11R2. Matrix Methods of Structural Analysis, Second Edition. - MB Kanchi *(Ballistic Missiles Div, Space and Tech Group, TRW)*. Wiley, New York. 1993. 561 pp. ISBN 0-470-21859-2. $41.95.

Reviewed by DW Nicholson (Dept of Mech and Aerospace Eng, Univ of Central Florida, PO Box 25000, Orlando FL 32816).

The first edition of the above-titled book was published ten years earlier in India. This second edition, according to the preface, has been extensively rewritten and enlarged to incorporate finite element notions. This edition goes well beyond the classical framework viewpoints typical of earlier texts with similar titles. It appears to be best suited for upper division undergraduate courses in civil engineering, and includes a good selection of well-stated problems. However, it ends with topics that are not generally included in such courses, including dynamic response and incremental nonlinear methods. Complete and properly paced coverage of this text would appear to require a two-semester sequence.

The presentation is technically sound and is written on a consistent pedagogical level. Despite the term *matrix methods* in the title, there is little formal use of matrix mathematics. Instead, the subject matter is typically presented using simple applications, for example using cantilevered beams, which give rise to low order systems amenable to *manual* solution. The number and detail of such applications is striking.

The first chapter is introductory. The second and third chapters give an elementary review of basic concepts of structural mechanics. Chapter 4 introduces virtual work with little recourse to the notions of variational calculus. Chapters 5 and 6 review the conventional flexibility and force methods of structural mechanics. Chapters 7-10 introduce the finite element method using simple applications. Chapter 11 addresses dynamic response including numerical intergration methods. Chapters 12 and 13 concern nonlinear finite element analysis based on incremental principles, including iterative solution algorithms. Finally, Chapter 13, entitled *Computational aspects*, primarily describes the input for a finite element code addressing plane elastic problems. The FORTRAN listing of the code is given. For the most part, as previously noted, the presentations are based on examples. In a few cases, for example time integration methods, there are more formal developments, which generally are very similar to corresponding sections of well known texts in structural mechanics and finite element analysis.

To this reviewer, the earlier frame-oriented matrix methods textbooks are no longer of interest. However, textbooks whose primary goal is to present the finite element method risk shortchanging the structural mechanics viewpoint. The current text attempts to maintain this viewpoint, while using finite element concepts pervasively as a tool. From a pedagogical standpoint, the attempt is not completely successful. For example, the principle of virtual work is discussed in Chapter 4 using simple applications. However, it is thereafter hardly mentioned. It appears doubtful that systematic construction of finite element approximations will not be impressed upon the student, unless the instructor supplements the text. It would certainly appear desirable for the instructor to provide a finite element code with which to ask the student to check many of the examples used in the text.

The textbook could have used more careful editing and proofreading. For example, "weight functions" are elsewhere called "weighting functions." Some of the notation is confusing. Further, the print quality and paper do not meet high standards. However, *Matrix Methods of Structural Analysis* is affordable to students and the content and presentation are otherwise of satisfactory quality.

11N3. Computational Methods and Experimental Measurements VII. Proc of 7th Int Conf, Capri, Italy, May 1995. - Edited by GM Carlomagno *(Univ of Naples, Naples, Italy)* and CA Brebbia *(Wessex IT, Southampton, UK)*. Comput Mech, Billerica MA. 1995. 770 pp. ISBN 1-56252-237-X. $298.00.

This book contains the edited versions of the papers presented at the Seventh International Conference on Computational Methods and Experimental Measurements, held in Capri, Italy, May 16-18, 1995.

These proceedings deal with developing a better understanding of how to match computational methods with experiment. The greater diversity of engineering and scientific software, together with the emergence of increasingly powerful computer codes, has led to an increasing need to re-appraise experimental validation. More efficient experiments are being developed to assess numerical results, and these proceedings provide material relating to experimental results with those obtained from programs.

Contents include: General measurements; Heat and mass transfer; Fluid mechanics; Fluid measurements; Flow in machines, cavitation, and sedimentation; Fluid mechanics of floating bodies; Geology and water resources; Vibrations; Solid and applied mechanics; Fracture mechanics; Structural dynamics and fatigue; and Materials.

11N4. Iterative Methods for Linear and Nonlinear Equations. Frontiers in Applied Mathematics Series, Vol 16. - CT Kelley *(Dept of Math, Center for Res and Sci Comput, N Carolina State Univ, Raleigh NC)*. SIAM, Phila, PA. 1995. 165 pp. ISBN 0-89871-352-8. $32.50. Softcover.

Linear and nonlinear systems of equations are the basis for many, if not most, of the models of phenomena in science and engineering, and their efficient numerical solution is critical to progress in these areas. Although this book stresses recent developments in this area, such as Newton-Krylov methods, considerable material on linear equations has been incorporated. It focuses on a small number of methods and treats them in depth.

