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STRUCTURAL DYNAMICS

CRC Press Dynamics is increasingly being identified by consulting engineers as one of the key skills which needs to be taught in civil engineering degree programs. This is driven by the trend towards lighter, more vibration-prone structures, the growth of business in earthquake regions, the identification of new threats such as terrorist attack and the increased availability of sophisticated dynamic analysis tools. Martin Williams presents this short, accessible introduction to the area of structural dynamics. He begins by describing dynamic systems and their representation for analytical purposes. The two main chapters deal with linear analysis of single (SDOF) and multi-degree-of-freedom (MDOF) systems, under free vibration and in response to a variety of forcing functions. Hand analysis of continuous systems is covered briefly to illustrate the key principles. Methods of calculation of non-linear dynamic response is also discussed. Lastly, the key principles of random vibration analysis are presented - this approach is crucial for wind engineering and is increasingly important for other load cases. An appendix briefly summarizes relevant mathematical techniques. Extensive use is made of worked examples, mostly drawn from civil engineering (though not exclusively - there is considerable benefit to be gained from emphasizing the commonality with other branches of engineering). This introductory dynamics textbook is aimed at upper level civil engineering undergraduates and those starting an M.Sc. course in the area.

FUNDAMENTALS OF STRUCTURAL DYNAMICS

John Wiley & Sons From theory and fundamentals to the latest advances in computational and experimental modal analysis, this is the definitive, updated reference on structural dynamics. This edition updates Professor Craig's classic introduction to structural dynamics, which has been an invaluable resource for practicing engineers and a textbook for undergraduate and graduate courses in vibrations and/or structural dynamics. Along with comprehensive coverage of structural dynamics fundamentals, finite-element-based computational methods, and dynamic testing methods, this Second Edition includes new and expanded coverage of computational methods, as well as introductions to more advanced topics, including experimental modal analysis and "active structures." With a systematic approach, it presents solution techniques that apply to various engineering disciplines. It discusses single degree-of-freedom (SDOF) systems, multiple degrees-of-freedom (MDOF) systems, and continuous systems in depth; and includes numeric evaluation of modes and frequency of MDOF systems; direct integration methods for dynamic response of SDOF systems and MDOF systems; and component mode synthesis. Numerous illustrative examples help engineers apply the techniques and methods to challenges they face in the real world. MATLAB(r) is extensively used throughout the book, and many of the .m-files are made available on the book's Web site. Fundamentals of Structural Dynamics, Second Edition is an indispensable reference and "refresher course" for engineering professionals; and a textbook for seniors or graduate students in mechanical engineering, civil engineering, engineering mechanics, or aerospace engineering.

STRUCTURAL DYNAMICS

THEORY AND COMPUTATION

Springer Science & Business Media The use of COSMOS for the analysis and solution of structural dynamics problems is introduced in this new edition. The COSMOS program was selected from among the various professional programs available because it has the capability of solving complex problems in structures, as well as in other engineering fields such as Heat Transfer, Fluid Flow, and Electromagnetic Phenomena. COSMOS includes routines for Structural Analysis, Static, or Dynamics with linear or nonlinear behavior (material

nonlinearity or large displacements), and can be used most efficiently in the microcomputer. The larger version of COSMOS has the capacity for the analysis of structures modeled up to 64,000 nodes. This fourth edition uses an introductory version that has a capability limited to 50 nodes or 50 elements. This version is included in the supplement, **STRUCTURAL DYNAMICS USING COSMOS 1**. The sets of educational programs in Structural Dynamics and Earthquake Engineering that accompanied the third edition have now been extended and updated. These sets include programs to determine the response in the time or frequency domain using the Ff (Fast Fourier Transform) of structures modeled as a single oscillator. Also included is a program to determine the response of an inelastic system with elastoplastic behavior and a program for the development of seismic response spectral charts. A set of seven computer programs is included for modeling structures as two-dimensional and three dimensional frames and trusses.

ELEMENTS OF EARTHQUAKE ENGINEERING AND STRUCTURAL DYNAMICS

Presses inter Polytechnique "In order to reduce the seismic risk facing many densely populated regions worldwide, including Canada and the United States, modern earthquake engineering should be more widely applied. But current literature on earthquake engineering may be difficult to grasp for structural engineers who are untrained in seismic design. In addition no single resource addressed seismic design practices in both Canada and the United States until now. Elements of Earthquake Engineering and Structural Dynamics was written to fill the gap. It presents the key elements of earthquake engineering and structural dynamics at an introductory level and gives readers the basic knowledge they need to apply the seismic provisions contained in Canadian and American building codes."--Résumé de l'éditeur.

