



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

**Joseph Mathew, Lin Ma, Andy Tan, Deryk
Anderson**



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 quasiarithmetic 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 *Structural Health Monitoring* Ruqiang Yan, Xuefeng Chen, Subhas Chandra Mukhopadhyay, 2017-04-29 This book highlights the latest advances and trends in advanced signal processing such as wavelet theory time frequency analysis empirical mode decomposition compressive sensing and sparse representation and stochastic resonance for structural health monitoring SHM Its primary focus is on the utilization of

advanced signal processing techniques to help monitor the health status of critical structures and machines encountered in our daily lives wind turbines gas turbines machine tools etc As such it offers a key reference guide for researchers graduate students and industry professionals who work in the field of SHM *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

Recent Advances in Industrial Machines and Mechanisms Sanjoy K. Ghoshal,Arun K. Samantaray,Sandipan Bandyopadhyay,2024-01-04 This book presents select proceedings of the Conference on Industrial Problems on Machines and Mechanisms IPRoMM 2022 It presents a comprehensive coverage of the recent developments in analysis design and manufacturing of a range of modern and next generation industrial machines and solutions to mitigate common and emerging problems in their maintenance and operation The topics covered include design manufacturing and performance analysis of mechanical and mechatronic machine components and assemblies machine dynamics including rotor dynamics vehicle dynamics and multi body dynamics robotics and automation hydraulic and pneumatic systems and control vibration engineering tribology condition monitoring failure analysis manufacturing systems and processes reliability and quality engineering thermo fluid and combustion systems aerospace systems acoustics automotive engineering etc The book discusses theoretical and practical developments in these fields which have direct industrial relevance The book serves as a valuable reference for researchers and professionals interested in analysis design manufacturing maintenance and operation of industrial machinery

Digital Filters and Signal Processing Fausto Pedro García Márquez,Noor Zaman,2013-01-16 Digital filters together with signal processing are being employed in the new technologies and information systems and are implemented in different areas and applications Digital filters and signal processing are used with no costs and they can be adapted to different cases with great flexibility and reliability This book presents advanced developments in digital filters and signal process methods covering different cases studies They present the main essence of the subject with the principal approaches to the most recent mathematical models that are being employed worldwide

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

Deep Neural Networks-Enabled Intelligent Fault Diagnosis of Mechanical Systems Ruqiang Yan,Zhibin Zhao,2024-06-06 The book aims to highlight the potential of deep learning DL enabled methods in intelligent fault diagnosis IFD along with their benefits and contributions The authors first introduce basic applications of DL enabled IFD including auto encoders deep belief networks and convolutional neural networks Advanced topics of DL enabled IFD are also explored such as data augmentation multi sensor fusion unsupervised deep transfer learning neural architecture search self supervised learning and reinforcement learning Aiming to revolutionize the nature of IFD Deep Neural Networks Enabled Intelligent Fault Diagnosis of Mechanical Systems contributes to improved efficiency safety and reliability of mechanical systems in various industrial domains The book will appeal to academic researchers practitioners and students in the fields of intelligent fault diagnosis prognostics and health management and deep learning

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

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Computational Artificial Intelligence and Methods for industries

Vijayarangan Natarajan, 2025-07-04 This book presents the result of an innovative challenge to create a systematic literature overview driven by machine generated content Questions and related keywords were prepared for the machine to query discover collate and structure by Artificial Intelligence AI clustering The AI based approach seemed especially suitable to provide an innovative perspective as the topics are indeed both complex interdisciplinary and multidisciplinary for example climate planetary and evolution sciences Springer Nature has published much on these topics in its journals over the years so the challenge was for the machine to identify the most relevant content and present it in a structured way that the reader would find useful The automatically generated literature summaries in this book are intended as a springboard to further discoverability They are particularly useful to readers with limited time looking to learn more about the subject quickly and especially if they are new to the topics Springer Nature seeks to support anyone who needs a fast and effective start in their content discovery journey from the undergraduate student exploring interdisciplinary content to Master or PhD thesis developing research questions to the practitioner seeking support materials this book can serve as an inspiration to name a few examples It is important to us as a publisher to make the advances in technology easily accessible to our authors and find new ways of AI based author services that allow human machine interaction to generate readable usable collated research content Advanced signal processing techniques in radiation detection and imaging Jian Dong, Zilong Liu, Yayun

