



Editorial: Special issue on advanced nonstationary signal processing algorithms and techniques for machinery fault diagnosis and prognosis

Industrial machinery experiences inevitable state degradation, which affects its performance and structural integrity. Timely diagnosis and prognosis of the degradation are essential to support predictive maintenance decision-making and to guarantee industrial safety and productivity. A major challenge encountered in industrial machinery diagnosis and prognosis is the non-stationarity of condition monitoring signals, primarily due to the complex nature of machinery structures and variations of operating conditions. Industrial machinery can be subject to multisource excitations and fault-induced vibration signals are usually cycle-stationary. At the same time variable operating conditions are prevalent. For instance, wind turbine gearboxes operate under random speed and load conditions due to the randomness of wind speed and direction, while train traction gearboxes operate under variable speed and load conditions when the train passes through high-curvature areas. These variable operating conditions may accelerate the degradation process of machinery and manifest in the condition monitoring data, which impede the diagnosis and prognosis of the machinery. Developing methods to effectively and efficiently process the nonstationary condition monitoring data to achieve accurate and reliable fault diagnosis and prognosis, has therefore drawn much interest over the past decade.

It is foundational to machinery diagnosis and prognosis to understand how faults manifest in the monitored signals. Zhou et al. (2023) review fault-induced vibration signal modulation effects for gears, bearing, and rotors. The effects of variable operating conditions on these fault-induced modulation signatures are detailed. The authors further review time-frequency analysis and signal decomposition methods for diagnosis purposes. Their work contribute to solidifying the foundations of machinery diagnosis and prognosis.

Operating condition information is useful to assist the processing of nonstationary condition monitoring signals. While such information is usually acquired from tachometers or load cells, estimating it from nonstationary vibration signals can potentially not only reduce the cost of hardware but also avoid the difficulty of mounting additional sensors. To this end, Li, Geog, et al. (2023) propose the time-frequency ridge extraction method enhanced with a multi-order probabilistic approach to fully exploit the operating condition information contained within the vibration response, while promising robustness to variations in the running regimes. Li, Zhang, et al. (2023) further develop a time-frequency ridge extraction method that integrates a new cost kernel function and an adaptive search region detection principle for bearing fault diagnosis.

Researchers have made advances to classical signal processing areas including envelope spectrum, mode decomposition, and sparse filtering. For detecting periodic impulses/cycle-stationary components, Chen et al. (2023) propose the product envelope spectrum optimization-gram that fuses the advantages of different generalized envelope spectra. The product envelope spectrum is approximately equivalent to the Fourier transform of the cross-correlation of the periodic components in the corresponding generalized envelopes. Song et al. (2023) propose a smart multichannel mode extraction method based on multivariate variational mode decomposition and manifold learning, which is without predefined parameter tuning and with higher computational efficiency over conventional decomposition methods. Zhang, Xu, and Chen (2023) propose label induced sparse filtering by introducing a fully-connected label layer on top of the conventional sparse representation. The discriminative ability of the sparse learned features was therefore enhanced.

Time-frequency analysis transforms the nonstationary signals into the time-frequency plane, in which both time and frequency information are shown for the extraction of fault-related signatures. Yan et al. (2023) revisit advances in wavelet transforms over the past decade. Particularly, the use of wavelet transforms in conjunction with intelligent algorithms in the sense of improving diagnosis

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Machinery Fault Diagnosis And Advanced Signal Processing

Ian Pickup



Machinery Fault Diagnosis And Advanced Signal Processing:

Intelligent Machinery Fault Diagnostics and Prognostics Deepam Goyal, Ankit Sharma, Mohamad Abou Houran, 2025-05-01 The field of machinery maintenance is undergoing a remarkable transformation driven by the convergence of intelligent technologies and data driven approaches This book delves into the fascinating world of intelligent machinery fault diagnostics and prognostics exploring how these advancements are reshaping the way we monitor diagnose and predict faults in machinery *Intelligent Machinery Fault Diagnostics and Prognostics The Future of Smart Manufacturing* uses an interdisciplinary approach to provide a well rounded understanding of smart manufacturing It discusses cutting edge smart manufacturing technologies and encompasses various aspects from sensors and data analytics to predictive maintenance The book offers real world case studies illustrating how these innovations are successfully implemented in industrial settings and includes practical guidelines and methodologies that facilitate the implementation of solutions The book also highlights the scalability and adaptability of this approach to different industries and manufacturing environments Whether this book is for industry professionals students or researchers readers can leverage the book s insights to optimize machinery performance minimize downtime reduce costs and improve safety in their respective industries Sparsity Measures and their Signal Processing Applications for Machine Condition Monitoring Dong Wang, Bingchang Hou, 2025-02-01 *Sparsity Measures and their Signal Processing Applications for Machine Condition Monitoring* presents newly designed sparsity measures and their advanced signal processing technologies for machine condition monitoring and fault diagnosis This book systematically covers new sparsity measures including a quasarithmetic mean ratio framework for fault signatures quantification a generalized Gini index as well as classic sparsity measures based on signal processing technologies and a cycle embedded sparsity measure based on new impulsive mode decomposition technology This book additionally includes a sparsity measure data driven framework based optimized weights spectrum theory and its relevant advanced signal processing technologies Provides the background roadmaps and detailed discussion of newly designed sparsity measures and their advanced signal processing technologies for machine condition monitoring and fault diagnosis Covers new theories advanced technologies and the latest contributions in the field of machine condition monitoring and fault diagnosis Particularly focuses on newly advanced sparsity measures for fault signature quantification classic and advanced sparsity measures based signal processing technologies and sparsity measures using data driven framework based signal processing technologies Provides experimental and real world practical validation cases including newly advanced sparsity measures and their advanced signal processing technologies **International Journal of Prognostics and Health Management Volume 2 (color)** PHM Society, 2013-09-24 *International Journal of Prognostics and Health Management* IJPHM was established in 2009 to facilitate archival publication of peer reviewed results from research and development in the area of PHM As a journal solely dedicated to the emerging field of PHM IJPHM is the first of its kind and has been a focal point for

dissemination of peer reviewed PHM knowledge While for the first few years the journal maintained only an online presence the printed volumes will now be available and can be obtained upon request IJPHM is dedicated to all aspects of PHM technical management economic and social In addition to regular periodic volumes IJPHM also publishes special issues with quality papers dedicated to focused topics **Engineering Asset Management** Joseph Mathew,Lin Ma,Andy Tan,Deryk Anderson,2008-02-06 It is with great pleasure that we welcome you to the inaugural World Congress on Engineering Asset Management WCEAM being held at the Conrad Jupiters Hotel on the Gold Coast from July 11 to 14 2006 More than 170 authors from 28 countries have contributed over 160 papers to be presented over the first three days of the conference Day four will be host to a series of workshops devoted to the practice of various aspects of Engineering Asset Management WCEAM is a new annual global forum on the various multidisciplinary aspects of Engineering Asset Management It deals with the presentation and publication of outputs of research and development activities as well as the application of knowledge in the practical aspects of strategic asset management risk management in asset management design and life cycle integrity of physical assets asset performance and level of service models financial analysis methods for physical assets reliability modelling and prognostics information systems and knowledge management asset data management warehousing and mining condition monitoring and intelligent maintenance intelligent sensors and devices regulations and standards in asset management human dimensions in integrated asset management education and training in asset management and performance management in asset management We have attracted academics practitioners and scientists from around the world to share their knowledge in this important emerging transdiscipline that impacts on almost every aspect of daily life