BASIC STRUCTURAL DYNAMICS

John Wiley & Sons A concise introduction to structural dynamics and earthquake engineering Basic Structural Dynamics serves as a fundamental introduction to the topic of structural dynamics. Covering single and multiple-degree-of-freedom systems while providing an introduction to earthquake engineering, the book keeps the coverage succinct and on topic at a level that is appropriate for undergraduate and graduate students. Through dozens of worked examples based on actual structures, it also introduces readers to MATLAB, a powerful software for solving both simple and complex structural dynamics problems. Conceptually composed of three parts, the book begins with the basic concepts and dynamic response of single-degree-of-freedom systems to various excitations. Next, it covers the linear and nonlinear response of multiple-degree-of-freedom systems to various excitations. Finally, it deals with linear and nonlinear response of structures subjected to earthquake ground motions and structural dynamics-related code provisions for assessing seismic response of structures. Chapter coverage includes: Single-degree-of-freedom systems Free vibration response of SDOF systems Response to harmonic loading Response to impulse loads Response to arbitrary dynamic loading Multiple-degree-of-freedom systems Introduction to nonlinear response of structures Seismic response of structures If you're an undergraduate or graduate student or a practicing structural or mechanical engineer who requires some background on structural dynamics and the effects of earthquakes on structures, Basic Structural Dynamics will quickly get you up to speed on the subject without sacrificing important information.

ADVANCED STRUCTURAL DYNAMICS AND ACTIVE CONTROL OF STRUCTURES

Springer Science is for those who learn; poetry for those who know. —Joseph Roux This book is a continuation of my previous book, Dynamics and Control of Structures [44]. The expanded book includes three additional chapters and an additional appendix: Chapter 3, "Special Models"; Chapter 8, "Modal Actuators and Sensors"; and Chapter 9, "System Identification." Other chapters have been significantly revised and supplemented with new topics, including discrete-time models of structures, limited-time and -frequency grammians and reduction, almost-balanced modal models, simultaneous placement of sensors and actuators, and structural damage detection. The appendices have also been updated and expanded. Appendix A consists of thirteen new Matlab programs. Appendix B is a new addition and includes eleven Matlab programs that solve examples from each chapter. In Appendix C model data are given. Several books on structural dynamics and control have been published. Meirovitch's textbook [108] covers methods of structural dynamics (virtual work, d'Alembert's principle, Hamilton's principle, Lagrange's and Hamilton's equations, and modal analysis of structures) and control (pole placement methods, LQG design, and modal control). Ewins's book [33] presents methods of modal testing of structures. Natke's book [111] on structural identification also contains excellent material on structural dynamics. Fuller, Elliot, and Nelson [40] cover problems of structural active control and structural acoustic control.

INTRODUCTION TO STRUCTURAL DYNAMICS AND AEROELASTICITY

Cambridge University Press This text provides an introduction to structural dynamics and aeroelasticity, with an emphasis on conventional aircraft. The primary areas considered are structural dynamics, static aeroelasticity and dynamic aeroelasticity. The structural dynamics material emphasizes vibration, the modal representation and dynamic response.

Aeroelastic phenomena discussed include divergence, aileron reversal, airload redistribution, unsteady aerodynamics, flutter and elastic tailoring. More than one hundred illustrations and tables help clarify the text and more than fifty problems enhance student learning. This text meets the need for an up-to-date treatment of structural dynamics and aeroelasticity for advanced undergraduate or beginning graduate aerospace engineering students.

STRUCTURAL DYNAMICS OF EARTHQUAKE ENGINEERING

THEORY AND APPLICATION USING MATHEMATICA AND MATLAB

Elsevier Given the risk of earthquakes in many countries, knowing how structural dynamics can be applied to earthquake engineering of structures, both in theory and practice, is a vital aspect of improving the safety of buildings and structures. It can also reduce the number of deaths and injuries and the amount of property damage. The book begins by discussing free vibration of single-degree-of-freedom (SDOF) systems, both damped and undamped, and forced vibration (harmonic force) of SDOF systems. Response to periodic dynamic loadings and impulse loads are also discussed, as are two degrees of freedom linear system response methods and free vibration of multiple degrees of freedom. Further chapters cover time history response by natural mode superposition, numerical solution methods for natural frequencies and mode shapes and differential quadrature, transformation and Finite Element methods for vibration problems. Other topics such as earthquake ground motion, response spectra and earthquake analysis of linear systems are discussed. Structural dynamics of earthquake engineering: theory and application using Mathematica and Matlab provides civil and structural engineers and students with an understanding of the dynamic response of structures to earthquakes and the common analysis techniques employed to evaluate these responses. Worked examples in Mathematica and Matlab are given. Explains the dynamic response of structures to earthquakes including periodic dynamic loadings and impulse loads Examines common analysis techniques such as natural mode superposition, the finite element method and numerical solutions Investigates this important topic in terms of both theory and practise with the inclusion of practical exercise and diagrams

