuses mainly on the Russian literature in the field.

The first chapter reviews the classical spatial contact models applied to geotechnics, gives the useful fundamental solutions for spatial problems in elasticity, and analyzes the behavior of the influence function for some elastic-type bases (soldered half-spaces with variable thickness layers, and elastic half-spaces with variable soil deformation modulus).

Chapter 2 is devoted to the analytical solutions, and their approximation, of mixed problems for the spatial contact of a rigid foundation with an elastic half-space. One reduces the problem to solve a system of integral equations which is performed, in the case of Mindlin fundamental solutions, using triangular and quadrilateral boundary elements. One presents some examples concerning the contact of a rigid body, at axial loading and torsion, with an elastic half-space, for complex shaped punches with flat and smooth base.

The third chapter deals with the numerical implementation of the developed algorithms into a program package. One investigates here the stress and strain behavior due to the interaction of foundations with the soil, under the action of various kind of forces. The accuracy and efficiency of BEM are shown by several examples, regarding the problems of contact for flat punches of circular, annular, or polygonal shape with an elastic half-space. Finally, the author analyzes some spatial contact problems concerning rigid spherical, cylindrical, and conical punches deepened into an elastic half-space.

In Chapter 4, one considers the BEM solutions of spatial contact problems for complex shaped footings resting an elastic nonhomogeneous half spaces. Some optimization problems have been solved, controlling the loading parameters and the shapes of base, to provide a uniform settlement of rigid foundation plates. Combining BEM with Finite Difference Method the author investigates contact problems with orthotropic plates situated on elastic nonhomogeneous bases.

The fifth chapter contains the application of BEM for solving the problem of a deepened foundation in a spatial formulation. One obtains the solutions for deepened monolithic foundations most used: pyramidal piles; foundations made of short vertical and inclined bored piles with caps; bored pile foundations with supporting widening; slot foundations having longitudinal section of various shapes. Quantitative estimates of the foundations' shape influence on the displacements and slopes, for different loadings, are given.

The last chapter deals with the important problem of the spatial contact of a rigid punch with a poroelastic half-space. One derives the numerical modeling of the strains in soil mass due to the reducing of pore pressure in soil. The approach is based on the integral representation of displacements for a poroelastic half-space, saturated with fluid. It has various applications in underground gas and oil deposits design, or in the withdrawing of underground water.

In conclusion, *Boundary Element Method in Contact Problems for Elastic Spatial-and-Nonhomogeneous Bases* is recommended by this reviewer to graduate students, researchers, and engineers working in the field of geotechnics and civil engineering, and can be purchased by the libraries. However, its impact is linked to the knowledge of Russian language.

7R24. Homogenization of Reticulated Structures. - D Cioranescu *(Lab d'Analyze Numerique, Univ Paris VI et CNRS, 4, place Jussieu, Paris Cedex 05, 75252, France)* and *J Paulin (Dept de Mathematique, Univ de Metz, Ile du Saulcy, Metz, Cedex 01, 57045, France).* Springer-Verlag, NY. 1999. 343 pp. ISBN 0-387-98634-0. $74.95.

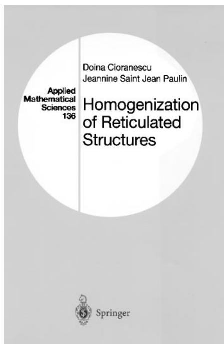
Reviewed by JJ Telega (Inst of Fund Tech Res, Polish Acad of Sci, Swietokrzyska 21, 00-049 Warsaw, Poland).

Many books have already been published on various mathematical and applied problems of homogenization which provide rigorous tools for micro-macro passage. The books which have appeared in recent years include *Homogenization of Multiple Integrals*, by A Braides and A Defranceschi, (Oxford Univ Press, Oxford, 1998); *Variational Methods for Structural Optimization*, by A Cherkaev, (Springer-Verlag, New York, 2000); *An Introduction to Homogenization*, by D Cioranescu and P Donato, (Oxford Univ Press, Oxford, 1999); *Homogenization and Porous Media*, by U Hornung, (Springer-Verlag, New York, 1997); *Plates Laminates and Shells: Asymptotic Analysis and Homogenization*, by T Lewinski and JJ Telega, (World Scientific, Singapore, 2000); *Theory of Composites*, by GW Milton, (Laminated Publishers, in press); and *Macroscale Models of Flow Through Highly Heterogeneous Porous Media*, by M Panfilov, (Kluwer Academic Publishers, Dordrecht, 2000).

The current book under review is written by applied mathematicians and presents a rigorous study of a significant class of linear problems related to homogenization of lattice-type structures characterized by two or three small parameters. The homogenization means passing with these parameters to zero, thus finding macroscopic models.

The book consists of six chapters. Chapter 1 introduces the reader to homogenization problems of stationary second-order linear differential equations posed on microperiodically perforated domains. The boundary conditions imposed on microholes are the homogeneous Neumann condition, the Dirichlet condition, the Fourier condition. Each case is carefully examined since the homogenized behavior in these three cases differs. First- and second-order correctors are also introduced. Having in mind applications, not only regular microperforated domains were investigated, but also domains where the holes meet the boundary. The last topic presented in the first chapter concerns the homogenization problem for the Neumann eigenvalue problem in perforated domains. Such a study pertains to convergence of eigenvalues and eigenvectors.

In Chapter 2, two- and three-dimensional lattice-type structures are investigated. Such structures are characterized by two small parameters: the periodicity parameter ε and the thickness of the elements of the structure δ. The passage with ε utilizes the results of the previous section. More difficult is the passage to zero with the second small parameter. The authors studied carefully both two-dimensional and three-dimensional cases. To obtain the final results, one has to derive a lot of estimates. In essence, here and in subsequent chapters, the part of the unit cell occupied by the material is suitably decomposed and next transformed to domains independent of small parameter. Both transport equation, ie, the heat equation, and the linear elasticity equations posed on such structures (domains) have been investigated. In the case of rod-like structure, referred to in the book as *a reinforced structure*, the ellipticity is lost. Then the passage with δ is more difficult since one has to resort to singular perturbations method. The eigenvalue problem for the transport equation is also briefly discussed.



The next two chapters are concerned with rigid and elastic gridworks with periodic microstructure. Now, similarly to the case of thin plates, its thickness 2e is also small. In Chapter 3, the authors studied only stationary thermal problems. It was shown that the order of passage to the limit with the three small parameters; ε, δ, and e plays generally an important role. Linear elastic gridworks characterized by three small parameters have been studied in Chapter 4. The passage to the limit (zero) with these parameters is carefully studied. In the limit, one obtains plate models. Here also the phenomenon of loss of stability for certain structures has also been observed. It has also been shown how to avoid this unpleasant property; for instance, if the gridwork contains oblique bars then this phenomenon does not occur. Time-dependent plate models are also briefly discussed. Now, however, only a simplified problem has been investigated since one starts at once from a two-dimensional plate model. The reader lacks a discussion of problems similar to the static case where the starting point was a 3D problem.

The last two chapters are concerned with thin tall structures. More precisely, in Chapter 5 thermal problems for such structures, characterized by three small parameters, have been carefully examined. Both two- and three-dimensional problems are discussed. In the last chapter thin three-dimensional, linear elastic tall structures have been investigated. Then in the limit a beam model is obtained.

The book is well written. However, throughout it plate-like structures are misleadingly called honeycomb structures. Sometimes the authors refer to references not listed in the list of references. Also, linear elasticity is always called linearized elasticity.

Homogenization of Reticulated Structures is addressed to specialists in micromechanics familiar with mathematical tools of homogenization and asymptotic analysis methods. It will also be useful to researchers elaborating models of cellular solids. Specialists in structural mechanics, exploiting asymptotic methods, will appreciate its rigor. Finally, applied mathematicians interested in mathematical problems of solid mechanics will profit from the book since it offers a lot of new problems.

The book is nicely edited and its price is acceptable even for those who are not from rich countries.

7R25. Machine Design: A CAD Approach. - AD Dimarogonas *(Deceased).* Wiley, New York. 2001. 996 pp. ISBN 0-471-31528-1. $99.00.

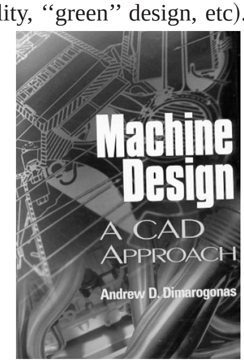
Reviewed by G Lewis (Dept of Mech Eng, Univ of Memphis, 312 Eng Bldg, Memphis TN 38152).

In the discussion about pedagogical approaches in the field of mechanical engineering education, perhaps no issues are more contentious than those that deal with the definition of design, how to teach it, and methods to ensure its seamless integration into the curriculum. Thus, any new book on the subject of mechanical engineering design is awaited with bated breadth, to see the extent to which its contributions to the debate on the aforementioned issues and other pertinent matters are informative and/or innovative. It needs to be stated at the outset that this text does not disappoint. It takes a decidedly bold new approach to the subject, successfully synthesizing well-established principles with evolving concepts. In the end, the student (whom one suspects is the primary, if not the only, intended readership) is given a treat, spread over an Introduction section, 14 chapters, and close to a thousand pages. Taxonomically speaking, the material in this text may be divided into three groups: description of the historical evolution of machine design as a key engineering process; the principles of machine design; and the applications of these principles to specific cases.

In the Introduction section, *The machine: a historical introduction*, the author captures completely the spectrum of changes that occurred in the approaches to machine design over a period that spans several centuries, from the design of water storage systems in Potamic Civilizations through the design of the pendulum clock in the Middle Ages to the design of the first practical locomotive, by George Stephenson, in 1829. This chapter also contains discussions of the following two topics: the group technology concept, which had its genesis in the pioneering work on symbolic representation carried out in the 17th and 18th centuries; and the evolution of machine design methodology, from the first application of engineering science to mechanical design performed at the Ecole Polytechnique (during the early part of the 19th century) to the ''comprehensive model'' introduced by Pahl and Beitz in 1996.

Machine design principles are expounded upon in Chapters 1 to 7. In many parts of these chapters, the author breaks no new ground; rather, he offers succinct treatment of a wide menu of familiar topics. In other portions, though, the author is very informative on a number of less familiar topics.

