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Optimum Unbalance in Rotating Machinery for Maximum Bearing Life
Proceedings of the 9th IFToMM International Conference on Rotor Dynamics

JULISSA HEAVEN

Vibratory Condition Monitoring of Machines Cambridge University Press
This textbook covers the fundamentals and applications of mechanical vibrations and is useful for both undergraduate and postgraduate courses. It provides a concise and clear presentation of dynamics and vibrations including many examples to provide instant illustration and applications of the mathematical relations obtained. It contains self-explanatory sketches, graphs, and figures to curtail long text. Numerous illustrated examples, exercises, and problems at the end of each chapter serve as good sources to grasp the basic principles presented in the text. Review questions and sufficient problems have also been included at the end of each chapter with answer keys for self evaluation. This textbook can also be used as a reference book by researchers and professionals interested in vibrations.
Safety and Reliability – Safe Societies in a Changing World CRC Press
This text is intended for use as an advanced course in either rotordynamics or vibration at the graduate level. This text has mostly grown out of the research work in my laboratory and the lectures given to graduate students in the Mechanical Engineering Department, KAIST. The text contains a variety of topics not normally found in rotordynamics or vibration textbooks. The text emphasizes the analytical aspects and is thus quite different from conventional rotordynamics texts; potential readers are expected to have a firm background in elementary rotordynamics and vibration. In most previously published rotordynamics texts, the behavior of simple rotors has been of a primary concern, while more realistic, multi-degree-f-freedom or continuous systems are seldom treated in a rigorous way, mostly due to the difficulty of a mathematical treatment of such complicated systems. When one wanted to gain a deep insight into dynamic phenomena of complicated rotor systems, one has, in the past, either had to rely on computational techniques, such as the transfer matrix and finite element methods, or cautiously to extend ideas learned from simple rotors whose analytical solutions are readily available. The former methods are limited in the interpretation of results, since the calculations relate only to the simulated case, not to more general system behavior. Ideas learned from simple rotors can, fortunately, often be extended to many practical rotor systems, but there is of course no guarantee of their validity.
Inverse Problems in Engineering American Society of Mechanical Engineers
Publisher Description
Rotating Machinery Vibration CRC Press
Since 1976, the Vibrations in Rotating Machinery conferences have successfully brought industry and academia together to advance state-of-the-art research in dynamics of rotating machinery. 12th International Conference on Vibrations in Rotating Machinery contains contributions presented at the 12th edition of the conference, from industrial and academic experts from different countries. The book discusses the challenges in rotor-dynamics, rub, whirl, instability and more. The topics addressed include: - Active, smart vibration control - Rotor balancing, dynamics, and smart rotors - Bearings and seals - Noise vibration and harshness - Active and passive damping - Applications: wind turbines, steam turbines, gas turbines,

compressors - Joints and couplings - Challenging performance boundaries of rotating machines - High power density machines - Electrical machines for aerospace - Management of extreme events - Active machines - Electric supercharging - Blades and bladed assemblies (forced response, flutter, mistuning) - Fault detection and condition monitoring - Rub, whirl and instability - Torsional vibration Providing the latest research and useful guidance, 12th International Conference on Vibrations in Rotating Machinery aims at those from industry or academia that are involved in transport, power, process, medical engineering, manufacturing or construction.

Elements of the Theory and Method of Determining the Dynamic Unbalance of Rotors Nirali Prakashan