STRUCTURAL DYNAMICS

RECENT ADVANCES

Springer Science & Business Media This book contains some new developments in the area of Structural Dynamics. In general it reflects the recent efforts of several Austrian research groups during the years 1985 - 1990. The contents of this book cover both theoretical developments as well as practical applications and hence can be utilized by researchers as well as the practicing engineers. Quite naturally, realistic modeling of a number of load types such as wind and earthquake loading, etc. , requires taking into account statistical uncertainties. Hence these loads have to be characterized by stochastic processes. As a consequence, stochastic aspects must play a major role in modern structural dynamics. Since an extended modeling of the load processes should not be counterbalanced by simplifying the structural models, considerable efforts have been put into the development of procedures which allow the utilization of e. g. FE models and codes which are utilized presently in context with simplified, i. e. "deterministic" load models. Thus the processing of the additional information on loads as well as including statistical properties of the material allows to provide additional answers, i. e. quantification of the risk of structural failure. This volume concentrates on four major areas, i. e. on load modeling, structural response analysis, computational reliability procedures, and finally on practical application. Quite naturally only special fields and particular, i. e. selected types of problems can be covered. Specific reference is made, however, to cases where generalizations are possible.

STRUCTURAL DYNAMICS

CONCEPTS AND APPLICATIONS

CRC Press Structural Dynamics: Concepts and Applications focuses on dynamic problems in mechanical, civil and aerospace engineering through the equations of motion. The text explains structural response from dynamic loads and the modeling and calculation of dynamic responses in structural systems. A range of applications is included, from various engineering disciplines. Coverage progresses consistently from basic to advanced, with emphasis placed on analytical methods and numerical solution techniques. Stress analysis is discussed, and MATLAB applications are integrated throughout. A solutions manual and figure slides for classroom projection are available for instructors.

NONLINEARITY IN STRUCTURAL DYNAMICS

DETECTION, IDENTIFICATION AND MODELLING

CRC Press Many types of engineering structures exhibit nonlinear behavior under real operating conditions. Sometimes the unpredicted nonlinear behavior of a system results in catastrophic failure. In civil engineering, grandstands at sporting events and concerts may be prone to nonlinear oscillations due to looseness of joints, friction, and crowd movements.

STRUCTURAL DYNAMICS WITH APPLICATIONS IN EARTHQUAKE AND WIND ENGINEERING

Springer This book offers a comprehensive introduction to the theory of structural dynamics, highlighting practical issues and illustrating applications with a large number of worked out examples. In the spirit of "learning by doing" it encourages readers to apply immediately these methods by means of the software provided, allowing them to become familiar with the broad field of structural dynamics in the process. The book is primarily focused on practical applications. Earthquake resistant design is presented in a holistic manner, discussing both the underlying geophysical concepts and the latest engineering design methods and illustrated by fully worked out examples based on the newest structural codes. The spectral characteristics of turbulent wind processes and the main analysis methods in the field of structural oscillations due to wind gusts and vortex shedding are also discussed and applications illustrated by realistic examples of slender chimney structures. The user-friendly software employed is downloadable and can be readily used by readers to tackle their own problems.

STRUCTURAL DYNAMICS

John Wiley & Sons Across many disciplines of engineering, dynamic problems of structures are a primary concern. Civil engineers, mechanical engineers, aircraft engineers, ocean engineers, and engineering students encounter these problems every day, and it is up to them systematically to grasp the basic concepts, calculation principles and calculation methods of structural dynamics. This book focuses on the basic theories and concepts, as well as the application and background of theories and concepts in engineering. Since the basic principles and methods of dynamics are applied to other various engineering fields, this book can also be used as a reference for practicing engineers in the field across many multiple disciplines and for undergraduate and graduate students in other majors as well. The main contents include basic theory of dynamics, establishment of equation of motion, single degree of freedom systems, multi-degree of freedom systems, distributed-parameter systems, stochastic structural vibrations, research projects of structural dynamics, and structural dynamics of marine pipeline and risers. Whether for the veteran engineer or student, this is a must-have for any scientific or engineering library.

TWELVE LECTURES ON STRUCTURAL DYNAMICS

Springer Science & Business Media This text addresses the modeling of vibrating systems with the perspective of finding the model of minimum complexity which accounts for the physics of the phenomena at play. The first half of the book (Ch.1-6) deals with the dynamics of discrete and continuous mechanical systems; the classical approach emphasizes the use of Lagrange's equations. The second half of the book (Ch.7-12) deals with more advanced topics, rarely encountered in the existing literature: seismic excitation, random vibration (including fatigue), rotor dynamics, vibration isolation and dynamic vibration absorbers; the final chapter is an introduction to active control of vibrations. The first part of this text may be used as a one semester course for 3rd year students in Mechanical, Aerospace or Civil Engineering. The second part of the text is intended for graduate classes. A set of problems is provided at the end of every chapter. The author has a 35 years experience in various aspects of Structural dynamics, both in industry (nuclear and aerospace) and in academia; he was one of the pioneers in the field of active structures. He is the author of several books on random vibration, active structures and structural control.

