Fundamentals Of Rotating Machinery Diagnostics

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Monitoring of Machines Nonstationary Vibration Diagnostics of Rotating Machinery Automated Fault Diagnosis in Rotating Machinery The Shock and Vibration Digest Rotating machinery: reliability, condition, monitoring and failure diagnostics, Manchester, 20 October 2011 Diagnostic Models for Rotating Machinery Subject to Vibration Monitoring for Condition-based Maintenance [microform] *Donald E. Bently Moncef Krarti Ahmed Felkaoui Y. Ding Siew Hon Teay International Centre for Mechanical Sciences Jaroslaw Bednarz K. et al Berge G. Diana J-Y. Jong Basir Abdul Paya J. F. Dill Agnieszka Muszynska J. S. Rao Fadi Karkafi Shilpa Reddy Pantula IMechE Fluid Machinery Group Yimin Zhan*

a practical course in the fundamentals of machinery diagnostics for anyone who works with rotating machinery from operator to manager from design engineer to machinery diagnostician this comprehensive book thoroughly explains and demystifies important concepts needed for effective machinery malfunction diagnosis a vibration fundamentals vibration phase and vibration vectors b data plots timebase average shaft centerline polar bode apht spectrum trend xy and the orbit c rotor dynamics the rotor model dynamic stiffness modes of vibration anisotropic asymmetric stiffness stability analysis torsional and axial vibration and basic balancing modern root locus methods pioneered by walter r evans are used throughout this book d malfunctions unbalance rotor bow high radial loads misalignment rub and looseness fluid induced instability and shaft cracks hundreds of full color illustrations explain key concepts and several detailed case studies show how these concepts were used to solve real machinery problems a comprehensive glossary of diagnostic terms is included

this monograph presents the latest research developments of innovative building envelope systems these systems have the ability to allow building structures responsive to changes in outdoor conditions to ensure comfortable indoor environment at higher energy efficiency compared to conventional systems

this book provides readers with a timely snapshot of the potential offered by and challenges posed by signal processing methods in the field of machine diagnostics and condition monitoring it gathers contributions to the first workshop on signal processing applied to rotating machinery diagnostics held in setif algeria on april 9 10 2017 and organized by the applied precision mechanics laboratory lmpa at the institute of precision mechanics

university of setif algeria and the laboratory of mechanics modeling and manufacturing la2mp at the national school of engineers of sfax the respective chapters highlight research conducted by the two laboratories on the following main topics noise and vibration in machines condition monitoring in non stationary operations vibro acoustic diagnosis of machinery signal processing and pattern recognition methods monitoring and diagnostic systems and dynamic modeling and fault detection

the papers presented on this occasion examined the most significant aspects of diagnostic strategies emphasizing the importance of predictive maintenance in reducing production shortages and the costs of plant management the contributions of these authors allow a critical comparison of the varied experiences in developing and applying the different diagnostic methodologies employed in several parts of the world the following problems are discussed characteristics of condition monitoring systems data acquisition techniques and data processing methodologies choice of transducers and of measurement point locations data compression techniques alarm levels evaluation acceptance regions strategies for detecting malfunction conditions diagnostic methodologies for the on line and off line identification of the cause of fault expert systems definition of the guidelines for the presentation in control rooms of monitoring data and diagnostic results rotordynamic models used off line to confirm faults diagnosed on line

vibration analysis has found widespread application for condition monitoring in a variety of applications and industries with the continual development of cheaper and more powerful processing hardware such systems have developed from utilizing simple checks on amplitude to those based around sophisticated spectral analysis this book presents application of the model based diagnostic method for early detection of faults in rotating machinery the proposed diagnostics system based on two methods modal analysis oma and omax methods and non linear signals models narx in the book the diagnostic system based on such modeling is presented the proposed system was verified during research on a specialized test rig which can generate vibration signals and on data recorded at wind turbine in the book practical aspects of the developed diagnostics system application are also discussed i e sensitivity of the method complexity of the algorithm and effort needed to apply the method on a real machine

as the most important parts of rotating machinery rotors are also the most prone to mechanical vibrations which may lead to machine failure correction is only possible when proper and accurate diagnosis is obtained through understanding of rotor operation and all of the potential malfunctions that may occur mathematical modeling in particular

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

the proper functioning of rotating machines relies on vibration monitoring of fragile rotating components such as gears and bearings concerning more particularly the case of power transmission systems in aeronautics vibration monitoring presents considerable challenges that are addressed in this thesis i nonstationary operating regimes which require the adoption of synchronous approaches ii complex interactions between different subsystems likely to mask or disturb diagnostic signals and iii noise emitted by various sources both environmental and internal making fault detection more difficult to address these challenges the diagnostic principles proposed in this thesis are structured around several objectives 1 a reliable estimation of the instantaneous angular speed allowing the synchronization of the signals with the variations of the regime 2 the extraction of the relevant vibration components to isolate the critical mechanical components and 3 the application of specific diagnostics to each component taking into account the operational variations to guarantee robustness and reliability the developed methodologies are validated by experimental data demonstrating their potential to improve the reliability and safety of transmission systems in aeronautics

rotating machinery are an important part of industrial equipment their components are subjected to harsh operating environments and hence experience significant wear and tear it is necessary that they function efficiently all the time in order to avoid significant monetary losses and down time monitoring the health of such machinery components has become an essential part in many industries to ensure their continuous operation and avoiding loss in

productivity traditionally signal processing methods have been employed to analyze the vibration signals emitted from rotating machines with time the complexity of machinery components has increased which makes the process of condition monitoring complex and time consuming and consequently costly hence a paradigm shift in condition monitoring methods towards data driven approaches has recently taken place towards reducing complexity in estimation where the monitoring of machinery is focused on purely data driven methods in this thesis a novel data driven framework to condition monitoring of gearbox is studied and illustrated using simulated and experimental vibration signals this involves analyzing the signal deriving feature sets and using machine learning algorithms to discern the condition of machinery the algorithm is implemented on data from a drivetrain dynamics simulator dds equipment designed by spectraquest inc for academic and industrial research purposes datasets from pristine state and faulty gearboxes are collected and the algorithms are tested against this data this framework has been developed to facilitate automated monitoring of machinery in industries thus reducing the need for manual supervision and interpretation

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