This work provides an analysis of the conjugate gradient and generalized minimum residual iterations as well as recent advances including Newton-Krylov methods, incorporation of inexactness and noise into the analysis, new proofs and implementations of Broyden's method, and globalization of inexact Newton methods.

Examples, methods, and algorithmic choices are based on applications to infinite dimensional problems such as partial differential equations and integral equations. The analysis and proof techniques are constructed with the infinite dimensional setting in mind and the computational examples and exercises are based on the MATLAB environment.

Contents include: *Preface* - How to get the software; *Part I: Linear Equations* - Chapter 1: Basic concepts and stationary iterative methods; Chapter 2: Conjugate gradient iteration; Chapter 3: GMRES iteration; *Part II: Nonlinear Equations* - Chapter 4: Basic concepts and fixed point iteration; Chapter 5: Newton's method; Chapter 6: Inexact Newton methods; Chapter 7: Broyden's method; Chapter 8: Global convergence; Bibliography; and Index.

Finite Element Procedures. - K-J Bathe *(Dept of Mech Eng, MIT)*. Prentice-Hall, Englewood Cliffs NJ. 1996. 1037 pp. ISBN 0-13-301458-4. (Under review)

II. DYNAMICS & VIBRATION

11R5. Fundamentals of Vehicle Dynamics. - TD Gillespie *(Univ of Michigan Transportation Res Inst)*. SAE, Warrendale PA. 1992. 493 pp. ISBN 1-560-199-9.

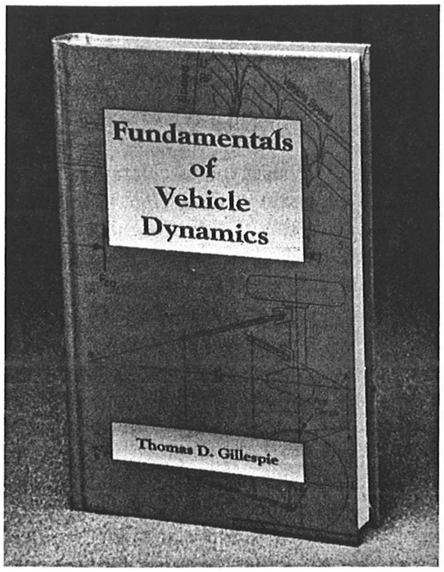
Reviewed by ML Nagurka (Carnegie Mellon Res Inst, 700 Technology Dr, Pittsburgh PA 15219).

In this hardcover book, Thomas Gillespie presents the engineering principles and analytical methods to explain the performance of an automobile. The author claims that his goal is to introduce the basic mechanics governing vehicle dynamics and to familiarize the reader with available analytical methods and appropriate terminology. In this spirit, he attempts to balance "doses of equations with practical explanations of the mechanics involved."

The subject of *vehicle dynamics* is concerned with the motion of all vehicles, such as aircraft, ships, trains, and off-road ground vehicles, and is much broader than the book's title reflects. The coverage of the text is specific to driver-steered pneumatic-tired vehicles such as automobiles and trucks operating on road surfaces.

The book is divided into ten chapters, each of which is well referenced. Chapter 1 is an Introduction and reviews fundamentals of modeling and the concept of dynamic axle loads. Performance issues associated with acceleration (including power-limited and traction-limited acceleration) and braking are discussed in Chapters 2 and 3, respectively. Chapter 4 addresses road loads, such as aerodynamic forces and rolling resistance. Ride quality issues, in terms of excitation sources, vehicle response properties, and perception of ride, are covered in Chapter 5. Chapter 6 discusses steady-state cornering. Suspension and steering systems are characterized in Chapters 7 and 8, respectively; and the concept of vehicle roll-over is presented in Chapter 9. The final chapter gives a detailed discussion of tires.

Although there are no end-of-chapter problems, most of the chapters include a section of solved example problems, making the book particularly well suited for self-study. (End-of-chapter problems would be an asset if the book were to be used as a course textbook.) There are also two appendices drawn from Society of Automotive (SAE) documents. The first covers vehicle dynamics terminology; the second is an SAE ride and vibration data manual.



The book balances well-written explanations of concepts (backed by an extensive set of excellent figures) with fully-developed solutions of example problems. It includes a significant amount of information for the "real" practitioner. Physical insights abound, and topics are well organized. However, it should be noted that the level of mathematics is basic, and (in spots) the book is a bit "thin" on free body diagrams and on rigorous derivations of the appropriate equations. There are few competitive books (possibly *Vehicle Dynamics* by JR Ellis and *Theory of Ground Vehicles* by JY Wong.) The book seems up-to-date covering topics such as anti-lock brakes and active ride control, but makes no reference to software for analysis and design of automotive systems nor for forensic engineering (such as accident reconstruction). It promises wide appeal to those seeking an introduction to the physics of automotive performance.