STRUCTURAL DYNAMICS

EURODYN 2002 : PROCEEDINGS OF THE 4TH [I.E. 5TH] INTERNATIONAL CONFERENCE ON STRUCTURAL DYNAMICS, MUNICH, GERMANY, 2-5 SEPTEMBER 2002

CRC Press The proceedings contain contributions presented by authors from more than 30 countries at EURODYN 2002. The proceedings show recent scientific developments as well as practical applications, they cover the fields of theory of vibrations, nonlinear vibrations, stochastic dynamics, vibrations of structured elements, wave propagation and structure-borne sound, including questions of fatigue and damping. Emphasis is laid on vibrations of bridges, buildings, railway structures as well as on the fields of wind and earthquake

engineering, respectively. Enriched by a number of keynote lectures and organized sessions the two volumes of the proceedings present an overview of the state of the art of the whole field of structural dynamics and the tendencies of its further development.

ELEMENTS OF STRUCTURAL DYNAMICS

A NEW PERSPECTIVE

John Wiley & Sons Structural dynamics is a subset of structural analysis which covers the behavior of structures subjected to dynamic loading. This subject has seen rapid growth and also change in how the basic concepts can be interpreted. For instance, the classical notions of discretizing the operator of a dynamic structural model have given way to a set-theoretic, function-space based framework, which is more conducive to implementation with a computer. This modern perspective, as adopted in this book, is also helpful in putting together the various tools and ideas in a more integrated style. Elements of Structural Dynamics: A New Perspective is devoted to covering the basic concepts in linear structural dynamics, whilst emphasizing their mathematical moorings and the associated computational aspects that make their implementation in software possible. Key features: Employs a novel 'top down' approach to structural dynamics. Contains an insightful treatment of the computational aspects, including the finite element method, that translate into numerical solutions of the dynamic equations of motion. Consistently touches upon the modern mathematical basis for the theories and approximations involved. Elements of Structural Dynamics: A New Perspective is a holistic treatise on structural dynamics and is an ideal textbook for senior undergraduate and graduate students in Mechanical, Aerospace and Civil engineering departments. This book also forms a useful reference for researchers and engineers in industry.

FUNDAMENTALS OF STRUCTURAL DYNAMICS

THEORY AND COMPUTATION

Springer Nature This text closes the gap between traditional textbooks on structural dynamics and how structural dynamics is practiced in a world driven by commercial software, where performance-based design is increasingly important. The book emphasizes numerical methods, nonlinear response of structures, and the analysis of continuous systems (e.g., wave propagation). Fundamentals of Structural Dynamics: Theory and Computation builds the theory of structural dynamics from simple single-degree-of-freedom systems through complex nonlinear beams and frames in a consistent theoretical context supported by an extensive set of MATLAB codes that not only illustrate and support the principles, but provide powerful tools for exploration. The book is designed for students learning structural dynamics for the first time but also serves as a reference for professionals throughout their careers.

ADVANCED STRUCTURAL DYNAMICS

Cambridge University Press Based on the author's lectures at the Massachusetts Institute of Technology, this concise textbook presents an exhaustive treatment of structural dynamics and mechanical vibration.

THE TIME DOMAIN IN SURFACE AND STRUCTURAL DYNAMICS

Springer About two years ago, while studying the dynamic properties of Fe (CO)₁₂, we realized that there was virtually no single source of information on the structural dynamics of materials. The time domain of different dynamic structural processes covers many orders of magnitude and may be investigated by numerous, vastly different, experimental techniques. Indeed, the subject seemed appropriate for a NATO Advanced Study Institute at which we could bring together chemists, physicists, metallurgists, and bioscientists using the various techniques for the study of sundry time sensitive materials. The actual Advanced Study Institute, which met in Il Ciocco, Italy, from 14 to 26 June 1987, was, in fact, a dynamic experience for those of us involved. Now we have come to the final phase, the communication of the results of this Advanced Study Institute to the general scientific community. In so doing, we hope to provide in one place a convenient source of information on dynamics at the surface and within a solid state material. The beautiful mountainous setting of Tuscany and especially the idyllic surroundings of Il Ciocco provided an ideal venue for the Advanced Study Institute. Our field trip to Pisa linked our topic to the history of time measurement through a visit to the Pisa cathedral where, presumably, Galileo first conceived the isochronism of the simple pendulum and its use in time measurement.

