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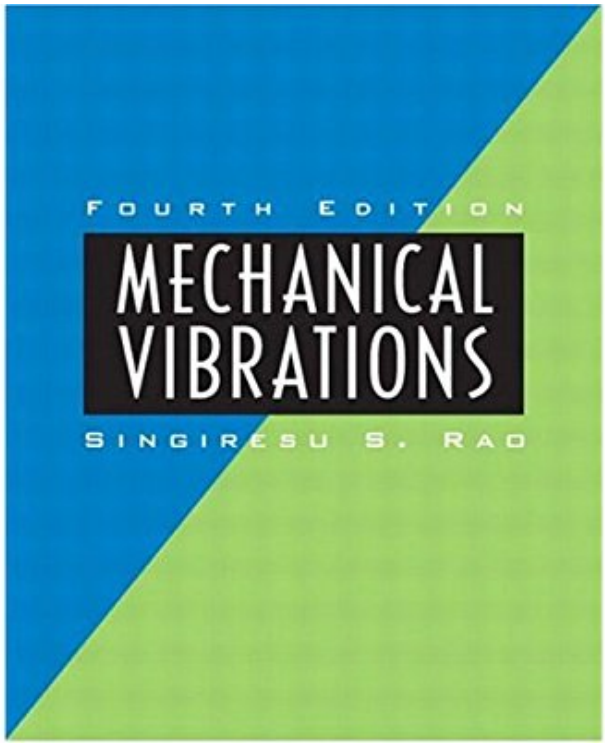

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Synopsis :

Review “This is a very comprehensive text that includes introductory, intermediate, and advanced material appropriate for mechanical engineering seniors and graduate students.” — Ara Arabyan, University of Arizona “Comprehensive coverage of virtually all vibration related topics.” — Ara Arabyan, University of Arizona “The book covers all the relevant topics of vibration analysis. The material is presented in a simple manner, easy to read, follow and understand. Moreover, illustrations are simple, yet complete and serve well the presented material and solution strategy and methodology.” — Faissal A. Moslehy, University of Central Florida “The book presents a comprehensive coverage of mechanical vibration. It is a very resourceful textbook as well as a “must have” reference.” — Faissal A. Moslehy, University of Central Florida “Presentation of a wide range of vibration topics, including experimental modal analysis, machine monitoring, nonlinear and random vibration, which are normally taught at the graduate level. This makes the book a viable reference for practicing engineers as well.” — Faissal A. Moslehy, University of Central Florida “I absolutely love this text book. This is one of my favorites Vibrations book. I must congratulate the author for doing such a great job in the planning, organization, writing, editing and continuous improvement of the book.” — Mohen Rao, Michigan Tech “The chapters are excellently written and presented. What I like about this text is that it includes all the steps in arriving an equation or conclusion and the solutions to the example problems are very detailed.” — Amir Rezael, California State Polytechnic University --This text refers to an out of print or unavailable edition of this title. Read more From the Inside Flap This text serves as an introduction to the subject of vibration engineering at the undergraduate level. The style of the prior editions has been retained, with the theory, computational aspects, and applications of vibrations presented in as simple a manner as possible. As in the previous editions, computer techniques of analysis are emphasized. Expanded explanations of the fundamentals are given, emphasizing physical significance and interpretation that build upon previous experiences in undergraduate mechanics. Numerous examples and problems are used to illustrate principles and concepts. Favorable reactions and encouragement from professors and students have provided me with the impetus to write the third edition of this book. Several new sections have been added and many topics modified and rewritten. Most of the additions were suggested by those who have used the text and by numerous reviewers. Some important changes should be noted: The sections on the history of vibration, harmonic motion and harmonic analysis are expanded in Chapter 1. In Chapter 3 the section on self-excitation and stability analysis has been rewritten and expanded. A section on earthquake response spectra has been added to Chapter 4. Two new sections, Using Newton's Second Law to Drive Equations of Motion and Free Vibration of Undamped Systems, have been added to Chapter 6. A section on forced vibration of beams has been added to Chapter 8. The sections on isolation and absorbers have been expanded in Chapter 9. The section on experimental modal analysis has been rewritten and a new section on machine condition monitoring and diagnosis has been added to Chapter 10. A section on chaos has been added to Chapter 13. A section on response of a multidegree of freedom system has been added to Chapter 14. Two new appendixes, on mathematical relationships and deflection of beams and plates, are now included. Approximately 30 new illustrative examples appear throughout the book. More than 220 new problems have been added at the ends of various chapters. In several chapters, more project type problems are now included. Features Each topic in Mechanical Vibrations is self-contained, with all concepts explained fully and the derivations presented with complete details. The computational aspects are emphasized throughout the book. Several Fortran computer programs, most of them in the form of general purpose subroutines, are included in the diskette accompanying the book. These programs are given for use by the students. Although the