The thrust of Chapter 1, *Machine design methodology*, is the illustration of the processes to be used in identifying the most promising design solution from a given or derived set of candidate concepts. The key topics covered in this chapter are: the relative attractions and drawbacks of the ''traditional'' or ''sequential'' machine design procedure proposed by George Sandor, in 1964, compared to the more modern concurrent design procedure; axiomatic foundation and design rules (Reuleaux's design rule, Suh's axioms, revised design rules); conventional, intuitive, and systematic methods of generating machine functional concepts; development of alternative design concepts and use of the morphological table; and myriad philosophical and legal aspects of machine design (aesthetics, product liability, ''green'' design, etc).



In Chapter 2, *Kinematic analysis of machines*, the reader is provided with a comprehensive treatment of the kinematics principles that are used to obtain the main dimensions of a machine. Among the topics covered are: fixed kinematic pairs, velocity and acceleration analyses of closed-loop and open-loop linkages, cams and followers, kinematics of gears, and geometry of spur gears.

In Chapter 3 (*Analysis of machine loads*), the principles to be used in determining the magnitude of the loads to which a machine member is subjected during service are presented. Energy, work, power flow analysis, force analysis in general determinate system, internal loading diagram, and deflection analysis are the concepts treated.

In Chapter 4 (*Machine design materials and manufacture*), various aspects of engineered materials are discussed. These include: effect of test temperature, test loading rate, and time on the tensile properties of materials; materials processing methods; materials selection; determination of factor of safety; and estimation of statistical parameters relevant to design reliability.

In Chapter 5 (*Sizing machine components for strength*), the basic mechanics of materials concepts are presented. The topics covered may be clustered into four groups. The first group is the analysis of stresses developed when a machine member is subjected to quasi-static tension force, compression force, torque, or bending moment acting alone. The second group focuses on stress analysis when the aforementioned types of loading act simultaneously on the member. The third group considers stress analysis of various common machine components (such as thin- and thick-walled pressure vessels, interference fit joints, and rotating disks). Stress analysis when a machine member is subjected to dynamic loading is covered in the fourth group.

The various methods that may be used to model all features of a machine's components and track the machine's overall performance are the subject of Chapter 6 (*Computer methods for machine modeling*). The salient features of two broad categories of these methods are presented. The first is geometric modeling (exemplified by computer-aided machine design). The examples discussed in second category of methods, solid modeling, are wireframe, surface, and constructive solid geometry modeling. Other topics covered in this chapter include: geometric transformation of data, mesh generation, the finite element stress analysis method, and stress analysis of axisymmetric solids.

The utilization of machine models to obtain final machine design and methods of obtaining the best possible performance of the selected design are covered in Chapter 7 (*Machine design synthesis*). The opening sections of the chapter deal with some fundamental concepts of machine design formalization (namely, machine synthesis, its application to kinematic synthesis of linkages, and uses of a machine macromodel). The rest of the chapter is devoted to a detailed treatment of the principles of machine design optimization, moving from development of the general optimization statement to primers on analytical, numerical, and search algorithmic methods for obtaining maxima or minima in an optimization problem, and concluding with a description of the concept of the minimization of the total cost function.

In the third group of chapters (comprising Chapters 8 to 14), all the concepts covered in the previous chapters are combined with relevant special considerations to present the details of methods that may be used to size a wide variety of common machine elements. These elements are: rivets, bolts, welded joints, and interference fits (Chapter 8); springs, machine mounts and foundations (Chapter 9); clutches, brakes, and friction belts (Chapter 10); hydrodynamic and hydrostatic bearings (Chapter 11); dry contacts and rolling bearings (Chapter 12); spur, helical, and bevel gears, crossed gearing, worm gear drives, and chain drives (Chapter 13); and shafts, couplings, and keys (Chapter 14). In each of these chapters, the presentational format has three commonalities. First, the underlying principles and governing equations are presented (for example, ''stress distribution in highly loaded contacts'' and ''elastohydrodynamic lubrication'' in Chapter 12). Second, the selection application(s) are described in detail (for example, in Chapter 12, classes of roller bearings, antifriction bearing design database, bearing loads, and load distribution within a bearing are among the topics covered). Third, example problems are solved. Fourth, an actual relevant case study is described (in Chapter 12, this involved the redesign, by Task Corporation, of the ball bearings of the electric motors for pumps in the hydraulic systems in the Thunder 99 aircraft).

This text has five key attractive features. First, the historical antecedents are given for each of the important principles described. (As a bonus, potted biographies and photographs of all the persons involved in the development of these principles are included.) This is a commendable contribution to the much-neglected field of the history of engineering (there are many of today's young computer nerds who truly believe that Steve Jobs or Bill Gates introduced computing!). Second, many of the case studies presented, all of which are culled from actual events, highlight the way in which machine component design analysis may be utilized in the analysis of service failure of a component. Third, many worked examples are provided of the use of computer methods to solve machine design problems. Fourth, the text has very pleasing aesthetics: a plethora of appropriate typefaces; crisp and fully-annotated diagrams; and well laid-out tables. Fifth, the six appendices are a compendium of much needed information on stress concentration factors, dimensions of standard machine elements, geometrical characteristics of standard hot rolled section members, and properties of various alloys, and the properties of four common cross-sections.

There are two main shortcomings of this text. First, a number of important topics are not covered at all, three examples being: theories of failure for filamentary composite materials (such as the Tsai-Wu theory); the use of the Weibull distribution in analyzing machine component failure data; and cumulative fatigue failure methods, other than the Palmberg-Miner rule (an example is the Corten-Dolan rule). Second, the omission of a discussion of the principles and applications of the geometric element modeling method (upon which the widely-used, commercially-available software, *ProEngineer*®, is based) in this text, which has a publication date of 2001, is both surprising and disappointing.

All things considered, the author has written an impressive and highly-readable text, and the present reviewer thus recommends *Machine Design: A CAD Approach* very highly to both mechanical engineering students and designers, especially those in the early part of their careers.

7N26. Acoustical Imaging, Volume 24. - Edited by Hua Lee *(Dept of Elec and Comput Eng, UC, Santa Barbara CA).* Kluwer Acad Publ, Norwell MA. 2000. 422 pp. ISBN 0-306-46518-3. $150.00.

This proceedings, from the 24th International Symposium of Acoustical Imaging, contains articles on the following topics: advanced systems and techniques, microscopy and nondestructive evaluation, and biomedical applications.

The contents are divided into three parts and contain almost 50 papers.

7N27. Advances in Structural Engineering and Mechanics, Volume 1. - Proc of 1st Int Conf, Seoul, August 1999. - Edited by Chang-Koon Choi and WC Schnobrich *(Univ of Illinois, Urbana IL).* Techno-Press Ltd, Taejon, Korea. 892 pp. ISBN 89-950042-6-6. $80.00. (2-Vol set ISBN 89-950042-5-8, $155).

The papers in this proceedings volume cover computational technology, meshless methods, theory of beam/plate, AI and soft computing, plates and shells material and constitutive laws, fatigue and fracture, stability and buckling, structural engineering, optimization and reliability, structural dynamics, earthquake engineering, parallel computational and testing, and structural control.

7N28. Advances in Structural Engineering and Mechanics, Volume 2. Proc of 1st Int Conf, Seoul, August 1999. - Edited by Chang-Koon Choi and WC Schnobrich. Techno-Press Ltd, Taejon, Korea. 844 pp. ISBN 89-950042-7-4. $80.00. (2-Vol set ISBN 89-950042-5-8, $155).

The topics in this proceedings include steel structures, modeling of RC structures, shear and torsion in RC structures, concrete and RC structures, masonry structures, composite materials, structural health monitoring, maintenance and rehabilitation, geomechanics, soil-structure interactions, biomechanics, high-rise buildings, bridge engineering, fluid and wind engineering, and hyundai form of wind engineering.

7N29. Application of Stress-Wave Theory to Piles: Quality Assurance on Land and Offshore Piling. Proc of 6th Int Conf, Sao Paulo, Sept 2000. - Edited by S Niyama and J Beim. Balkema Publ, Rotterdam, Netherlands. 2000. 800 pp. ISBN 90-5809-150-3. $105.00

Topics covered include Wave mechanics and its application to pile analysis; Driving equipment and recent developments - New technologies for quality assurance of piles; Pile integrity and low strain dynamic testing; Pile - soil interaction; Codes; High strain dynamic testing of driven and in situ piles - Dynamic testing of large piles; SPT measurements and special field monitoring test; Vibratory pile driving - Vibration in pile driving; Statnamic and other similar techniques; Case histories, pile set-up and correlations between test methods - Prediction reliability; and more.

7N30. Applications of Fracture Mechanics in Failure Assessment. Proc of ASME Pressure Vessels and Piping Conf, July 2000, Seattle. - Edited by R Mohan ASME, New York. 2000. 224 pp. ISBN 0-7918-1893-4. ASME Book No H01180. $100.00. (ASME members $50.00).

This volume of 24 full-length, peer-reviewed technical papers covers the following major topics:

Development and User Experience of Advanced Methods of Fracture Mechanics Assessment: These papers discuss the FAD approach to fracture, the use of the R6 method, results of a study using the Gurson model, the UK experience with the operation of LPG storage spheres and related programs, evaluation of various methods for determining fracture toughness curves, the prediction of toughness behavior, and methods for estimating parameters characterizing crack propagation.

The Master Curve: These papers discuss the applications of master curve technology to the assessment of structures, addressing the effect of loading rate, the effect of constraint loss, margins and material uncertainty, universality of the master curve shape, practical results, etc.

7N31. Composite Structures: Theory and Practice. (STP 1383). - Edited by P Grant *(Boeing Commercial Airplane Group)* and CQ Rousseau *(Bell Helicopter Textron)*. ASTM, W Conshohocken PA. 2000. 552 pp. ISBN 0-8031-2862-2. $295.00.

This comprehensive publication reflects the latest worldwide research in composite structures technology and specifically focuses on structural certification and qualification concerns. It includes 29 peer-reviewed papers, written by academia, government, and industry experts. The papers are divided into the following sections: Structural damage tolerance, Skin-stringer behavior, Rotorcraft and propeller structural qualification issues, Bolted joint analysis, Test methods, Strength prediction, and Environmental effects.

7N32. Experimental Evidence and Theoretical Approaches in Unsaturated Soils. Proc of an Int Workshop on Unsaturated Soils, Trento, Italy, April 2000. - Edited by A Tarantino and C Mancuso. Balkema Publ, Rotterdam, Netherlands. 2000. 200 pp. ISBN 90-5809-186-4. $30.00.