Rotating machinery is extensively used in the industry today. The dynamics of rotating machines and the critical issues associated with them have been the principal focus of a large part of the research and development in industry in recent times. The rotating machines are one of the most essential components of machinery in industry as they play a vital role in the process of transferring power from one place to another. The assemblies of the important industrial machinery such as gas turbines, compressors, hydroelectric systems, locomotives, vehicles etc. are made of different rotating parts. Therefore it becomes necessary to analyze the dynamic behavior of the rotating systems in order to understand the level of stresses to which these components are subjected to during their operation. This pre-design phase analysis can greatly contribute to the trouble shooting of the critical issues. However, the dynamic behavior of rotating machinery is quite complex which necessitates the need for understanding the mechanics behind the operation of these devices thoroughly. The complexity of the analysis increases further whenever there is an unbalance in the rotating components which leads to an undesirable whirling response. The gyroscopic effects present in the rotating disks amplify at higher rotating speeds of shafts thereby inducing some undesirable stresses in the components. Due to the complexity of these rotating structures, they are subjected to stresses during the industrial processes. So, it becomes necessary to perform the vibration analysis for predicting their behavior prior to their application phase. This analysis would be of great aid in determining the natural frequencies and the associated mode shapes of the system. Initially, a free vibration analysis is carried out which is followed by the forced vibration analysis to predict their behavior when subjected to the excitations arising from the residual unbalance and any other external excitations. The primary goal of this dissertation is to analyze the dynamic behavior of the industrial rotors and address the critical issues associated with them. Initially, a simple Jeffcott rotor is analyzed in detail to determine its natural frequencies, critical speeds from the Campbell diagram, the forward and backward whirl modes. This is followed by the analysis of an actual industrial rotor in ANSYS in order to understand its dynamic behavior which involves the detailed analysis of the Campbell diagrams, critical speeds, effect of the gyroscopic moments etc. The phenomenon called ‘Curve veering’ was observed from the inspection of the obtained natural frequencies of the system and discussed. Campbell diagrams are obtained and critical speeds, effect of the gyroscopic moments etc. are identified and discussed.

Applied Longitudinal Analysis John Wiley & Sons

This book, written for practicing engineers, designers, researchers, and students, summarizes basic vibration theory and established methods for analyzing vibrations. Principles of Vibration Analysis goes beyond most other texts on this subject, as it integrates the advances of modern modal analysis, experimental testing, and numerical analysis with fundamental theory. No other book brings all of these topics together under one cover. The authors have compiled these topics, compared them, and provided experience with practical application. This must-have book is a comprehensive resource that the practitioner will reference time and again.

Rotating Machinery Vibration John Wiley & Sons

Delineating a comprehensive theory, Advanced Vibration Analysis provides the bedrock for building a general mathematical framework for the analysis of a model of a physical system undergoing vibration. The book illustrates how the physics of a problem is used to develop a more specific framework for the analysis of that problem. The author elucidates a general theory applicable to both discrete and continuous systems and includes proofs of important results, especially proofs that are themselves instructive for a thorough understanding of the result. The book begins with a discussion of the physics of dynamic systems comprised of particles, rigid bodies, and deformable bodies and the physics and mathematics for the analysis of a system with a single-degree-of-freedom. It develops mathematical models using energy methods and presents the mathematical foundation for the framework. The author illustrates the development and analysis of linear operators used in various problems and the formulation of the differential equations governing the response of a conservative linear system in terms of self-adjoint linear operators, the inertia operator, and the stiffness operator. The author focuses on the free response of linear conservative systems and the free response of non-self-adjoint systems. He explores three method for determining the forced response and approximate methods of solution for continuous systems. The use of the mathematical foundation and the application of the physics to build a framework for the modeling and development of the response is emphasized throughout the book. The presence of the framework becomes more important as the complexity of the system increases. The text builds the foundation, formalizes it, and uses it in a consistent fashion including application to contemporary research using linear vibrations.