STRUCTURAL DYNAMICS AND PROBABILISTIC ANALYSIS FOR ENGINEERS

Elsevier Probabilistic structural dynamics offers unparalleled tools for analyzing uncertainties in structural design. Once avoided because it is mathematically rigorous, this technique has recently reemerged with the aid of computer software. Written by an author/educator with 40 years of experience in structural design, this user friendly manual integrates theories, formulas and mathematical models to produce a guide that will allow professionals to quickly grasp concepts and start solving problems. In this book, the author uses simple examples that provide templates for creating of more robust case studies later in the book. *Problems are presented in an easy to understand form *Practical guide to software programs to solve design problems *Packed with examples and case studies of actual projects *Classical and the new stochastic factors of safety

SPECTRAL ELEMENT METHOD IN STRUCTURAL DYNAMICS

John Wiley & Sons Spectral Element Method in Structural Dynamics is a concise and timely introduction to the spectral element method (SEM) as a means of solving problems in structural dynamics, wave propagations, and other related fields. The book consists of three key sections. In the first part, background knowledge is set up for the readers by reviewing previous work in the area and by providing the fundamentals for the spectral analysis of signals. In the second part, the theory of spectral element method is provided, focusing on how to formulate spectral element models and how to conduct spectral element analysis to obtain the dynamic responses in both frequency- and time-domains. In the last part, the applications of SEM to various structural dynamics problems are introduced, including beams, plates, pipelines, axially moving structures, rotor systems, multi-layered structures, smart structures, composite laminated structures, periodic lattice structures, blood flow, structural boundaries, joints, structural damage, and impact forces identifications, as well as the SEM-FEM hybrid method. Presents all aspects of SEM in one volume, both theory and applications Helps students and professionals master associated theories, modeling processes, and analysis methods Demonstrates where and how to apply SEM in practice Introduces real-world examples across a variety of structures Shows how models can be used to evaluate the accuracy of other solution methods Cross-checks against solutions obtained by conventional FEM and other solution methods Comes with downloadable code examples for independent practice Spectral Element Method in Structural Dynamics can be used by graduate students of aeronautical, civil, naval architectures, mechanical, structural and biomechanical engineering. Researchers in universities, technical institutes, and industries will also find the book to be a helpful reference highlighting SEM applications to various engineering problems in areas of structural dynamics, wave propagations, and other related subjects. The book can also be used by students, professors, and researchers who want to learn more efficient and more accurate computational methods useful for their research topics from all areas of engineering, science and mathematics, including the areas of computational mechanics and numerical methods.

STRUCTURAL DYNAMICS

Springer Science & Business Media This book introduces to the theory of structural dynamics, with focus on civil engineering structures that may be described by line-like beam or beam-column type of systems, or by a system of rectangular plates. Throughout this book the mathematical presentation contains a classical analytical description as well as a description in a discrete finite element format, covering the mathematical development from basic assumptions to the final equations ready for practical dynamic response predictions. Solutions are presented in time domain as well as in frequency domain. Structural Dynamics starts off at a basic level and step by step brings the reader up to a level where the necessary safety considerations to wind or horizontal ground motion induced dynamic design problems can be performed. The special theory of the tuned mass damper has been given a comprehensive treatment, as this is a theory not fully covered elsewhere. For the same reason a chapter on the problem of moving loads on beams has been included.

COMPUTATIONAL STRUCTURAL DYNAMICS

PROCEEDINGS OF THE INTERNATIONAL WORKSHOP, IZIIS, SKOPJE, MACEDONIA, 22-24 FEBRUARY 2001

CRC Press The papers in this volume deal with the demonstration of the possibilities offered by computational technology as to finding better solutions to problems in different fields of structural dynamics, with a special emphasis on earthquake structural dynamics.

STRUCTURAL DYNAMICS

DYNAMICS OF STRUCTURES UNDERGOING OVERALL MOTION

1. Introduction, 2. Kinematics, 3. Dynamics, 4. Control, 5. Applications. This book covers the dynamics of structures undergoing overall motion. It includes chapters on kinematics, dynamics, control, and applications. The book is written for students and practitioners in the field of structural dynamics.

STRUCTURAL DYNAMICS AND VIBRATION IN PRACTICE

AN ENGINEERING HANDBOOK

Butterworth-Heinemann This straightforward text, primer and reference introduces the theoretical, testing and control aspects of structural dynamics and vibration, as practised in industry today. Written by an expert engineer of over 40 years experience, the book comprehensively opens up the dynamic behavior of structures and provides engineers and students with a comprehensive practice based understanding of the key aspects of this key engineering topic. Written with the needs of engineers of a wide range of backgrounds in mind, this book will be a key resource for those studying structural dynamics and vibration at undergraduate level for the first time in aeronautical, mechanical, civil and automotive engineering. It will be ideal for laboratory classes and as a primer for readers returning to the subject, or coming to it fresh at graduate level. It is a guide for students to keep and for practicing engineers to refer to: its worked example approach ensures that engineers will turn to Thorby for advice in many engineering situations. Presents students and practitioners in all branches of engineering with a unique structural dynamics resource and primer, covering practical approaches to vibration engineering while remaining grounded in the theory of the topic. Written by a leading industry expert, with a worked example lead approach for clarity and ease of understanding. Makes the topic as easy to read as possible, omitting no steps in the development of the subject; covers computer based techniques and finite elements