A tradition of geotechnical engineering researchers in Italy is to invite young fellows to present their work and stimulate discussion. Accordingly, this proceedings is from the workshop which was a forum for 12 post-graduate and post-doctoral researchers from different universities to present their recent work in unsaturated soil mechanics. Papers included were revised following comments and suggestions from the audience and post conference referee. Topics cover the area of unsaturated soils: innovative experimental techniques, new experimental data on compacted, collapsible and swelling soils, and advances in constitutive modeling. This publication is expected to be of value to researchers and engineers working with unsaturated soils.

7N33. Experimental Physics and Rock Mechanics. - Edited by AN Stavrogin, BG Tarasov, C Fairhurst. Balkema Publ, Rotterdam, Netherlands. 2000. 360 pp. ISBN 90-5809-213-5. $65.00.

This monograph summarizes the results of experimental investigations on the mechanical behavior of rock, conducted over a period of 40 years in the Laboratory for the Physics of Rocks at High Pressures. Contents include Pre-failure and post-failure strength and deformation properties of rocks under a wide range of stress states and loading paths; Time-dependent properties of rocks; Effect of deformation rate on the "post-peak strength" properties of rock and energy balance during dynamic uncontrolled fracture; and Mechanics of deformation and fracture of saturated rocks.

7N34. Fatigue and Fracture Mechanics: 31st Volume. (STP 1389). - Edited by GR Halford *(NASA Lewis Res Center, 21000 Brookpark Rd, Cleveland OH 44135)* and JP Gallagher *(Univ of Dayton Res Inst, Dayton OH)*. ASTM, W Conshohocken PA. 2001. 560 pp. ISBN 0-8031-2868-1. $295.00.

The latest volume in this on-going series examines a broad range of topics including advances in analysis and predictive capability, behavior of new and emerging materials, design tools and approaches to control failures, accelerated testing, and industrial applications.

There are 29 peer-reviewed papers which are divided into five sections:

Swedlow Memorial Lecture - addresses undergraduate educational needs in the area of fatigue and fracture;

Keynote Tributes to George Irwin - summarizes some of the most important contributions of Dr George R Irwin, the father of modern fracture mechanics;

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

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

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

7N35. Fracture Mechanics in Engineering Structures and Rock Mass. - Edited by BG Orekhov and MG Zertsalov. Balkema Publ, Rotterdam, Netherlands. 2000. 300 pp. ISBN 90-5410-285-3. $85.00.

The book covers the application of the concepts of failure mechanics in investigating the deformation and strength of engineering structures and rock bases. The book contains examples to illustrate the application of the developed method for solving a range of practical problems. Contents include Strength and deformation of brittle materials; Analytical models of the strength of brittle materials; Strength of building conditions and structures; Mechanics of the failure and deformation of rocks and concretes under compression; Elastoplastic model of rocks and the criteria of failure under compression; and Investigation of the load-bearing capacity of engineering structures.

7N36. Geotechnical and Geoenvironmental Engineering Handbook. - Edited by RK Rowe *(Dept of Civil Eng, Univ of W Ontario, London, Canada)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2001. 1160 pp. ISBN 0-7923-8613-2. $499.00.

This one-volume handbook discusses a wide array of topics that have entered the mainstream of Geotechnical and Geoenvironmental Engineering over the past two decades, while at the same time not losing sight of the more conventional aspects of the discipline. The topics covered range from conventional saturated soil mechanics to unsaturated soil behavior, rock mechanics, hydrogeology, and geosynthetics. The book deals with pavements, shallow and deep foundations, embankments, slopes, retaining walls, buried structures, dynamics and earthquakes, contaminant transport, groundwater monitoring, and the containment, treatment and remediation of contaminated sites. Risk assessment and risk-based management for both geotechnical and geoenvironmental applications are discussed. The 30 various chapters of the book have been extensively cross-referenced to assist the reader who opens the book at the section most relevant to their current needs in finding other relevant material in this book.

7N37. Manual of Bridge Engineering. - Edited by MJ Ryall, GAR Parke, JE Harding. Thomas Telford Ltd, London. 2000. 1040 pp. ISBN 0-7277-2774-5.

As bridge design becomes ever more innovative and the demands placed on bridges increase, the bridge engineering industry faces a constantly growing variety of challenges. This manual addresses these challenges. Not only does it provide a comprehensive overview of the subject of bridge engineering from concept to completion, but it focuses on detailed aspects of analysis, design, construction, and maintenance.

Throughout the book, emphasis has been placed on simplicity - the authors have attempted to present a text which is straightforward and not obscured with unnecessary detail. Each chapter is written in sufficient depth to enable budding engineers to gain an awareness of the subject matter and allow more seasoned engineers to refresh their memories or discover something new. Numerous references are available which can be explored for more refined or extended information.

The manual begins with an introduction to all of the bridge types encountered in bridge construction, from the simplest beam through arches, to the more complex cable stayed and suspension bridges, and describes their behavior in a qualitative manner. It moves on to discuss loads beginning with a brief history of loading specification and focusing on some current code specifications. It makes reference to loads due to wind, temperature, shrinkage, and construction and introduces the reader to the concepts of load distribution as well as explaining the use of influence lines in bridge design.

The middle section of the manual deals with the analysis, design, and construction of the more commonly known bridge types. It discusses analysis tools and explains general design concepts, both globally and locally. The modern methods of construction for each particular bridge types are explained.

The manual also considers modern developments in the construction of bridges and the consideration of aluminum, fibre composites, bridge enclosures, and intelligent structures. This section discusses expansion joints, bearings, parapets, drainage, waterproofing, and substructures.

The manual concludes with a look at bridge management. It offers guidance on what is to be considered once the bridge has been commissioned, including protection of both concrete and steel (also with reference to scour protection), project planning, management systems and strategies, inspection, monitoring, assessment and repair, and strengthening.

7N38. Mechanical, Thermal and Environmental Testing and Performance of Ceramic Composites and Components. (STP 1392). - Edited by MG Jenkins *(Univ of Washington)*, E Lara-Curzio *(ORNL, Oak Ridge TN 37830)*, ST Gonczy *(Gateway Mat Tech)*. ASTM, W Conshohocken PA. 2000. 340 pp. ISBN 0-8031-2872-X. $125.00.

This concise, archival reference examines the results of the latest research and developmental programs on continuous fiber ceramic composites. It examines specific issues, such as thermal stresses, stress gradients, measurement capabilities, gripping methods, environmental effects, statistical considerations, and limited material quantities.

There are 22 peer-reviewed papers divided into four major categories: Room-temperature test results methods, Test results/methods related to design implications, Environmental effects and characterization, and Damage accumulation and material development.

7N39. Metal Forming 2000. Proc of 8th Int Conf, Krakow, Poland, Sept 2000. - Edited by M Pietrzyk, J Kusiak, J Majta, P Hartley, I Pillinger. Balkema Publ, Rotterdam, Netherlands. 2000. 780 pp. ISBN 90-5809-157-0. $110.00.

Metal forming has for years maintained its position as the most efficient way of shaping metals and alloys. Metal forming technologies have to improve continuously to face higher and higher requirements regarding the quality of products. Therefore, a lot of effort is placed on scientific research in this field. The conference is a forum for the exchange of knowledge on the progress of theoretical and experimental works in this field. This book contains papers that present state-of-the-art knowledge in the field of metal forming science and technology.

7N40. Understanding and Predicting Material Degradation. Proc of ASME Pressure Vessels and Piping Conf, July 2000, Seattle. - Edited by R Mohan. ASME, New York. 2000, 200 pp. ISBN 0-7918-1894-2. ASME Book No H01181. $90.00. (ASME members $45.00).

This volume of 24 full-length, peer-reviewed technical papers addresses the unresolved issues in the areas of material degradation, failure, and life prediction under complex operating conditions.

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

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

V. MECHANICS OF FLUIDS

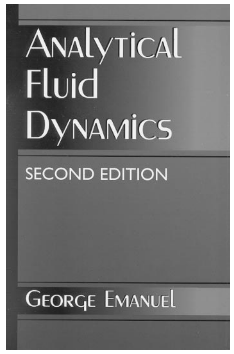
7R41. Analytical Fluid Dynamics, Second Edition. - G Emanuel *(Dept of Mech and Aerospace Eng, Univ of Texas, Arlington TX),* CRC Press LLC, Boca Raton FL. 2001. 790 pp. ISBN 0-8493-9114-8. $89.95.

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

This is the second edition of a graduate-level textbook that first appeared in 1994. The author is a distinguished teacher and scholar of fluid mechanics, particularly compressible flows. The book contains some original research, but also much of the fundamentals needed for a first graduate-level course in fluid dynamics. The emphasis is on compressible flows and the analytical, in contrast to numerical or empirical, approach. Much new material has been added since the first edition, increasing the original 424 pages to 790 pages, and the 18 chapters to the present 23.

The book is organized into five parts: Basic Concepts, Advanced Gas Dynamics, Viscous/Inviscid Fluid Dynamics, Exact Solutions for a Viscous Flow, and Laminar Boundary-Layer Theory for Steady Two-Dimensional or Axisymmetric Flow. Each chapter has its own list of references and a limited number of problems suitable for the classroom. Unlike the first edition, however, the present book does not provide hints for answers to the problems.

New chapters in the second edition include Calorically Imperfect Flows; Sweep; Interaction of an Expansion Wave with a Shock Wave; Unsteady, One-Dimensional Flow; and Force and Moment Analysis. Chapters dominated by the author's own scholarly work and unique to this book include The Substitution Principle; Sweep; and Second-Order Boundary-Layer Theory. The discussion on the second coefficient of viscosity and bulk viscosity, a controversial subject prone to errors in most other textbooks (see *Journal of Fluids Engineering*, vol 117, no 1, pp 3–5, 1995), is superb in the present book, reflecting George Emanuel's seminal contributions to this issue.



The pluses for this book are the precise mathematics, the broad coverage, the increased emphasis on practicality, and the lucid, personable writing style. First principles are emphasized, and empiricism is kept to a minimum and clearly flagged when used. The author does state at the outset that major topics such as turbulence, computational fluid dynamics, and rarefied gas flows are left to other more specialized books. On the negative side, discussion of the physics is often austere and the book has the feel of enhanced classnotes. More discussion of the limits of the different approximations used such as the continuum hypothesis, the incompressible flow assumption, and the inviscid flow approximation would have been most welcome. The book does not contain a single photograph, a most curious omission in a treatise about fluid flows. Students would have benefited greatly from seeing a picture of an oblique or bow shock wave. The organization could have been streamlined a bit, perhaps avoiding going back and forth between compressible and incompressible flows.