The author presents, in a single textbook, the basics of automobile dynamics. Clearly, such an endeavor cannot be exhaustive neither in terms of material presented nor in its range of examples. To his credit, the author has written a serious engineering textbook with wide coverage, and many readers will benefit by his contribution. *Fundamentals of Vehicle Dynamics* is appropriate for those seeking a reference book as well as for engineering students in a vehicle dynamics course. In summary, this book is a highly-recommended addition to the library of every engineer who is concerned with automobile dynamics.

11R6. Mechanical and Structural Vibrations. - DG Fertis *(Akron OH)*. Wiley, New York. 1995. 804 pp. ISBN 0-471-10600-3. $84.95.

Reviewed by M Ewing (Dept of Aerospace Eng, Univ of Kansas, 2004 Learned Hall, Lawrence KS 66049).

This book is primarily intended as a text for both undergraduate and graduate students in civil, mechanical, or aerospace engineering and engineering mechanics. Based on the examples used, the student of civil engineering will find the text more in line with his or her discipline. The text includes all of the topics one would expect in a vibration text, plus a number of advanced topics and a strong coverage of model simplification and numerical methods of solution. With regard to audience, the book is very much appropriate for a year-long undergraduate class or a semester-long graduate class. A practicing engineer may also find the book a reasonable choice for self-study, especially if one has an interest in surveying the field of structural vibrations with a special interest modeling approximations and numerical solutions schemes.

The early chapters in the text are mostly conventional. However, as an example of the numerical solution schemes presented, the "acceleration impulse extrapolation method" is given for use in nonperiodic forced response analyses of descretized systems. For continuous systems, the concept of a "dynamic hing" is used to idealize a multi-span, uniform beam by considering its "dyanamically equivalent system." This technique can be useful whenever one has an idea where in a structure's mode shape the internal moment is zero or near zero. The author reports excellent results for uniform beams by estimating the location of the dynamic hinge (where the internal moment is zero) by using a static analysis of the larger structure.

In a chapter on commonly used vibration analysis methods, the techniques of Rayleigh and Stodola are presented for free vibration analysis. A good deal of attention is given to the transfer matrix methods of Myklestad, Prohl, and Holzer for both free and forced vibration. Numerous examples with shafts and beams are given in great detail. The chapter on the finite element method is dedicated to beams and plates. The element formulations and the system of equations in both cases are obtained by minimizing the total potential energy of the system. Coverage of the geometric nonlinearity due to initial prestress in a beam is nicely presented. The solution schemes given for the finite element method include direct integration and modal superposition, in both cases using the Newmark-Beta method for approximate solutions.

In the next chapter, modal analysis is presented in conjunction with techniques to derive system equations of motion with Lagrange's equations. Techniques for discretized systems are presented first, then a discussion of beam and thin plates makes up the coverage of continuous systems. This chapter closes with the very practical consideration of earthquake response of framed civil structures. A whole chapter is then dedicated to vibration response of beam and frame structures with variable stiffness, including inelastic response. The approach used throughout is to use equivalent linear, nonlinear, and pseudolinear systems to model the structures. The following chapter covers the use of Fourier and LaPlace transforms to solve for the forced response of structures - especially very simple systems or the equivalent systems of more complex structures.

Variational calculus is presented in a chapter shared with an introduction to random vibrations. Both presentations are well done and of appropriate rigor for an elementary text. A nice study of the acoustic response of concrete (in a strength assessment study) finishes the chapter. The final chapter presents the elements of dimensional and model analysis. The inclusion of these topics is yet another example of the attention to matters of engineering practice which characterize this text. This reviewer is unaware of such coverage elsewhere.

In summary, *Mechanical and Structural Vibrations* includes a thorough treatment of the elements of mechanical vibration, with particular emphasis on civil structures. Perhaps the most unique aspect of the text is the attention to methods of approximation in both modeling and numerical solution. College and university instructors, especially in civil engineering, should consider this text for either undergraduate or graduate courses in vibration.

11N7. Acoustic Radiation and Wave Propagation. Int Mech Eng Congress and Exposition, Chicago, IL, Nov 6-11, 1994. - Edited by SF Wu. ASME Press, New York. 1994. 172 pp. ISBN 0-7918-1429-7. ASME Book No G00924. $84.00. (ASME members $42.00).

The main body of papers in this volume address the following topics: acoustic radiation from a vibrating structure in relative motion with respect to the surrounding fluid medium; acoustic scattering from a finite structure; and turbulence generated sound.

11N8. Active and Passive Control of Mechanical Vibration. Int Mech Eng Congress and Exposition, Chicago IL, Nov 6-11, 1994. - Edited by YW Kwon and F Hara. ASME Press, New York. 1994. 80 pp. ISBN 0-7918-1387-8. ASME Book No G00882. $40.00. (ASME members $20.00).

The papers in this publication highlight technology and research in the area of active and passive vibration control. They not only describe