Determination Of Unbalance In Rotating Machine Using

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Determination Of Unbalance In Rotating
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CPC Definition - Subclass G01M
Other machines measure and/or correct for force or couple unbalance. Compressive During compression a ... The cyclic load may be applied using a tensile tester with cycling capability, rotating beam ...

Deflectometers and Extensometers Specifications
Other machines measure and/or correct for force or couple unbalance. Compressive During compression a ... The cyclic load may be applied using a tensile tester with cycling capability, rotating beam ...

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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.

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.

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.

Rotating machinery (eg pumps, motors, compressors) is normally manufactured to precise measurements but there comes a point when the costs of manufacture mean that further precision is not cost-effective and thus any slight imbalance inherent in the machine will need to be attended to after manufacture. When such machinery is in operation, often at very high speeds of thousands of revs per minute, any imbalance will set up vibration and often noise. In addition, such imbalance will cause extra wear and loss of efficiency in the machine. The answer is to balance the affected parts of the machine so that it operates smoothly and efficiently. This book is a practical account of such balancing techniques e.g how to balance a rotor, how to set up and verify performance of a balancing machine, and procedures for on-site balancing. In addition, other common causes of vibration will be covered e.g. misalignment, bad bearings and looseness. This book is the distillation of a successful course run by the author and developed over 20 years. University engineering departments do not teach balancing techniques beyond the very basic, and there is a need for educators and engineers to have a practical book available on the topic. · A practical book which will help the reader understand the importance of balance in today's high technology world · Outlines the history of dynamic balancing and other vibration reduction techniques · Profusely illustrated throughout

This book opens with an explanation of the vibrations of a single degree-of-freedom (dof) system for all beginners. Subsequently, vibration analysis of multi-dof systems is explained by modal analysis. Mode synthesis modeling is then introduced for system reduction, which aids understanding in a simplified manner of how complicated rotors behave. Rotor balancing techniques are offered for rigid and flexible rotors through several examples. Consideration of gyroscopic influences on the rotordynamics is then provided and vibration evaluation of a rotor-bearing system is emphasized in terms of forward and backward whirl rotor motions through eigenvalue (natural frequency and damping ratio) analysis. In addition to these rotordynamics concerning rotating shaft vibration measured in a stationary reference frame, blade vibrations are analyzed with Coriolis forces expressed in a rotating reference frame. Other phenomena that may be assessed in stationary and rotating reference frames include stability characteristics due to rotor internal damping and instabilities due to asymmetric shaft stiffness and thermal unbalance behavior.

The aim of this book is to motivate students into learning Machine Analysis by reinforcing theory and applications throughout the text. The author uses an enthusiastic 'hands-on' approach by including photos of actual mechanisms in place of abstract line illustrations, and directs students towards developing their own software for mechanism analysis using Excel & Matlab. An accompanying website includes a detailed list of tips for learning machine analysis, including tips on working homework problems, note taking, preparing for tests, computer programming and other topics to aid in student success. Study guides for each chapter that focus on teaching the thought process needed to solve problems by presenting practice problems are included, as are computer animations for common mechanisms discussed in the text.

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.

MATLAB is an indispensable asset for scientists, researchers, and engineers. The richness of the MATLAB computational environment combined with an integrated development environment (IDE) and straightforward interface, toolkits, and simulation and modeling capabilities, creates a research and development tool that has no equal. From quick code prototyping to full blown deployable applications, MATLAB stands as a de facto development language and environment serving the technical needs of a wide range of users. As a collection of diverse applications, each book chapter presents a novel application and use of MATLAB for a specific result.

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.