This reviewer was not impressed with the production job performed by CRC Press. Several typographical errors were found including a glaring one in the back cover. A half decent copy editing job should have spotted those. The typesetting appears to be quite unprofessional, resembling more desktop publishing or camera-ready manuscript. In particular, all equations containing vectors are eye sores and do not have the crisp look that can be obtained nowadays with readily available software such as LaTeX. The line drawings are amateurishly generated as well as poorly reproduced. The particular copy this reviewer received came unglued presumably as a result of the trauma of double shipping, first to *Applied Mechanics Reviews* then to the reviewer.

The present book competes with many good ones on the same general topic. Panton's *Incompressible Flow*, while limited in its discussion of compressible flows, provides an excellent, comprehensive introduction at the graduate level. Saad's *Compressible Fluid Flow* is suited for both senior undergraduate students and first-year graduate ones. Anderson's *Modern Compressible Flow* and *Hypersonic and High Temperature Gas Dynamics* provide a broader coverage while staying more approachable to the students. Emanuel's *Analytical Fluid Dynamics* is precise in its mathematics and offers more rigorous analysis, but needed more fillings between the numerous equations, more pedagogical material. This reviewer recommends the present book *Analytical Fluid Dynamics* for fluid dynamics scholars searching for a serious reference book on continuum, compressible, laminar flows, but recommends something else for the classroom.

7R42. Metode Matematice in Aerodinamica. Mathematical Methods in Aerodynamics. (Romanian). - L Dragos *(Fac of Math, Univ of Bucharest, Str Academiei 14, Bucharest, 70109, Romania).* Editura Acad Romane, Bucharest. 2000. 560 pp. Softcover. ISBN 973-27-0781-X.

Reviewed by L Librescu (Col of Eng, ESM Dept, VPI and State Univ, Blacksburg VA 24061-0129).

Professor Lazar Dragos belongs to the younger generation of Romanian scientists in applied mathematics and mechanics and represents the best product of the brilliant school of aerodynamics illustrated by its founders, Victor Valcovici, Elie Carafoli, and Caius Jacob. His book contains the results generated by him during a period of three decades or so, in which he has interacted with his former students, now established names in the area of aerodynamics.

The present book presents a thorough approach of the aerodynamics of aircraft wings in various flight speed regimes, including the subsonic, transonic, and the supersonic ones. One of the distinguished features of this work consists of an unifying approach for all these cases, approach based on the *fundamental solution methodology*. The book is divided into 11 chapters arranged in the order of the complexity of the exposed, material and contains six appendices.

Chapter 1 provides a brief review of the equations of the ideal compressible fluids, and of their linearized and irrotational counterparts. Within the same chapter, a review of the theory of shock waves is also provided.

Chapter 2 is devoted to the equations of the linearized aerodynamics and their fundamental solutions. Within this chapter, the small disturbance concept is used to derive the governing system of equations and the boundary conditions necessary for determining the disturbance quantities related to the pressure, velocity, and air density. In this chapter, the fundamental solutions of the equation for the velocity potential are obtained for each speed regime, and for both the stationary and nonstationary cases. In this context, a wide use of the generalized functions (distributions) was made. In addition, alternative methods, among these, that one based on the concept of the fundamental matrices was provided.

The third chapter treats the case of wings of infinite aspect ratios in a subsonic gas flow. In this context, the method of the singular integral equations considered in conjunction with that of the fundamental solution methodology is used to determine the pressure jump, and implicitly, the aerodynamic lift and twist moment that appear in the aeroelastic governing equations. A variety of situations are considered for which the pressure jump is determined. Such situations concern, eg, the wing in the presence of the ground effect; the case of the symmetric profile; the wing in a wind tunnel; the case of a biplane, and of wings in tandem, etc. Notice that in all these cases, the concept of fundamental solutions developed by the author was used.

In Chapter 4, the boundary element method (BEM) is used to address the problem of aircraft wings of infinite aspect ratio in a subsonic flow field. As is shown via the application of this method, it is also possible to consider the case of thick profiles. The results obtained by this method are validated by comparing the obtained predictions with the exact ones obtained for the case of circular obstacle and an incompressible flow.

Chapter 5 deals with the theory of aircraft wings of finite span in a subsonic flow. Herein the author develops an original mathematical model of lifting surfaces that is based on the method of the fundamental solutions.

The power of these methodologies appears again from the fact that the resulting equations contain, implicitly, the famous assumptions used by Prandtl in his lifting surface model, assumptions that, in contrast to Prandtl lifting surface model, have not been a priori postulated. Powerful analytical and numerical methods are supplied for the solution of the equation of lifting surfaces.

The case of the wings of small aspect ratio is also addressed in this chapter.

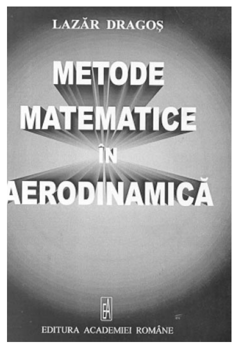
Chapter 6 is devoted to lifting line (straight and curved), theory aerodynamics in which framework the author makes use of the method of the fundamental solutions.

The application of this method yields the famous Praudtl's equation. The solution of this singular integro-differential equation, and its extensions done by Weissinger and Reissner, as well as its exact solution done by Vekua are contained in this chapter.

In Chapter 7, the problems addressed in Chapter 4 for the case of the 2D wing, based on the boundary integral method, are extended to the case of the 3D wing.

In Chapter 8, the case of the wing in a stationary, supersonic flow is considered. A wealth of results that concern the 3D wing, obtained via the application of the fundamental function methodology, are supplied.

In Chapter 9, the problem of the stationary transonic aerodynamics is considered. As a first step, the general transonic small-perturbation equation that contains the nonlinear term due to von-Karman is derived. The fundamental solutions for the 2D and 3D flows, when the motion is accompanied by a shock-wave or is free of it, are developed.



Chapter 10 is devoted to the unsteady motion of a gas in various flight speed regimes, and in the context, the disturbance pressure on an harmonically oscillating wing is determined. For the subsonic compressible flows, Possio's integral equation is derived, and as special case, its counterpart for the incompressible and transonic flows is obtained. A thorough analysis related with the various representations of the aerodynamic kernels and the solution of the integral equations for these cases is presented.

A similar analysis is done for the case of 2D and 3D harmonically, oscillating wings in a supersonic, and in the limit, in a transonic flow.

Chapter 11 is devoted to the aerodynamics of slender bodies in both subsonic in supersonic flow fields. Finally, the six appendices provide details about the mathematical tools that have been used in the treatment of the various problems.

Appendix A supplies a concise treatment of Fourier transform and of the distribution theory. Appendix B includes basic items related to the determination of some intricate integrals; Chapter 6 deals with the solution of singular integral equations of the Cauchy type.

Appendix D discusses the concept of the finite part of improper integrals, with special emphasis on such integrals appearing in aerodynamics. Appendix E presents some basic results on multiple singular integrals, while Appendix F surveys some results connected with the quadrature formulas of the Gauss type used to evaluate the principal value of integrals.

The book ends with an extensive list of references related to each chapter. In the reviewer's opinion, *Metode Matematice in Aerodinamica* represents a valuable contribution to the treasure of the literature in the area of the aerodynamics of aircraft wings and aeroelasticity. Research workers and graduate students of the faculties of applied mathematics or from the departments of aeronautics of polytechnic universities, as well as engineers with a need for results of modern aerodynamics and a willingness to accept modern analytical tools will certainly find, each one in his own way, this book an exceptional value.

A single barrier, that of the language remains, but this difficulty can be removed through a translation of the book into English; a fact that is highly desirable.

7R43. Multi-Media Fluid Mechanics. - GM Homsy, J Koseff, C Robertson *(Stanford Univ)* H Aref, S Thoroddsen *(Univ of Illinois, Urbana IL),* K Breuer *(Brown Univ),* S Hochgreb *(Sandia Natl Labs),* B Munson *(Iowa State Univ),* K Powell *(Univ of Michigan).* Cambridge UP, Cambridge, UK. 2000. CD-ROM. ISBN 0-521-78748-3. $19.95.

Reviewed by TF Balsa (Dept of Aerospace and Mech Eng, Univ of Arizona, Tucson AZ 85721).

This CD-ROM is a superb rendition of some of the most important concepts in fluid mechanics, including an excellent library of flow visualization pictures (mostly short movie clips and computer animations). The CD is designed to complement, either at the undergraduate or intermediate graduate levels, traditional instructor-based courses in fluid mechanics. It can also be used as a stand-alone source by a mature student, researcher, or practicing engineer to facilitate the review some of the key ideas in the subject.

The CD is very attractively produced, quick and easy to install, and runs well on a mid-priced PC ($1300–$1500 price range, about one year old; this reviewer tried it on three different computers including a laptop of the same vintage).

The CD is very moderately priced (under $20). This reviewer estimates the ratio (educational value to cost) to be (almost) infinite and has purchased three CDs for departmental use and plan to purchase another five for student use. As the reader may guess, this reviewer highly recommends the CD to both instructors as well as students. The CD enables the subject of fluid mechanics, where flow-visualization historically played an important role, to come alive to impart lasting visual impressions and images, most of them in color.

This reviewer will introduce his own terminology to describe the contents of the CD. At the outset, one should know that there is no audio. This reviewer did not find this to be a problem, but perhaps in a new release audio can be included (this is probably not as simple as it sounds). Audio would help to draw the viewers' attention to certain aspects of the visualizations. It is worth reemphasizing that the CD is meant to be a companion to a course on fluid mechanics (so the audio could come from a qualified instructor).

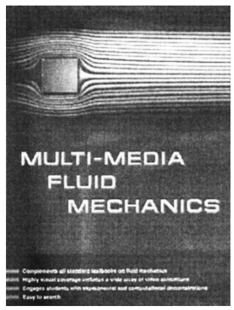
The CD contains five chapters (Dynamics, Kinematics, Boundary Layers, History, and Video Library). Each chapter contains numerous sections (eg, Reynolds Number: Inertia and Viscosity in the chapter on Dynamics); sections are further subdivided into topics (eg, Simple Flows with and without Inertia in the aforementioned section). A topic may be several pages long. A page is equivalent to a large ''window'' of information on the computer monitor. The left hand side of the page contains a verbal description of the topic, generally clearly written. The right hand side contains a visual image, usually a short and relevant movie clip.