Rotor Dynamics New Age International

Presents 79 papers from the June 1996 conference, covering a wide range of topics in the areas of mathematics, mechanics, and heat transfer. Presented by scientists, mathematicians, and engineers from the U.S. and Europe, papers include treatments of: bidimensional inversion in microwave radiometric imaging, iteration schemes for inverse obstacle problems, and inverse approach to plasto-hydrodynamic lubrication. Annotation copyrighted by Book News, Inc., Portland, OR

Vibration Analysis of Rotating Machinery Under Induced Unbalance, Shaft Misalignment, and Coupling Deformation Springer

An in-depth analysis of machine vibration in rotating machinery Whether it's a compressor on an offshore platform, a turbocharger in a truck or automobile, or a turbine in a jet airplane, rotating machinery is the driving force behind almost anything that produces or uses energy. Counted on daily to perform any number of vital societal tasks, turbomachinery uses high rotational speeds to produce amazing amounts of power efficiently. The key to increasing its longevity, efficiency, and reliability lies in the examination of rotor vibration and bearing dynamics, a field called rotordynamics. A valuable textbook for beginners as well as a handy reference for experts, Machinery Vibration and Rotordynamics is teeming with rich technical detail and real-world examples geared toward the study of machine vibration. A logical progression of information covers essential fundamentals, in-depth case studies, and the latest analytical tools used for predicting and preventing damage in rotating machinery. Machinery Vibration and Rotordynamics: Combines rotordynamics with the applications of machinery vibration in a single volume Includes case studies of vibration problems in several different types of machines as well as computer simulation models used in industry Contains fundamental physical phenomena, mathematical and computational aspects, practical hardware considerations, troubleshooting, and instrumentation and measurement techniques For students interested in entering this highly specialized field of study, as well as professionals seeking to expand their knowledge base, Machinery Vibration and Rotordynamics will serve as the one book they will come to rely upon consistently.

Vibrations in Rotating Machinery Rotating Machinery

The book aims to impart basic knowledge of vibration and its effects on the process, functions and life of industrial machinery and acceptable limits of vibration, derived from different international standards. It highlights characteristics of vibration amplitude (displacement, velocity and acceleration), frequency and phase. It explains the basics of vibration theories of free & forced, single and double degree, damped and un-damped vibration systems, mode shapes, critical speeds of rotor and presents solution of complex vibrations in simplified mathematical models. Vibration measurement techniques, various types of transducers and their applications are also illustrated briefly. The book elaborates fault diagnosis & condition analysis techniques through simplified tabular charts for machines and mechanical modelling solution of vibration on complex bodies. Condition analysis by machine performance like efficiency, water rate, fuel consumption, or output and specific functional deviation(s) in machine is elaborated specially for setting alarms at suitable parameter of vibration. The static and dynamic balancing techniques are explored for single plane balancing, using only amplitude, amplitude and phase, or only phase for practical applications. In situ two-plane balancing by graphical, mathematical and computerized techniques are described in a simplified manner to achieve acceptable value of unbalance (reference international standards for different types of machines). The case studies of single or multi-degree freedom, damped or un-damped, torsional, and translational vibration are described for understanding, trouble diagnosis and their remedial actions to resolve the problems.

Advanced Vibration Analysis CRC Press

This book presents the proceedings of the 9th IFToMM International Conference on Rotor Dynamics. This conference is a premier global event that brings together specialists from the university and industry sectors worldwide in order to promote the exchange of knowledge, ideas, and information on the latest developments and applied technologies in the dynamics of rotating machinery. The coverage is wide ranging, including, for example, new ideas and trends in various aspects of bearing technologies, issues in the analysis of blade dynamic behavior, condition monitoring of different rotating machines, vibration control, electromechanical and fluid-structure interactions in rotating machinery, rotor dynamics of micro, nano and cryogenic machines, and applications of rotor dynamics in transportation engineering. Since its inception 32 years ago, the IFToMM International Conference on Rotor Dynamics has become an irreplaceable point of reference for those working in the field and this book reflects the high quality and diversity of content that the conference continues to guarantee.

Machine Analysis with Computer Applications for Mechanical Engineers CRC Press

The theory and method of facilitating and speeding up the process of finding the point of rotor unbalance was studied. At the present time the point of unbalance is determined with the aid of complex tracking systems (photocell-optics-oscillograph; generator, synchronously rotating with rotor; stroboscope etc.). The rotating movement of the rotor is replaced with angular oscillatory movement, with oscillation amplitude of the order of several degrees. (Author).