STRUCTURAL DYNAMICS

John Wiley & Sons Across many disciplines of engineering, dynamic problems of structures are a primary concern. Civil engineers, mechanical engineers, aircraft engineers, ocean engineers, and engineering students encounter these problems every day, and it is up to them systematically to grasp the basic concepts, calculation principles and calculation methods of structural dynamics. This book focuses on the basic theories and concepts, as well as the application and background of theories and concepts in engineering. Since the basic principles and methods of dynamics are applied to other various engineering fields, this book can also be used as a reference for practicing engineers in the field across many multiple disciplines and for undergraduate and graduate students in other majors as well. The main contents include basic theory of dynamics, establishment of equation of motion, single degree of freedom systems, multi-degree of freedom systems, distributed-parameter systems, stochastic structural vibrations, research projects of structural dynamics, and structural dynamics of marine pipeline and risers. Whether for the veteran engineer or student, this is a must-have for any scientific or engineering library.

MECHANICAL VIBRATIONS

THEORY AND APPLICATION TO STRUCTURAL DYNAMICS

John Wiley & Sons

STRUCTURE-PRESERVING INTEGRATORS IN NONLINEAR STRUCTURAL DYNAMICS AND FLEXIBLE MULTIBODY DYNAMICS

Springer This book focuses on structure-preserving numerical methods for flexible multibody dynamics, including nonlinear elastodynamics and geometrically exact models for beams and shells. It also deals with the newly emerging class of variational integrators as well as Lie-group integrators. It discusses two alternative approaches to the discretization in space of nonlinear beams and shells. Firstly, geometrically exact formulations, which are typically used in the finite element community and, secondly, the absolute nodal coordinate formulation, which is popular in the multibody dynamics community. Concerning the discretization in time, the energy-momentum method and its energy-decaying variants are discussed. It also addresses a number of issues that have arisen in the wake of the structure-preserving discretization in space. Among them are the parameterization of finite rotations, the incorporation of algebraic constraints and the computer implementation of the various numerical methods. The practical application of structure-preserving methods is illustrated by a number of examples dealing with, among others, nonlinear beams and shells, large deformation problems, long-term simulations and coupled thermo-mechanical multibody systems. In addition it links novel time integration methods to frequently used methods in industrial multibody system simulation.

EXPLOITING NONLINEAR BEHAVIOR IN STRUCTURAL DYNAMICS

Springer Science & Business Media Introductory material.- Approximate methods for analyzing nonlinear structures.- Vibration isolation.- Designing nonlinear torsional vibration absorbers.- Vibrations of beams in the elasto-plastic and geometrically nonlinear regime.- Control and exploitation of nonlinearity in smart structures. The articles in this volume give an overview and introduction to nonlinear phenomena in structural dynamics. Topics treated are approximate methods for analyzing nonlinear systems (where the level of nonlinearity is assumed to be relatively small), vibration isolation, the mitigation of undesirable torsional vibration in rotating systems utilizing specifically nonlinear features in the dynamics, the vibration of nonlinear structures in which the motion is sufficiently large amplitude and structural systems with control.

ADVANCED STRUCTURAL DYNAMICS AND ACTIVE CONTROL OF STRUCTURES

Springer Science & Business Media Science is for those who learn; poetry for those who know. —Joseph Roux This book is a continuation of my previous book, Dynamics and Control of Structures [44]. The expanded book includes three additional chapters and an additional appendix: Chapter 3, “Special Models”; Chapter 8, “Modal Actuators and Sensors”; and Chapter 9, “System Identification. ” Other chapters have been significantly revised and supplemented with new topics, including discrete-time models of structures, limited-time and -frequency grammians and reduction, almo- balanced modal models, simultaneous placement of sensors and actuators, and structural damage detection. The appendices have also been updated and expanded. Appendix A consists of thirteen new Matlab programs. Appendix B is a new addition and includes eleven Matlab programs that solve examples from each chapter. In Appendix C model data are given. Several books on structural dynamics and control have been published. Meirovitch’s textbook [108] covers methods of structural dynamics (virtual work, d’Alembert’s principle, Hamilton’s principle, Lagrange’s and Hamilton’s equations, and modal analysis of structures) and control (pole placement methods, LQG design, and modal control). Ewins’s book [33] presents methods of modal testing of structures. Natke’s book [111] on structural identification also contains excellent material on structural dynamics. Fuller, Elliot, and Nelson [40] cover problems of structural active control and structural acoustic control.