Navigation is done by a mouse-pointer acting on pull-down menus, page tabs, or tool bars. The verbal information on a page often contains ''hot links'' to other topics. For example, still referencing the aforementioned section, one finds another topic on Dynamic Similarity. It is described on three pages (each can be brought to the foreground via tabs). A hot link in color on the second page is Vortex Shedding; a mouse click on this takes the reader to a different part of the CD; namely, the topic on Flow over Cylinder: unsteady motion. One can get ''lost'' in the book; special icons are provided for ''Home,'' ''Return,'' ''Help,'' and ''Quit.'' I think a small printed pamphlet would provide a helpful reference for the basic organization of the CD, that is, the layout of all the chapters, sections, and topics.

Compressible flow (eg, shock waves) and transport phenomena (eg, convective heat transfer) are not covered in detail. For example, the internal search-engine acting on *Shock Wave* produced one entry. The search on *Supersonic* yielded no entries. On the other hand, for incompressible flows, the entire Reynolds number range is discussed.

The CD contains a number of simulators that open up in separate java application windows. These are: 1) boundary layer solver (ie, the user provides the external steady flow for which the boundary layer development is calculated numerically), 2) a potential flow simulator that can be used to calculate the flow pattern for arbitrary combination of elementary building blocks (eg, point sources, vortices, uniform stream, etc), and 3) a molecular dynamics simulator to track the motion and interaction of many (on the order of 100) particles to develop a feel for the continuum hypothesis. This reviewer should also mention the historical material on the ''greats'' of fluid mechanics (15 in number; from Couette to von Karman) and the extensive video library containing 256 animations. The collection in the library is directly accessible without opening the other chapters.

There is a lot of material on this CD. Even an experienced researcher can spend hours(!) browsing around and viewing classic animations, either experimental or numerical. This reviewer thoroughly enjoyed this activity. Many of the video clips are also available from other sources. However, this CD is a compact (no pun intended) source of reference. The verbal descriptions are longer and much more informative than typical captions in a photo album of flow visualizations.



This reviewer is no computer expert, yet had no problem navigating through the various topics. However, this reviewer was unable to print any information from the CD or minimize the window when the CD was running. These may be minor shortcomings.

The verbal commentary is generally clear and good. There are some instances where greater precision should be exercised. For example, it is stated that the flow outside a boundary layer is irrotational. An experienced reader will immediately recognize the implicit meaning (ie, irrotational upstream flow). A student, however, may be confused. Here is where the instructor must step in. Another instance is in the potential (irrotational) flow simulator in which there is an option to view the motion of a small line of fluid particles of fixed identity. The line rotates. Again, an experienced reader will immediately understand this. A student, on the other hand, may be puzzled. Audio would also help to explain things.

Few things are perfect in life. This CD, *Multi-Media Fluid Mechanics*, is an excellent study-companion. This reviewer recommends it enthusiastically. It is also a bargain. CUP: please do not raise the price!

7N44. 30th Computational Fluid Dynamics. - von Karman Inst Fluid Dyn, Belgium. 1999.

The aim of these lecture notes on Computational Fluid Dynamics is to provide in-depth presentations of established methods and recent advances in numerical flow simulation. This book focuses on the computation of compressible flow with low Mach number effects. This is notoriously known as a very stiff computational problem because of the large difference in acoustic and velocity scales at low Mach number. Critical applications which are studied are low speed combustion and flame propagation, two phase flows, pressurization and plume formation, but also flow in high lift devices in aeronautics.

The following topics will be covered in detail: Finite volume and finite element schemes for low Mach number compressible flows; Preconditioning methods for removing stiffness due to low Mach number or viscous effects; Adaptivity and error estimation for a finite element method applied to low speed combustion; Hyperbolic pde models for two-phase flow, including flux vector splitting and approximate Riemann solvers, Low Mach number and two-phase flow extensions of the AUSM scheme; A unified staggered grid pressure correction method for incompressible and compressible flow; and Applications in thermohydraulics, cavitating flow and low speed combustion.

7N45. Computational Aereosciences in the 21st Century. ICASE/LaRC Interdisciplinary Series in Science and Engineering, Vol. 8. - Edited by MD Salas *(ICASE, NASA Langley Res Center, Hampton VA)* and WK Anderson *(NASA Langley Res Center, Hampton VA).* Kluwer Acad Publ, Norwell MA. 2000. 304 pp. ISBN 0-7923-6728-6. $123.00.

Over the last decade, the role of computational simulations in all aspects of aerospace design has steadily increased. However, despite the many advances, the time required for computations is far too long. This book examines new ideas and methodologies that may, in the next 20 years, revolutionize scientific computing. The book specifically looks at trends in algorithm research, human computer interface, network-based computing, surface modeling and grid generation, and computer hardware and architecture. The book provides a good overview of the current state-of-the-art and provides guidelines for future research directions.

7N46. Industrial Computational Fluid Dynamics I. - von Karman Inst Fluid Dyn, Belgium. 1999.

Progress achieved in the modeling of thermohydraulic phenomena and in the development of robust and efficient numerical techniques makes feasible the application of the computational approach to the investigation of complex flows in situations of industrial interest. These notes present the state-of-the-art of computational solutions to industrial fluid dynamic problems by featuring the capabilities of general flow solver codes offered by different research establishments and software producers and their utilization in an industrial environment.

The first part is devoted to an introductory overview of industrial CFD. Basic lectures describe the efficient and robust schemes/methods and grid generation which can be used for a range of flows from incompressible and low speed to high speed and for steady and unsteady problems. Strong emphasis is given to turbulence modeling and its effect on the simulation.

Additional notes specifically address practical applications and the issue of the practicality of the technology by presenting comparative results for simulation and experiment. The topics cover convective-radiative heat transfer, multiphase flow including free surface flows and surface tension effects, airflow and contamination control within and around buildings, chemical reactions and mixing mass transfer as well as combustion problems.

By its nature and content, the notes are addressed to all industrial users and research laboratories which are interested in acquiring and/or developing a predictive capability in the domain of fluid flow problems, as well as to researchers interested in the application of CFD to the solution of practical problems in an industrial context.

7N47. IUTAM Symposium on Geometry and Statistics of Turbulence. Held at the Shonan International Village Center, Japan, November

1999. - Edited by T Kambe *(Univ of Tokyo, Japan)*, T Nakano *(Chuo Univ, Japan)*, T Miyauchi *(Tokyo Inst of Tech, Japan)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2000. 416 pp. ISBN 0-7923-6711-1. $159.00.

In this book, emphasis is placed on the aspect that the statistical laws in turbulence are not disconnected with the coherent structures distributing randomly in space and forming/decaying spontaneously in time, and that the anomalous scaling laws of a passive scalar in turbulence are captured from the first principle. Existence of such coherences in the stochastic processes of turbulence leads to the intermittency and also non-Gaussian statistics. Details of the geometrical structures are investigated and they are described in terms of vortices of shear layers.

7N48. Mathematical Aspects of Numerical Solution of Hyperbolic Systems. - AG Kulikovskii *(Lomonosov Moscow State Univ, Moscow, Russia)*, NV Pogorelov, AY Semenov *(Russian Acad of Sci, Moscow, Russia)*. CRC Press LLC, Boca Raton FL. 2000. 560 pp. ISBN 0-8493-0608-6. $94.95.

This book systematically presents numeric methods of solving problems in hyperbolic systems of partial differential equations. It investigates a variety of problems in gasdynamic, shallow water, magnetogasdynamic, and elasticity equations. The book contains original results obtained by the authors and presents established results in the concise form needed to understand new and more complex material.

This book investigates a number of problems and describes numerical methods based on their analysis. For some systems, it presents the authors' results on the existence and uniqueness of self-similar solutions, which can be used in the development of discontinuity-capturing, high-resolution numerical methods. The authors illustrate their work with a number of numerical and analytical solutions from various applications, and purposely present all analytical results from the viewpoint of their possible application to constructing numerical methods.

7N49. Optical Diagnostics of Particles and Droplets. - von Karman Inst Fluid Dyn, Belgium. 1999.

Particles and droplets are used in many environments to enhance heat and mass transfer, such as in Diesel combustion engines, spray drying, and in numerous agricultural and chemical processes.

These notes discuss laser velocimetry of particles and droplets by 3D laser Doppler and Doppler global velocimetry as well as phase Doppler techniques and particle image velocimetry. An extensive overview of particle-sizing techniques suiting different types of industrial processes is given. Special attention is given to the performance of advanced phase Doppler techniques in measuring both size and refractive index. Rainbow interferometry is introduced and simultaneous measurements of fuel droplet size, velocity, and refractive index is discussed.

Lectures review signal processing requirements, data processing possibilities and the prerequisites, limitations and accuracies of the techniques as well as implementations into practical instruments.

Apart from applications to specific domains, a deep analysis is provided on the theory of light scattering by small particles and on their imaging, approached by the Generalized Lorenz-Mie Theory.

7N50. Turbomachinery Blade Design Systems. - von Karman Inst Fluid Dyn, Belgium. 1999.

Three-dimensional analysis methods have reached a high level of accuracy and are now commonly used for flow and performance prediction of 3D turbomachinery components. However they do not provide any information on geometry changes needed for performance improvement. It is only recently that one has seen emerging design and optimization tools for turbomachinery components and these notes provide a state-of-the-art review on this topic.

They start with a detailed discussion of loss mechanisms in turbomachinery and how to improve performance by means of lean, sweep and end-wall contouring. This is explained for both compressors and turbines and illustrated with experimental and theoretical results. A prediction method for part-span shroud losses in transonic fans is also included. The course continues with a more global approach to the conception and optimization of turbomachines. Different phases of the design are analyzed to ensure maximum overall performance, taking into account mechanical constraints, cost and weight considerations.

The next part is devoted to computerized blade design systems. After a report on the application of inverse methods to 3D turbine and compressor blade design, it describes an optimization procedure and its CAD-CAM related geometry definitions. The course concludes with a discussion on the influence of non-ideal blade shape related to manufacturing tolerances and blade erosion.