Non-Destructive Testing and Condition Monitoring Techniques in Wind Energy Fausto Pedro Garcia Marquez,Mayorkinos Papaalias,Valter Luiz Jantara Junior,2023-06-24 Non Destructive Testing and Condition Monitoring Techniques in Wind Energy looks at the complex and critical components of energy assets and the importance of inspection and maintenance to ensure their high availability and uninterrupted operation Presenting the main concepts state of the art advances and case studies this book approaches the topic by considering it as an integral part of the overall operation of any wind energy project Linking the essential NDT subject with its sub disciplines the book uses computational techniques dynamic analysis probabilistic methods and mathematical optimization techniques to support analysis of prognostic problems with defined constraints and requirements This book is the first of its kind and will provide useful insights to industrial engineers and scientists academics and students in the possibilities that NDT and condition monitoring technologies can offer Presents advances in Non Destructive Techniques and Condition Monitoring Systems applied in the energy industry Provides case studies in Fault Detection and Diagnosis and Prognosis for critical variability Offers technical maintenance actions for the observation and analyses of inspection monitoring testing diagnosis prognosis and active maintenance actions in wind

Computational Artificial Intelligence and Methods for industries Vijayarangan Natarajan,2025-07-04 This book presents

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Modern Mechanics and Applications Nguyen Tien Khiem, Tran Van Lien, Nguyen Xuan Hung, 2021-09-06 This proceedings book includes a selection of refereed papers presented at the International Conference on Modern Mechanics and Applications ICOMMA 2020 which took place in Ho Chi Minh City Vietnam on December 2 4 2020 The contributions highlight recent trends and applications in modern mechanics Subjects covered include biological systems damage fracture and failure flow problems multiscale multi physics problems composites and hybrid structures optimization and inverse problems lightweight structures mechatronics dynamics numerical methods and intelligent computing additive manufacturing natural hazards modeling The book is intended for academics including graduate students and experienced researchers interested in recent trends in modern mechanics and application

Equipment Intelligent Operation and Maintenance Ruqiang Yan, Jing Lin, 2025-03-07 The proceedings of the First International Conference on Equipment Intelligent Operation and Maintenance ICEIOM 2023 offer invaluable insights into the processes that ensure safe and reliable operation of equipment and guarantee the improvement of product life cycles The book touches upon a wide array of topics including equipment condition monitoring fault diagnosis and remaining useful life prediction With special emphasis on the integration of big data and machine learning the papers contained in this publication highlight how these technologies make the equipment operation process highly automated and ingenious Intelligent operation and maintenance is set to act as the driving force behind a new generation of smart manufacturing and equipment upgradation and promote demand for intelligent product services and management This is a highly beneficial guide to students researchers working professionals and enthusiasts who wish to stay updated on innovative research contributions and practical applications of state of the art technologies in equipment operation and maintenance

Signal Processing and Artificial Intelligence Technology for High-End Equipment Fault Diagnosis Bingyan

Chen,Yao Cheng,2025-08-25 This Reprint presents the latest research progress of signal processing and artificial intelligence technologies for fault diagnosis of high end mechanical equipment It contains 13 original research papers covering advanced dynamics modeling and mechanism analysis methods novel signal processing and artificial intelligence methods for machine fault diagnosis using various sensing technologies and their multi field applications These papers mainly report research outcomes in mechanical engineering and its interdisciplinary fields covering different themes including fault mechanism analysis structural health monitoring fault diagnosis and remaining useful life prediction of rotating machinery high end mechanical equipment in different industrial fields including the railway wind energy machinery manufacturing and aerospace industries and different sensing technologies including vibration temperature thermal imaging electrical signals and force or torque The Reprint highlights how different sensing technologies could be integrated with advanced signal processing and artificial intelligence technologies for fault diagnosis of industrial mechanical systems The research results of these interdisciplinary applications will contribute to better understanding of the mechanisms of machine fault diagnosis and remaining useful life prediction and the application of these advanced monitoring and diagnostic technologies will improve the safety and reliability of mechanical systems in various industrial fields