STRUCTURAL DYNAMICS FUNDAMENTALS AND ADVANCED APPLICATIONS, VOLUME II

VOLUME II

Academic Press The two-volume Structural Dynamics Fundamentals and Advanced Applications is a comprehensive work that encompasses the fundamentals of structural dynamics and vibration analysis, as well as advanced applications used on extremely large and complex systems. In Volume II, d’Alembert’s Principle, Hamilton’s Principle, and Lagrange’s Equations are derived from fundamental principles. Development of large structural dynamic models and fluid/structure interaction are thoroughly covered. Responses to turbulence/gust, buffet, and static-aeroelastic loading encountered during atmospheric flight are addressed from fundamental principles to the final equations, including aeroelasticity. Volume II also includes a detailed discussion of mode survey testing, mode parameter identification, and analytical model adjustment. Analysis of time signals, including digitization, filtering, and transform computation is also covered. A comprehensive discussion of probability and statistics, including statistics of time series, small sample statistics, and the combination of responses whose statistical distributions are different, is included. Volume II concludes with an extensive chapter on continuous systems; including the classical derivations and solutions for strings, membranes, beams, and plates, as well as the derivation and closed form solutions for rotating disks and sloshing of fluids in rectangular and cylindrical tanks. Dr. Kabe’s training and expertise are in structural dynamics and Dr. Sako’s are in applied mathematics. Their collaboration has led to the development of first-of-a-kind methodologies and solutions to complex structural dynamics problems. Their experience and contributions encompass numerous past and currently operational launch and space systems. The two-volume work was written with both practicing engineers and students just learning structural dynamics in mind Derivations are rigorous and comprehensive, thus making understanding the material easier Presents analysis methodologies adopted by the aerospace community to solve complex structural dynamics problems

NONLINEAR STRUCTURAL DYNAMICS AND DAMPING

Springer This book compiles recent research in the field of nonlinear dynamics, vibrations and damping applied to engineering structures. It addresses the modeling of nonlinear vibrations in beams, frames and complex mechanical systems, as well as the modeling of damping systems and viscoelastic materials applied to structural dynamics. The book includes several chapters related to solution techniques and signal analysis techniques. Last but not least, it deals with the identification of nonlinear responses applied to condition monitoring systems.

STRUCTURAL DYNAMICS

VIBRATIONS AND SYSTEMS

Springer Nature This book introduces the theory of structural dynamics, with focus on civil engineering structures. It presents modern methods of analysis and techniques adaptable to computer programming clearly and easily. The book is ideal as a text for advanced undergraduates or graduate students taking a first course in structural dynamics. It is arranged in such a way that it can be used for a one- or two-semester course, or span the undergraduate and graduate levels. In addition, this book serves the practicing engineer as a primary reference. This book is organized by the type of structural modeling. The author simplifies the subject by presenting a single degree-of-freedom system in the first chapters and then moves to systems with many degrees-of-freedom in the following chapters. Many worked examples/problems are presented to explain the text, and a few computer programs are presented to help better understand the concepts. The book is useful to the research scholars and professional engineers, besides senior undergraduate and postgraduate students.

EXPERIMENTAL STRUCTURAL DYNAMICS

AN INTRODUCTION TO EXPERIMENTAL METHODS OF CHARACTERIZING VIBRATING STRUCTURES

Mode shapes are introduced without any reference to the eigenvalue problem, but connected immediately to simple coordinate transformations in two and three dimensions. This allows a rather simple picture of operators, ultimately leading to a straight forward derivation of the Frequency Response Function (FRF) formula.

SPECIAL TOPICS IN STRUCTURAL DYNAMICS & EXPERIMENTAL TECHNIQUES, VOLUME 5

PROCEEDINGS OF THE 39TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2021

Springer Nature Dynamics of Coupled Structures, Volume 5: Proceedings of the 39th IMAC, A Conference and Exposition on Structural Dynamics, 2021, the fourth volume of nine from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of the Dynamics of Coupled Structures, including papers on: Methods for Dynamic Substructures Applications for Dynamic Substructures Interfaces & Substructuring Frequency Based Substructuring Transfer Path Analysis