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

A First Course in Fluid Mechanics for Civil Engineers. - DD Gray *(Dept of Civil and Env Eng, W Virginia Univ, Morgantown WV)*. Water Resources Publ, Highlands Ranch CO. 2000. 487 pp. ISBN 1-887201-11-4. $65.00. (Under review)

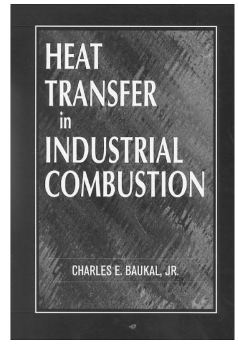
Perspectives in Fluid Dynamics: A Collective Introduction to Current Research. - GK Batchelor, HK Moffatt *(Isaac Newton Inst for Math Sci, Univ Cambridge, 20 Clarkson Rd, Cambridge, CB3 0EH, UK)*, MG Worster *(Inst of Theor Geophys, DAMTP, Univ Cambridge, Silver St, Cambridge, CB3 9EW, UK)*. Cambridge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

VI. HEAT TRANSFER

7R51. Heat Transfer in Industrial Combustion. - CE Baukal Jr *(R&D Test Center, John Zink Co LLC, Tulsa OK)*. CRC Press, Boca Raton FL. 2000. 545 pp. ISBN 0-8493-1699-5. $89.95

Reviewed by Lea-Der Chen (Dept of Mech Eng, Univ of Iowa, 2129EB, Iowa City IA 52242).

This book, as stated in Preface, is intended to "fill a gap in the literature for books on heat transfer in industrial combustion, written for the practicing engineers." This reviewer would like to congratulate the author for a well-written and a comprehensive book on industrial combustion. This book covers the three modes of heat transfer and their relevance to industrial combustion. It also covers the modeling strategies, including the thermodynamic equilibrium approximation, for example, using the robust NASA equilibrium code; correlations for heat calculation; and CFD-base multidimensional modeling. In addition, this book gives a comprehensive introduction of the experimental techniques that are important to combustion measurements. With the comprehensive review of the literature and the clear presentation of fundamentals of mass, momentum, and heat transport in combustion flames, this book should find its place as a valuable reference to practitioners in the field of combustion. As a university professor, this reviewer also finds that this book would be very useful when teaching my combustion and propulsion class (a senior-level technical elective or first-year graduate-level course). Examples from the book such as submerged burners and flame impingements will be used to illustrate the breadth and complexities of the field.



There are 12 chapters, five appendices, and two indices in the book. These chapters are, in numerical order: introduction, some fundamentals of combustion, heat transfer modes, heat sources and sinks, computer modeling, experimental techniques, flame impingement, heat transfer from burners, heat transfer in furnaces, lower temperature applications, higher temperature applications, and advanced combustion systems. The Appendices are reference sources for further information on: common conversions; methods of expressing mixture ratios for CH_4, C_3H_8, and H_2; properties for CH_4, C_3H_8, and H_2 flames; fluid dynamics equations; and material properties. The book concludes with an author index and a detailed subject index. Each chapter begins with a summary of a literature review and is followed by in-depth discussion of the chapter's subject matter. The book gives a clear link of fundamental principles to industrial combustion. At the same time, it also gives readers a working level of calculation that can be used to estimate heat transfer performance. Should the author plan a second edition of the book, perhaps it could be expanded into a handbook for heat transfer calculation for industrial combustion. In doing so, this reviewer also would like to suggest that Chapter 5 (*Computer Modeling*) be expanded to give more examples that can further illustrate the utilities and limitations of commercial CFD codes for heat transfer calculation of the industrial combustion examples.

This reviewer recommends *Heat Transfer in Industrial Combustion* to his peers as well as to the libraries of institutions for higher learning.

7R52. Thermal Stresses. - N Noda *(Dept of Mech Eng, Shizuoka Univ, Hamamatsu, Japan)*, RB Hetnarski *(Dept of Mech Eng, Rochester Inst of Tech, Rochester NY, Ja-*

pan). Y Tanigawa *(Dept of Mech Syst Eng, Osaka Prefecture Univ, Sakai, Japan).* Lastran Corp, Honeoye NY. 2000. 455 pp. ISBN 1-893000-01-X. $70.00

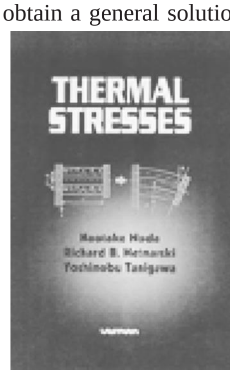
Reviewed by P Puri (Dept of Math, Univ of New Orleans, 2000 Lakeshore Dr, New Orleans LA 70148).

The authors of this book are three eminent researchers who have made significant contributions to thermoelasticity. They have produced an excellent textbook. It is meant for senior undergraduates or graduate students. The reader is expected to be familiar with engineering mechanics and partial differential equations. Some use is made of Laplace transforms and special functions, in particular, the Bessel functions and the Legendre polynomials and functions. Appendices at the end of the book give adequate information on these topics. While the book is primarily meant as a textbook, it can also be useful to researchers as it contains the solutions to the basic problems in thermal stresses.

The language is clear and the illustrative examples are well chosen. They help the reader understand the processes of thermal stresses. For example, one of the illustrative examples is that of a clamped beam subjected to thermal expansion. This example explains very clearly how the thermal stresses are produced. Another illustrative example is the case of two horizontal bars of equal length, but different thermal expansion coefficients, with left ends clamped and right ends attached to a plate that can translate, but not rotate. When the bars are subjected to heating, one of them is subjected to stretching and the other to compression in addition to the thermal expansion. The stresses produced because of these effects are thoroughly analyzed. This reviewer presents these cases as a sample of the simple, but illustrative examples given throughout the book. A salient feature of the book is that most of the exercises have answers. This allows the book to be self instructional. The authors have been able to bring this book to the level of a beginning graduate student. They have successfully avoided notational obfuscation.

Chapter 1 is on thermal stresses in bars. The basic notion of stress and strain is presented. A number of solved examples are given to illustrate the theory. Chapter 2 discusses the thermal stresses in beams. This chapter starts with an exposition of stresses in beams due to mechanical loads, thereby explaining the concept of bending stress (normal stress) and bending moments. After this introductory section, thermal stresses in beams of different shapes and materials under various boundary and initial conditions are calculated.

Chapter 3 contains the derivation of the classical heat conduction equation based on Fourier's law. The concepts of convection and radiation are explained. Solutions to several basic elementary problems are given. In Chapter 4, the governing equations of steady state thermoelasticity are developed. A general solution of Navier's equations in terms of displacement functions and also in terms of Boussinesq-Papkovitch functions is derived. The analogy between the gradient of the temperature term in the thermoelastic equations and the body force term in the isothermal equations of elasticity is analyzed. Finally, the basic equations of thermoelasticity in terms of cylindrical and spherical coordinate systems and for multiply connected domains are derived. Chapter 5 is on plane problems in thermoelasticity. First, the notion of plane stress and plane strain is explained; then the governing equations for plane problems are derived. The governing equations are simplified by introducing the thermal stress function, and a general solution is presented. In the next section, the complex variable method is explained. In the last section, potential functions are introduced to obtain a general solution.



Chapter 6 contains solutions to the problems on thermal stresses in circular cylinders. The following techniques are discussed: The displacement technique, Thermal stress function, Thermoelastic potential, Complex variables, and the Dislocation method. A variety of problems are solved in order to explain these methods. Chapter 7 covers the determination of thermal stresses in spherical bodies. Starting with a simple one-dimensional example of thermal stresses in a spherical shell, the authors present solutions to problems of increasing complexity. Chapter 8 contains problems on thermal stresses in plates. A number of different boundary conditions and thermal loadings are considered. The problems of both theoretical and practical interest are solved.

Chapter 9 contains the analyses of thermal buckling of beams. In the process of buckling, small temperature variations can cause large effects, thereby causing instability. The final chapter is on thermodynamics as it relates to thermoelasticity. In the first section, the mathematical expression for the principle of energy conservation for thermoelasticity is derived. The second section is on the second law of thermodynamics. In this section, the reversible and irreversible processes, the cycle of Carnot, and the entropy are explained. In the next section, the Helmholtz free energy function, F, is introduced, and the Gibbs thermodynamic potential is expressed in terms of F, the stress and strain tensors. It is shown that the function, F, is independent of the spatial gradients of temperature. Entropy and stresses are expressed as gradients of F with respect to the temperature and the strain, respectively. Equations of heat conduction and the dynamical equations of thermoelasticity are derived in Section 4. The loss of energy due to mechanical expansion is taken into account, and the heat conduction equation contains the gradient of strain. Thus, the heat conduction equation and the dynamical equation of motion are coupled. A general solution of these equations is given. Section 5 is on variational theorems in thermoelasticity. Section 6 is on the uniqueness theorem, and the last section is on the reciprocal theorem. In this section, the use of the reciprocal theorem is made to solve a one-dimensional problem of thermal loading of a circular cylinder.

The authors have chosen, quite wisely, not to include the current developments in generalized thermoelasticity based on non-Fourier heat conduction laws. This subject has yet to reach maturity, and its inclusion would have increased the size and scope of the book excessively.

Thermal Stresses is strongly recommended as a textbook for a course in thermoelasticity, for libraries of universities at which engineering is taught, and for libraries of technical and research institutions. It is recommended for researchers as a source book for significant problems in thermoelasticity and their solutions under the classical regimes.

7R53. Transport Phenomena: Equations and Numerical Solutions. - E Saatdjian *(ENSIC-INPL, Vandoeuvre, France).* Wiley, W Sussex, UK. 2000. 414 pp. ISBN 0-471-62230-3.

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

The author has undertaken the ambitious project of writing a text that presents Transport Phenomena as well as a description of the numerical solution methods that can be used to solve such problems. The text is thus divided into two parts.

The first part (Chs 1–7) is devoted to Transport Phenomena. Conservation equations are written in Chapter 1; these include mass, momentum, and energy conservation equations. Chapter 2 is on incompressible fluid dynamics, beginning with the Bernoulli Equation and continuing with unsteady flows, dimensional analysis, laminar and turbulent flows in a tube, flow over a flat plate, and a corresponding numerical solution formulation.

Chapter 3 covers conduction heat transfer. Some of the topics are steady-state conduction, heat flow through a composite plane or cylindrical wall, fin theory, and unsteady heat conduction. Forced convection is the subject of Chapter 4. Problems considered are laminar flow in a circular tube, flow in an annulus, external flow over a flat plate, and heat exchangers.