Materials, Industrial, and Manufacturing Engineering Research Advances 1.1 Denni Kurniawan,2013-12-04 Selected peer reviewed papers from the 1st International Materials Industrial and Manufacturing Engineering Conference MIMEC 2013 December 4 6 2013 Johor Bahru Malaysia

Intelligent Fault Diagnosis and Remaining Useful Life Prediction of Rotating Machinery Yaguo Lei,2016-11-02 Intelligent Fault Diagnosis and Remaining Useful Life Prediction of Rotating Machinery provides a comprehensive introduction of intelligent fault diagnosis and RUL prediction based on the current achievements of the author s research group The main contents include multi domain signal processing and feature extraction intelligent diagnosis models clustering algorithms hybrid intelligent diagnosis strategies and RUL prediction approaches etc This book presents fundamental theories and advanced methods of identifying the occurrence locations and degrees of faults and also includes information on how to predict the RUL of rotating machinery Besides experimental demonstrations many application cases are presented and illustrated to test the methods mentioned in the book This valuable reference provides an essential guide on machinery fault diagnosis that helps readers understand basic concepts and fundamental theories Academic researchers with mechanical engineering or computer science backgrounds and engineers or practitioners who are in charge of machine safety operation and maintenance will find this book very useful Provides a detailed background and roadmap of intelligent diagnosis and RUL prediction of rotating machinery involving fault mechanisms vibration characteristics health indicators and diagnosis and prognostics Presents basic theories advanced methods and the latest contributions in the field of intelligent fault diagnosis and RUL prediction Includes numerous application cases and the methods algorithms and models

introduced in the book are demonstrated by industrial experiences Vibrations in Rotating Machinery IMechE (Institution of Mechanical Engineers),2004 This essential text contains the papers from the 8th international IMechE conference on Vibrations in Rotating Machinery held at the University of Wales Swansea in September 2004 The themes of the volume are new developments and industrial applications of current technology relevant to the vibration and noise of rotating machines and assemblies TOPICS INCLUDE Rotor balancing including active and automatic balancing Special rotating machines including micromachines Oil film bearings and dampers Active control methods for rotating machines Smart machine technology Dynamics of assembled rotors Component life predictions and life extension strategies The dynamics of geared systems Cracked rotors detection location ad prognosis Chaotic behaviour in machines Experimental methods and discoveries Structural Health Monitoring II Tadeusz Uhl,2012-07-12 Selected peer reviewed papers from the Second International Conference on Smart Diagnostics of Structures November 14 16 2011 Cracow Poland Eighth International Conference on Quality Control by Artificial Vision David Fofi,Fabrice Meriaudeau,2007 Proceedings of SPIE present the original research papers presented at SPIE conferences and other high quality conferences in the broad ranging fields of optics and photonics These books provide prompt access to the latest innovations in research and technology in their respective fields Proceedings of SPIE are among the most cited references in patent literature CIRP Journal of Manufacturing Systems ,1999 Signal Processing for Fault Detection and Diagnosis in Electricmachines and Systems Mohamed Benbouzid,2021 **Stationary and Non-stationary Process Condition Monitoring and Fault Diagnosis and Its Application to Drilling Processes** Shuxin Gu,1997 **Fault Diagnosis and Failure Prognosis of Electrical Machines** Syed Sajjad Haider Zaidi,2010 *Frontiers of Manufacturing Science and Measuring Technology* Ran Chen,Wen Li Yao,2011-05-12 Selected peer reviewed papers from the 2011 International Conference on Frontiers of Manufacturing Science and Measuring Technology ICFMM 2011 June 23 24 2011 Chongqing China **Proceedings of the IEEE Signal Processing Workshop on Higher-Order Statistics, July 21-23, 1997, Banff, Alberta, Canada** ,1997 This text covering the 1997 IEEE Signal Processing Workshop on High Order Statistics is designed for researchers professors practitioners students and other computing professionals

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