programs have been tested, no warranty is implied as to their accuracy. Problems that are based on the use/development of computer programs are given at the end of each chapter and expose students to many important computational and programming details. Certain subjects are presented in a somewhat unconventional manner. The topics of Chapters 9, 10, and 11 fall in this category. Most textbooks discuss isolators, absorbers, and balancing in different places. Since one of the main purposes of the study of vibrations is to control vibration response, all topics directly related to vibration control are given in Chapter 9. The vibration-measuring instruments, along with vibration exciters, experimental modal analysis procedures, and machine condition monitoring, are presented in Chapter 10. Similarly, all the numerical integration methods applicable to single- and multi-degree of freedom systems, as well as continuous systems, are unified in Chapter 11. Specific features include the following: Nearly 130 Illustrative examples accompanying most topics. More than 50 review questions to help students in reviewing and testing their understanding of the text material. Approximately 850 problems, with solutions in the instructor's manual. More than 30 design project type problems at the ends of various chapters. Twenty-three computer programs to aid students in the numerical implementation of the methods discussed in the text. Biographical information about scientists and engineers who contributed to the development of the theory of vibrations given on the opening pages of chapters and appendixes. A convenient format for all examples: Following the statement of each example, the known information, the quantities to be determined, and the approach to be used are first identified and then the detailed solution is given. Notation and Units Both the SI and the English system of units have been used in the examples and problems. A list of symbols, along with the associated units in SI and English systems, is given following the Contents. A brief discussion of SI units as they apply to the field of vibrations is given in Appendix E. Arrows are used over symbols to denote column vectors and square brackets are used to indicate matrices. Contents Mechanical Vibrations is organized into 14 chapters and 5 appendixes. The material of the book provides flexible options for different types of vibration courses. For a one-semester senior or duel-level course, Chapters 1 through 5, portions of Chapters 6, 7, 8, and 10, and Chapter 9 may be used. The course can be given a computer orientation by including Chapter 11 in place of Chapter 8. Alternatively, with Chapters 12, 13, and 14, the text has sufficient material for a one-year sequence at the senior level. For shorter courses, the instructor can select the topics, depending on the level and orientation of the course. The relative simplicity with which topics are presented also makes the book useful to practicing engineers for purposes of self-study and as a source of references and computer programs. Chapter 1 starts with a brief discussion of the history and importance of vibrations. The basic concepts and terminology used in vibration analysis are introduced. The free vibration analysis of single degree of freedom undamped translational and torsional systems is given in Chapter 2. The effects of viscous, Coulomb, and hysteretic damping are also discussed. The harmonic response of single degree of freedom systems is considered in Chapter 3. Chapter 4 is concerned with the response of a single degree of freedom system under general forcing functions. The roles of convolution integral, Laplace transformation, and numerical methods are discussed. The concept of response spectrum is also introduced in this chapter. The free and forced vibration of two degree of freedom systems is considered in Chapter 5. The self-excited vibration and stability of the system are discussed. Chapter 6 presents the vibration analysis