Chapter 5 continues with natural convection heat transfer. The areas covered include dimensional analysis for natural convection problems, natural convection in a porous medium, mixed convection, and experimental results obtained for various problems. Chapter 6 is on radiation heat transfer with topics such as black body radiation, view factors, radiation in enclosures, gray bodies, and radiation in absorbing media.

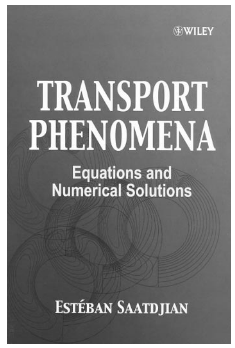
Mass transfer is the subject of Chapter 7. Fick's Law for a binary mixture is presented, along with molecular diffusion in gases and in liquids, steady-state diffusion problems, falling liquid films, and simultaneous heat and mass transfer, among other topics.

The second part of the book begins with Chapter 8 which describes the finite difference method of representing a differential equation. It presents explicit and implicit formulations and discusses how boundary conditions are treated mathematically. This chapter is relatively short, although it contains many other topics, such as solution methods for parabolic equations and for nonlinear equations. Elliptic equations are found in Chapter 9. Iterative solution methods and relaxation methods are described. One problem considered is natural convection in a porous medium. The finite volume method is the subject of Chapter 10. The method is described as are boundary conditions, unsteady regimes, and staggered grids.

The text also contains nine appendices. These are labeled alphabetically in the text as: (A) Equations in Curvilinear Coordinates; (B) Vector Analysis; (C) An Introduction to Tensor Analysis; (D) Prediction of Transport Properties; (E) Laplace Transforms; (F) Solution of Bessel's Equation; (G) Radiative Transfer in a Cloud of Particles; (H) Runge Kutta Method; and (I) Integration Using Gaussian Quadrature. Appendix E could be omitted from the text and would not be missed. Following the appendices is an index which appears to be rather complete.

Each chapter concludes with a Bibliography and (except for Chapter 10) Problems. The Bibliography sections contain titles that provide the reader with information about the topics covered in the chapter, rather than an extensive list of related topics. Some of the chapters conclude with a section titled *Examples and Problems* (rather than just Problems), in which "proof" type exercises are presented. The text contains 53 individual examples and problems.

The text is readable, although it contains an occasional Anglicanism (eg, aeroplane). The text is rather abrupt and in many places does not contain great detail especially in equation derivations. This could mean that the author may have written the text for the reader who is already familiar with Transport Phenomena. There are examples in the text that are written using italicized text, which at times may confuse the reader especially when trying to differentiate the dimension for mass from the unit for meter, or when trying to identify the symbol for absolute viscosity versus the symbol used as an SI prefix. The use of SI units is not strictly correct in a few places. In the examples where calculations are made, it would be helpful if the examples showed where the physical properties of the fluids were obtained.



The empty phrases "one can show that," and "one can easily show" have no place in any textbook, but both of these appear in Chapter 8. The footnotes, on the other hand, are very interesting. When a particular phenomenon is described and a personage is mentioned, the reader is referred to a footnote that provides information about the individual. These include such commonly recognized names as Daniel Bernoulli, as well as not so well known persons (eg, Niels Abel).

Missing from the text is an all-encompassing example that shows the methodology of solving a problem numerically. Such a problem would start with the differential equation and boundary conditions. The finite difference form of the equation and boundary conditions would be formulated. The equations would be solved and the results would be compared to the exact solution. All the information needed to do this is in the text, if it included such an example, the text would give a much better presentation.

Overall, *Transport Phenomena* is very good. It is readable and interesting and contains many problems. It would not be a very good text for a beginner in the area of Transport Phenomena, but for someone already familiar with fluid dynamics, heat transfer and mass transfer, the text is a good one. It would make a very good addition to any reference library. The book can be used successfully in the classroom if supplemented with more problems.

7R54. Turbulent Combustion. - N Peters *(Institut fur Technische Mechanik, RWTH, Aachen, Germany).* Cambridge UP, Cambridge, UK. 2000. 304 pp. ISBN 0-521-66082-3. $69.95.

Reviewed by AM Kanury (Dept of Mech Eng, Oregon State Univ, Corvallis OR 97331-6001).

Written by an author who is well-known in the field, this handsomely produced book is intended for researchers and students of engineering and applied mathematics as an introduction to turbulent combustion. Before examining the details of its content, let us consider the following background setting of the field of turbulence without and with combustion.

Most of the fluid flows are turbulent, be they reacting or non-reacting, and be they in nature or in manmade devices. The fundamental character of turbulence remained elusive over much of the last century. It has been said quite a while ago, "...there is a problem that is common to many fields, that is very old, and that has not been solved...in spite of its importance to (its) sister sciences. It is the analysis of ...*turbulent fluids*... we ought to solve some day,..." [*The Feynman Lectures on Physics*, Vol 1, p. 3.9, Addison-Wesley, (1963)].

Even in flows which are simpler due to absence of chemical reactions, once fluctuations in the flow are found to give rise to the Reynolds stresses, the resultant *closure problem* occupied much of the researchers' attention through the decades. Progress was tenuous in topics such as eddy diffusivity analyses, mixing length hypotheses, statistics of turbulence intensity, coherent structures and strange attractors. Prediction schemes proliferated, often with multiple *fitting* constants which bore little or no physical meaning. Only over the very recent years did the advances in speed and capacity of computation make possible substantial progress. Predominant carriers of energy in the flow are sought to be identified through techniques using probability distribution functions, orthogonal decompositions, direct numerical simulations and large eddy simulations.

In the field of turbulent reactive flows, ie, in combustion science, one of the sisters, the story is much the same. Damköhler's classical 1940 measurements of the dependency of turbulent flame speed on the flow Reynolds number got hashed and rehashed for decades. So also has been his explanation that turbulence enhances mixing/transport at low Reynolds numbers and increases the flame surface area at the high. Again, an intense research activity into the nature of turbulent flames has been inspired only in the last two decades by the advent of laser-based non-intrusive flame diagnostics coupled with high-speed computation for modeling and data processing. Roughly only in the last two decades too, the asymptotic theory of flames has been developed to answer certain previously unanswered important questions.

In the book presently being reviewed, Peters sets down the resultant progress in an elegant, methodical, and unified framework. The writing style is uniformly excellent. The title *Turbulent Combustion*, however, does not quite correctly convey the fact that almost all of this book deals only with gas flames. (''Turbulent Flames'' or ''Turbulent Combustion of Gases'' would probably have been better.)

The book is composed of four chapters. Chapter 1 is 65 pages long and is an excellent overview of modeling approaches for turbulent flows and of asymptotic flame theory. Chapters 2, 3, and 4 are 103, 66, and 24 pages long, respectively. They deal with the three distinct cases of flames in premixed, nonpremixed, and partially-premixed fuel+oxidant gases. At the end is given a valuable two-page Epilogue recapitulating the restrictions under which one can combine the methodologically disparate turbulence theory on one hand and the asymptotic flame theory on the other. The exhaustive Bibliography (with over 500 entries) is a strong feature in that each entry is complete with the title of the paper. This is something pleasing to this reviewer and something unusual in a world where, sadly, it is not uncommon for an author to cite a reference without ever having read it. Finally, the volume ends with an extensive author index and a short subject index.

Given in Chapter 1 is a brief review of statistical description of turbulent flows. Application of the fluctuations in the flow quantities is demonstrated to lead through the Navier-Stokes equations to the notion of the Reynolds stress tensor. Concepts useful in modeling to estimate the stresses are brought to the fore. These include: turbulent kinetic energy, viscous dissipation, the Taylor length and the Kolmogorov scales of length and time. A discussion of the energy and species conservation equations of the reactive flow forms the basis of identifying the conserved scalar which plays a major role in the models of Chapter 3. The asymptotic flame theory has then been presented briefly in order to define the spatial regions of preheating, fuel consumption, and oxidation across a flame in a fuel+oxidant gas mixture. Also introduced here are the various available combustion models to be encountered in future chapters.

Chapter 2 begins with a nice introduction to the fundamental flame speed of a given combustible gas mixture, flame thickness, and turbulent burning speed. A diagram is presented to show the different conditions required for combustion to occur in a laminar flame, wrinkled flamelets, corrugated flamelets, thin reaction zones, and broken reaction zones. The rest of the chapter deals with several modeling approaches to describe these different sorts of turbulent flames. Of special importance is the prediction of the flame surface area and thereby the turbulent burning speed as dependent on turbulence intensity. In the large scale turbulence regime where corrugated flamelets prevail, the model shows that the product of fundamental flame speed and gradient of the conserved scalar turns out to be independent of the molecular properties so that it can be calculated in terms of the viscous dissipation and turbulent kinetic energy. In the small scale turbulence regime where a thin reaction zone prevails, on the other hand, the model shows that the product of diffusivity and square of the gradient of the conserved scalar ought to be independent of the molecular properties so that it too can be calculated in terms only of the dissipation and kinetic energy. Both of these results, quite consistent with the explanations of Gerhard Damköhler, are compared with newer measurements. The chapter ends with numerical calculations of one- and multidimensional flames.

Chapter 3 is on turbulent flames arising when the fuel and oxidant gases are admitted into the combustor separately, ie, diffusion flames. In these flames, whose characteristics are independent of the very fast chemistry, all scalars such as temperature, species concentrations, and density are uniquely related to a conserved scalar known as the *mixture fraction*. This is illustrated for the: classical problem of Burke and Schumann; candle flame; counterflow diffusion flame; and one-dimensional unsteady laminar mixing layer. Here, too, a map is presented to show the different conditions (pertaining to the mixture fraction distribution, its root mean square fluctuation and the scalar dissipation rate) which would result in flames that are either contiguous reaction zones or separated flamelets. The mixture fraction distribution is obtained in a model for a turbulent jet diffusion flame. (A one-page-long discussion of the length of a buoyant turbulent gas jet diffusion flame seems to serve a purpose none other than simply interrupting the important exposition on the mixture fraction distribution.) Experimental measurements of composition and temperature as functions of the mixture fraction are presented. The chapter is concluded with modeling of laminar and turbulent flamelets, predictions of reactive scalar fields for pollutant formation, and quick surveys of modeling gas turbine combustion, burners and diesel engines.