Dynamics of Rotating Machines Notion Press

This comprehensivereference/text provides a thorough grounding in the fundamentals of rotating machinery vibration-treating computer model building, sources and types of vibration, and machine vibration signal analysis. Illustrating turbomachinery, vibration severity levels, condition monitoring, and rotor vibration cause identification, Rotating Machinery Vibration Provides a primer on vibration fundamentals Highlights calculation of rotor unbalance response and rotor self-excited vibration Demonstrates calculation of rotor balancing weights Furnishes PC codes for lateral rotor vibration analyses Treats bearing, seal, impeller, and blade effects on rotor vibration Describes modes, excitation, and stability of computer models Includes extensive PC data coefficient files on bearing dynamics Providing comprehensive descriptions of vibration symptoms for rotor unbalance, dynamic instability, rotor-stator rubs, misalignment, loose parts, cracked shafts, and rub-induced thermal bows, Rotating Machinery Vibration is an essential reference for mechanical, chemical, design, manufacturing, materials, aerospace, and reliability engineers; and specialists in vibration, rotating machinery, and turbomachinery; and an ideal text for upper-level undergraduate and graduate students in these disciplines.

12th International Conference on Vibrations in Rotating Machinery McGraw Hill Professional

Safety and Reliability – Safe Societies in a Changing World collects the papers presented at the 28th European Safety and Reliability Conference, ESREL 2018 in Trondheim, Norway, June 17-21, 2018. The contributions cover a wide range of methodologies and application areas for safety and reliability that contribute to safe societies in a changing world. These methodologies and applications include: - foundations of risk and reliability assessment and management - mathematical methods in reliability and safety - risk assessment - risk management - system reliability - uncertainty analysis - digitalization and big data - prognostics and system health management - occupational safety - accident and incident modeling - maintenance modeling and applications - simulation for safety and reliability analysis - dynamic risk and barrier management - organizational factors and safety culture - human factors and human reliability - resilience engineering - structural reliability - natural hazards - security - economic analysis in risk management Safety and Reliability – Safe Societies in a Changing World will be invaluable to academics and professionals working in a wide range of industrial and governmental sectors: offshore oil and gas, nuclear engineering, aeronautics and aerospace, marine transport and engineering, railways, road transport, automotive engineering, civil engineering, critical infrastructures, electrical and electronic engineering, energy production and distribution, environmental engineering, information technology and telecommunications, insurance and finance, manufacturing, marine transport, mechanical engineering, security and protection, and policy making.

Dynamic Balancing of Rotating Machinery Springer Science & Business Media

This book presents select proceedings of the International Conference on Future Learning Aspects of Mechanical Engineering (FLAME 2020). The book focuses on latest research in mechanical engineering design and covers topics such as computational mechanics, finite element modeling, computer

aided engineering and analysis, fracture mechanics, and vibration. The book brings together different aspects of engineering design and the contents will be useful for researchers and professionals working in this field.

Machinery Vibration: Balancing, Special Reprint Edition CRC Press

There are increasingly many situations where the art and engineering worlds overlap. This is particularly true in the art installations created by Sarah Oppenheimer's Folding Enterprises where engineering analyses were used to evaluate the structural integrity and behavior of a dynamic glass and aluminum rotational museum installation. This structure presented a particular challenge in that its rotational axis was only connected to two outer surfaces on either side of a hollow, 52 ft3 volume of glass and aluminum, introducing the risk of axis mis-alignment and unpredictable rotational behavior. The lack of predictability in the rotational behavior of these kinetic installations poses a danger to museum inhabitants and detracts from Oppenheimer's design intent. This study was performed to specifically address the dynamic behavior surrounding the rotational equilibrium of these kinetic installations. The dynamics of the system were described through Lagrangian mechanics and simulated numerically as a rotating machine with a static unbalance. The angular motion of the model was recorded with a 6-axis inertial measurement unit supported by an Arduino Board 101. A nonlinear least squares regression method was implemented within a grey-box system identification to estimate the parameters of static unbalance in the system. A numerical algorithm implemented in MATLAB determined the appropriate counterbalance sizes and locations to selectively alter the center of gravity of the system and, as a result, shift the rotational equilibrium positions of the system of interest.