of multi-degree of freedom systems. Matrix methods of analysis are used for the presentation of the theory. The modal analysis procedure is described for the solution of forced vibration problems. Several methods of determining the natural frequencies of discrete systems are outlined in Chapter 7. The methods of Dunkerley, Rayleigh, Holzer, and Jacobi and matrix iteration are also discussed. The vibration analysis of continuous systems, including strings, bars, shafts, beams, and membranes is given in Chapter 8. The Rayleigh and Rayleigh-Ritz methods of finding the approximate natural frequencies are also described. Chapter 9 discusses the various aspects of vibration control, including the problems of elimination, isolation, and absorption. The balancing of rotting and reciprocating machines and the whirling of shafts are also considered. The vibration-measuring instruments, vibration exciters, and signal analysis are the topics of Chapter 10. Chapter 11 presents several numerical integration techniques for finding the dynamic response of discrete and continuous systems. The central difference, Runge-Kutta, Houbolt, Wilson, and Newmark methods are summarized and illustrated. Finite element analysis, with applications involving one-dimensional elements, is discussed in Chapter 12. An introductory treatment of nonlinear vibration, including a discussion of subharmonic and superharmonic oscillations, limit cycles, systems with time-dependent coefficients and chaos, is given in Chapter 13. The random vibration of linear vibration systems is considered in Chapter 14. Appendixes A and B focus on mathematical relationships and deflection of beams and plates, respectively. Finally, the basic relations of matrices, Laplace transforms, and SI units are outlined, respectively, in Appendixes C, D, and E. Acknowledgments I would like to express my appreciation to the many students and faculty whose comments have helped me improve this edition. I am most grateful to the following people for reviewing the book and/or offering their comments, suggestions, and ideas: Richard Alexander, Texas A&M University; C. W. Bert, University of Oklahoma; Raymond M. Brach, University of Notre Dame; Alfonso Diaz-Jimenez, Universidad Distrital 'Francisco Jose de Caldas,' Colombia; George Doyle, University of Dayton; Hamid Hamidzadeh, South Dakota State University; H. N. Hashemi, Northeastern University; Zhikun Hou, Worcester Polytechnic Institute; J. Richard Houghton, Tennessee Technological University; Faryar Jabbari, University of California-Irvine; Robert Jeffers, University of Connecticut; Richard Keltie, North Carolina State University; J. S. Lamancusa, Pennsylvania State University; Harry Law, Clemson University; Robert Leonard, Virginia Polytechnic Institute and State University; James Li, Columbia University; Sameer Madanshetty, Boston University; M. G. Prasad, Stevens Institute of Technology; F. P. J. Rimrott, University of Toronto; Subhash Sinha, Auburn University; Daniel Stutts, University of Missouri-Rolla; Massoud Tavakoli, Georgia Institute of Technology; Theordore Terry, Lehigh University; Chung Tsui, University of Maryland-College Park; Alexander Vakakis, University of Illinois-Urbana Champaign; Chuck Van Karsen, Michigan Technological University; Aleksandra Vinogradov, Montana State University; K. W. Wang, Pennsylvania State University; William Webster, GMI Engineering and Management Institute. It has been gratifying to work with the staff of Addison-Wesley throughout this revision. In particular, the help of Stuart Johnson, Publishing Partner, has been most valuable. Helen Wythe, Senior Production Supervisor, and Marybeth Mooney, Production Coordinator, handled the task of incorporating my corrections and revisions very efficiently. I would like to thank Purdue University for granting me permission to use the Boilermaker Special in Problem 2.82. Finally, I wish to thank my wife, Kamala, and daughters Sridevi and Shobha without whose patience, encouragement, and support this edition might never have been completed. S. S. Rao --This text refers to an out of print or unavailable edition of this title. Read more See all Editorial Reviews

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