Chapter 4, the shortest and most qualitative one in this book, is on turbulent combustion of partially premixed gases. Here alone, and quite passingly, liquid fuel vaporization and combustion is mentioned. When a liquid fuel is injected into a combustion chamber and vaporized, the fuel+oxidant mixture in the vicinity of the injector port is neither premixed nor nonpremixed but is highly nonuniform in composition. Another situation in which the mixture is partially premixed arises in the *lift-off* (and stabilization at the lift-off height) of turbulent jet diffusion flames. Combustion in these mixtures of nonuniform composition poses special practical, modeling and computational challenges. This chapter is, in the main, made up of the topics of: *triple flames* in ignition and stabilization of lifted turbulent jet diffusion flames; scaling and numerical simulation of lift-off heights; and modeling turbulent flame propagation in mixtures of nonhomogeneous mixtures. The coverage on these topics seems to be done in strokes of a rather broader brush, briefer, and mathematically less detailed than that on other topics in the earlier chapters.

The unavailability of a nomenclature makes reading of this book a bit difficult. Topical indexing is less than adequate. This book probably will have only a limited use as an advanced graduate textbook, for it does not appear quite helpful for someone seeking freshly to be introduced to the science of gas flames. The scope and level of its contents make it an excellent repository of important developments in a difficult topical area. Every library must have a copy of it. People who are deeply involved in studying turbulent combustion of gases, and those who already know the material fairly well will enjoy and benefit from it. Being the result of a marriage of turbulence to combustion, it is bound to become an exciting addition to an applied mathematician's bookshelf. Having said all the good things and some minor not-so-good things about it, this reviewer believes that *Turbulent Combustion* will probably be counted among the most significant steps of progress in turbulence—progress for which Feynman so fondly longed. It will serve as a thorough, ready, and reliable reference for all combustion experts and modelers.

7N55. Cool Thermodynamics. - JM Gordon *(Dept of Energy and Env Phys, Ben-Gurion Univ of the Negev, Boqer Campus, Israel)* and Kim Choon Ng *(Dept of Mech and Prod Eng. Natl Univ, Singapore).* Cambridge Int Sci Publ, Cambridge, UK. 2000, 260 pp. ISBN 1-898326-908.

This book is geared toward those interested in the engineering and physics of air-conditioning and refrigeration devices (chillers). Analytic thermodynamic models are developed for a wide variety of cooling systems and a broad range of operating conditions. The focus is on mechanical (electrically-driven) chillers, primarily reciprocating and centrifugal machines. There is also substantial material on heat-driven absorption chillers, heat pumps, heat transformers and other common chiller types, such as thermoelectric, thermoacoustic, and vortex-tube units. There are 14 chapters.

7N56. Introduction to Turbulent Combustion. - von Karman Inst Fluid Dyn, Belgium. 1999.

The aim of these lecture notes is to present a state-of-the-art review of the on-going activities in this domain and indicate the current research directions. Introductory notes on the fundamentals of combustion, and in particular, of turbulent combustion are followed by up-to-date reviews on the numerical modeling and experimental results in single and two-phase flows and an appraisal of the future challenges and perspectives in this domain.

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

VII. EARTH SCIENCES

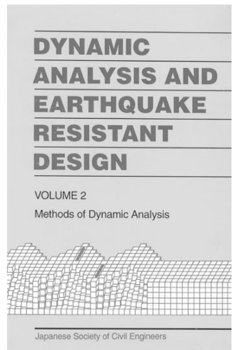
7R57. Dynamic Analysis and Earthquake Resistant Design, Volume 2: Methods of Dynamic Analysis. - Japanese Soc of Civil Eng. Balkema Publ, Rotterdam, Netherlands, 2000. 304 pp. ISBN 90-5410-292-6. $75.00.

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

This book is the English translation of the second volume of a four-volume series published originally in Japanese in 1989. The stated intention of this series is to provide the basic knowledge necessary to understand earthquake engineering in general and to analyze the dynamic response of civil structures such as foundations, dams, industrial facilities, bridges, in-ground structures, and port and harbor structures. The contents of the series are purported to be based on well-tested engineering facts and hence the emphasis is on clear exposition of *known procedures*. A specific objective of the series is to help readers understand the philosophy of earthquake-resistant design adopted by Japanese civil engineers. The focus of the volume under review is on outlining the various methods for dynamic response calculations of buildings, ground, and the foundation. The book is authored by a group of 19 researchers from various Japanese universities and research laboratories. There are 357 references with about 150 of these being in Japanese language.

The volume has two parts of almost equal length: the first part addresses methods of dynamic analysis and the second part deals with dynamic analysis of the ground and the foundation.

The first part has four chapters. A discussion on transfer matrix method, FEM, BEM, finite difference method for earthquake response analysis of structures and the ground is given in Chapter 1. Normal mode expansions and direct integration methods are explained elegantly in Chapter 2. Issues on random response analysis and inelastic response spectra are also discussed, but rather too briefly. Chapter 3 mainly focuses on the equivalent linearization method to treat nonlinear problems. A brief foray into Eulerian and Lagrangian descriptions is also made. Questions on dynamic analysis of soil-structure interactions are discussed in Chapter 4. The use of FEM, BEM, and substructuring schemes is clearly brought out.



The second part of the book also has four chapters and it begins with a discussion on input ground motions. This covers special topics such as underground earthquake motion distribution and on spatial variability of ground motion. Linear and nonlinear analyses of response of multi-layered ground to base motions are discussed in the next Chapter. This chapter also discusses earthquake motion analysis of irregular grounds and man made structures such as dams. Problems of rupture of ground due to earthquakes, together with discussion on liquefaction and slope stability, are covered in the following chapter. The concluding chapter discusses interaction between ground and foundations and also issues related to design guidelines on dynamic interactions.

The book has excellent intentions and offers commendable coverage of wide-ranging issues in earthquake response analysis of structures and the ground. Of particular merit is the discussion on response of ground and analysis of ground failures. The readers who would benefit the most are those who seek first cut information on the basic issues in seismic response analysis and are willing to approach more specialized literature for further details. For instance, the book does not aim to illustrate the response analysis procedures although the procedures themselves are described in some detail. The book is by and large well produced and contains nuggets of information encapsulated in elegant tables and graphs. It would have been useful if the contents and details of other volumes in the series were provided in Volume II. This is particularly so since parts of Volume II need to be read in conjunction with material given in Volume I. Given that the Japanese version of this book appeared in 1989, the reviewer wishes that the English translation could have appeared a bit early. The translation work seems to have introduced a few non-standard terminologies: for instance, a non-Gaussian random process is termed ‘‘abnormal’’. This reviewer would have personally preferred the use of SI units instead of units such as ‘‘gals’’ and ‘‘kine’’. There are several minor spelling and grammatical mistakes; a few of the graphs do not bear units/legends. These could be easily corrected in a future edition of the book.

On the whole, this reviewer considers *Dynamic Analysis and Earthquake Resistant Design, Volume 2: Methods of Dynamic Analysis* to be an excellent contribution to the literature on earthquake engineering. The book qualifies to be a reference book that certainly would be a valuable addition to libraries of universities and research laboratories pursuing earthquake engineering research.

7N58. Geotechnics of High Water Content Materials. (STP 1374). - TB Edil and PJ Fox. ASTM, W Conshohocken PA. 2000. 406 pp. ISBN 0-8031-2855-X. $68.00.

Written by worldwide leaders in their field, this book examines a broad range of topics covering geotechnical engineering developments in high water content materials. Emphasis is given to construction on marginal lands and disposal of high water content waste materials.

Various types of high water content materials are explored, including peats and organic soils, soft silts and clays, bentonite slurries, paper sludges, wastewater sludges, dredgings, lime wastes, and mine tailings. Papers also explore geotechnical problems, including handling and disposal, dewatering, stabilization, hydraulic performance, settlement, stability, in situ testing, and construction.

This book contains 26 peer-reviewed chapters in four sections which cover fundamentals, theory, and modeling; laboratory investigations; field performance; and case histories.

IX. BIOENGINEERING

7N59. Acoustical Imaging, Volume 25. - Edited by PNT Wells and M Halliwell *(Dept of Med Phys and Bioeng, Bristol General Hospital, UK).* Kluwer Acad Publ, Dordrecht, Netherlands. 2000. 580 pp. ISBN 0-306-46516-7. $175.00.

This proceedings, from the 25th International Symposium of Acoustical Imaging, contains articles on the following topics: mathematics and physics of acoustical imaging, transducers and arrays, nondestructive evaluation, geophysical and underwater ultrasonics, microscopy and microscanning, scattering by blood and tissue, medical and biological image formation, tissue characterization, tissue and motion and blood flow, elasticity imaging, hard tissues, and novel and emerging methods.

Contents includes keynote papers on mathematics and physics of acoustical imaging; transducers and arrays; nondestructive evaluation; geophysical and underwater ultrasonics; microscopy and microscanning; scattering by blood and tissue; medical and biological image formation; tissue characterization; tissue motion and blood flow; elasticity imaging; hard tissues; and novel and emerging methods. An author index and subject index are provided.

X. GENERAL & MISCELLANEOUS

7N60. Nonsmooth/Nonconvex Mechanics: Modeling, Analysis and Numerical Methods. Nonconvex Optimization and its Applications, Vol 50. - Edited by DY Gao *Dept of Math, VPI, Blacksburg VA)*, RW Ogden *(Dept of Math, Univ of Glasgow, UK)*, GE Stavroulakis *(Dept of Civil Eng, Inst of Appl Mech, Carolo Wilhelmina Tech Univ, Braunschweig, Germany)*. Kluwer Acad Publ, Dordrecht, Netherlands. 2001. 516 pp. ISBN 0-7923-6786-3. $157.00.

This volume contains 22 chapters written by various leading researchers and presents a cohesive and authoritative overview of recent results and applications in the area of nonsmooth and nonconvex mechanics.

The mathematical topics discussed in this book include variational and hemivariational inequalities, duality, complementarity, variational principles, sensitivity analysis, eigenvalue and resonance problems, and minimax problems. Applications are considered in the following areas among others: nonsmooth statics and dynamics, stability of quasi-static evolution processes, friction problems, adhesive contact and debonding, inverse problems, pseudoelastic modeling of phase transitions, chaotic behavior in nonlinear beams, and nonholonomic mechanical systems.

Author Index for July 2001

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