Modeling and Analysis of Dynamic Systems CRC Press

Rotating machinery is used in a variety of essential engineering systems, including motors, pumps, compressors, and gearboxes. The gas, oil, power, manufacturing, and process industries rely heavily on rotating machines. Their failures can be very expensive and lead to a decrease in production so proper maintenance is essential. Condition based maintenance is a relatively new strategy of performing maintenance on equipment when signal processing of sensor signals indicates a failure may be imminent. The most popular sensors for condition based maintenance measure the vibration of the rotating machine. These sensors provide information about the overall state of the machine and point to potential faults. This thesis studies the effectiveness of analyzing vibration data to determine the state of operation of rotating machine systems. Specifically, research and experiments are performed to discover if vibration signatures can determine if a system has certain faults, such as shaft misalignment, unbalance, or deformation in shaft couplings. The presence or absence of these faults can lead to the determination of the health of operation of a rotating machine system.

Safety and Services Management CRC Press

Diagnosis and correction are critical tasks for the vibrations engineer. Many causes of rotor vibration are so subtle and pervasive that excessive vibration continues to occur despite the use of usually effective design practices and methods of avoidance. Rotating Machinery Vibration: From Analysis to Troubleshooting provides a comprehensive, consolidated overview of the fundamentals of rotating machinery vibration and addresses computer model building, sources and types of vibration, and machine vibration signal analysis. This reference is a powerful tool to strengthen vital in-house competency on the subject for professionals in a variety of fields. After presenting governing fundamental principles and background on modern measurement, computational tools, and troubleshooting methods, the author provides practical instruction and demonstration on how to diagnose vibration problems and formulate solutions. The topic is covered in four sequential sections: Primer on Rotor Vibration, Use of Rotor Dynamic Analyses, Monitoring and Diagnostics, and Troubleshooting Case Studies. This book includes comprehensive descriptions of vibration symptoms for rotor unbalance, dynamic instability, rotor-stator rubs, misalignment, loose parts, cracked shafts, and rub-induced thermal bows. It is an essential reference for mechanical, chemical, design, manufacturing, materials, aerospace, and reliability engineers. Particularly useful as a reference for specialists in vibration, rotating machinery, and turbomachinery, it also makes an ideal text for upper-level undergraduate and graduate students in these disciplines.

Sound and Vibration Design and Analysis Springer

Vibratory Condition Monitoring of Machines discusses the basic principles applicable in understanding the vibratory phenomena of rotating and reciprocating machines. It also addresses the defects that influence vibratory phenomenon, instruments and analysis procedures for maintenance, vibration related standards, and the expert systems that help ensure good maintenance programs. The author offers a minimal treatment of the mathematical aspects of the subject, focusing instead on imparting a physical understanding to help practicing engineers develop maintenance programs and operate machines efficiently.

Analysis of Rotor Dynamics Acceptance Criteria in Large Industrial Rotors John Wiley & Sons

Uniquely comprehensive and precise, this thoroughly updated sixth edition of the well-established and respected textbook is ideal for the complete study of the kinematics and dynamics of machines. With a strong emphasis on intuitive graphical methods, and accessible approaches to vector analysis, students are given all the essential background, notation, and nomenclature needed to understand the various independent technical approaches that exist in the field of mechanisms, kinematics, and dynamics, which are presented with clarity and coherence. This revised edition features updated coverage, and new worked examples alongside over 840 figures, over 620 end-of-chapter problems, and a solutions manual for instructors.