TIME-PARALLEL METHODS FOR ACCELERATING THE SOLUTION OF STRUCTURAL DYNAMICS PROBLEMS

Stanford University The classical approach for solving evolution Partial Differential Equations (PDEs) using a parallel computer consists in first partitioning the spatial domain and assigning each subdomain to a processor to achieve space-parallelism, then advancing the solution sequentially. However, enabling parallelism along the time dimension, despite its intrinsic difficulty, can be of paramount importance to fast computations when space-parallelism is unfeasible, cannot fully exploit a massively parallel machine or when near-real-time prediction is desired. The aforementioned objective can be achieved by applying classical domain decomposition principles to the time axis. The latter is first partitioned into time-slices to be processed independently. Starting with approximate seed information that provides a set of initial conditions, the response is then advanced in parallel in each time-slice using a standard time-stepping integrator. This decomposed solution exhibits discontinuities or jumps at the time-slice boundaries if the initial guess is not accurate. Applying a Newton-like approach to the time-dependent system, a correction function is then computed to improve the accuracy of the seed values and the process is repeated until convergence is reached. Methods based on the above concept have been successfully applied to various problems but none was found to be competitive for even for the simplest of second-order hyperbolic PDEs, a class of equations that covers the field of structural dynamics among others. To overcome this difficulty, a key idea is to improve the sequential propagator used for correcting the seed values, observing that the original evolution problem and the derived corrective one are closely related. The present work first demonstrates how this insight can be brought to fruition in the context of linear oscillators, with numerical examples featuring structural models ranging from academic to more challenging large-scale ones. An extension of this method to nonlinear equations is then developed and its concrete application to geometrically nonlinear transient dynamics is presented. Finally, it is shown how the time-reversibility property that characterizes some of the above problems can be exploited to develop a new framework that provides an increased speed-up factor.

STRUCTURAL DYNAMICS AND ECONOMIC GROWTH

Cambridge University Press Ever since Adam Smith, economists have been preoccupied with the puzzle of economic growth. The standard mainstream models of economic growth were and often still are based either on assumptions of diminishing returns on capital with technological innovation or on endogenous dynamics combined with a corresponding technological and institutional setting. An alternative model of economic growth emerged from the Cambridge School of Keynesian economists in the 1950s and 1960s. This model - developed mainly by Luigi Pasinetti - emphasizes the importance of demand, human learning and the growth dynamics of industrial systems. Finally, in the past decade, new mainstream models have emerged incorporating technology or demand-based structural change and extending the notion of balanced growth. This collection of essays reassesses Pasinetti's theory of structural dynamics in the context of these recent developments, with contributions from economists writing in both the mainstream and the Cambridge Keynesian traditions and including Luigi Pasinetti, William Baumol, Geoffrey Harcourt and Nobel laureate Robert Solow.

BAYESIAN METHODS FOR STRUCTURAL DYNAMICS AND CIVIL ENGINEERING

John Wiley & Sons Bayesian methods are a powerful tool in many areas of science and engineering, especially statistical physics, medical sciences, electrical engineering, and information sciences. They are also ideal for civil engineering applications, given the numerous types of modeling and parametric uncertainty in civil engineering problems. For example, earthquake ground motion cannot be predetermined at the structural design stage. Complete wind pressure profiles are difficult to measure under operating conditions. Material properties can be difficult to determine to a very precise level - especially concrete, rock, and soil. For air quality prediction, it is difficult to measure the hourly/daily pollutants generated by cars and factories within the area of concern. It is also difficult to obtain the updated air quality information of the surrounding cities. Furthermore, the meteorological conditions of the day for prediction are also uncertain. These are just some of the civil engineering examples to which Bayesian probabilistic methods are applicable. Familiarizes readers with the latest developments in the field Includes identification problems for both dynamic and static systems Addresses challenging civil engineering problems such as modal/model updating Presents methods applicable to mechanical and aerospace engineering Gives engineers and engineering students a concrete sense of implementation Covers real-world case studies in civil engineering and beyond, such as: structural health monitoring seismic attenuation finite-element model updating hydraulic jump artificial neural network for damage detection air quality prediction Includes other insightful daily-life examples Companion website with MATLAB code downloads for independent practice Written by a leading expert in the use of Bayesian methods for civil engineering problems This book is ideal for researchers and graduate students in civil and mechanical engineering or applied probability and statistics. Practicing engineers interested in the application of statistical methods to solve engineering problems will also find this to be a valuable text. MATLAB code and lecture materials for instructors available at <http://www.wiley.com/go/yuen>

STRUCTURAL DYNAMICS

MODELS, METHODS, EXAMPLES

Wiley-VCH Since vibration is a common problem in many civil engineering structures, it is becoming increasingly important for civil engineers to gain an insight into the principles involved and to know how to use modern, computer-based methods. Designed for engineering students and practitioners alike, this is a comprehensive introduction to the theory of structural dynamics, placing special emphasis on practical issues and applications, illustrated by a wide range of worked examples. The book features a large number of computer programs as ready-to-use applications on a CD-ROM, complete with detailed input/output descriptions and auxiliary software. In the spirit of "learning by doing", readers are encouraged to apply these tools immediately to their specific problems, thus familiarising themselves with the broad field of structural dynamic response in the process.

BASICS OF STRUCTURAL DYNAMICS AND ASEISMIC DESIGN

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