Cheng, 2023-12-26 **Vibrations in Rotating Machinery** IMechE (Institution of Mechanical Engineers), 2004-10-22 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 and prognosis Chaotic behaviour in machines Experimental methods and discoveries *Advanced Manufacturing Technologies* Gopal Prasad Sinha, 2007 Contributed papers presented at the conference organized by Central Mechanical Engineering Research Institute

Advances in Wavelet Theory and Their Applications in Engineering, Physics and Technology Dumitru Baleanu, 2012-04-04 The use of the wavelet transform to analyze the behaviour of the complex systems from various fields started to be widely recognized and applied successfully during the last few decades In this book some advances in wavelet theory and their applications in engineering physics and technology are presented The applications were carefully selected and grouped in five main sections Signal Processing Electrical Systems Fault Diagnosis and Monitoring Image Processing and Applications in Engineering One of the key features of this book is that the wavelet concepts have been

described from a point of view that is familiar to researchers from various branches of science and engineering The content of the book is accessible to a large number of readers *Electric Machines* Hamid A. Toliyat, Subhasis Nandi, Seungdeog Choi, Homayoun Meshgin-Kelk, 2017-12-19 With countless electric motors being used in daily life in everything from transportation and medical treatment to military operation and communication unexpected failures can lead to the loss of valuable human life or a costly standstill in industry To prevent this it is important to precisely detect or continuously monitor the working condition of a motor *Electric Machines Modeling Condition Monitoring and Fault Diagnosis* reviews diagnosis technologies and provides an application guide for readers who want to research develop and implement a more effective fault diagnosis and condition monitoring scheme thus improving safety and reliability in electric motor operation It also supplies a solid foundation in the fundamentals of fault cause and effect Combines Theoretical Analysis and Practical Application Written by experts in electrical engineering the book approaches the fault diagnosis of electrical motors through the process of theoretical analysis and practical application It begins by explaining how to analyze the fundamentals of machine failure using the winding functions method the magnetic equivalent circuit method and finite element analysis It then examines how to implement fault diagnosis using techniques such as the motor current signature analysis MCSA method frequency domain method model based techniques and a pattern recognition scheme Emphasizing the MCSA implementation method the authors discuss robust signal processing techniques and the implementation of reference frame theory based fault diagnosis for hybrid vehicles *Fault Modeling Diagnosis and Implementation in One Volume* Based on years of research and development at the Electrical Machines Power Electronics EMPE Laboratory at Texas A M University this book describes practical analysis and implementation strategies that readers can use in their work It brings together in one volume the fundamentals of motor fault conditions advanced fault modeling theory fault diagnosis techniques and low cost DSP based fault diagnosis implementation strategies 10th International Conference on Vibrations in Rotating Machinery Institution of Mechanical Engineers, 2012-09-11 This book presents the papers from the 10th International Conference on Vibrations in Rotating Machinery This conference first held in 1976 has defined and redefined the state of the art in the many aspects of vibration encountered in rotating machinery Distinguished by an excellent mix of industrial and academic participation achieved these papers present the latest methods of theoretical experimental and computational rotordynamics alongside the current issues of concern in the further development of rotating machines Topics are aimed at propelling forward the standards of excellence in the design and operation of rotating machines Presents latest methods of theoretical experimental and computational rotordynamics Covers current issues of concern in the further development of rotating machines **Condition Monitoring with Vibration Signals** Hosameldin Ahmed, Asoke K. Nandi, 2020-01-07 Provides an extensive up to date treatment of techniques used for machine condition monitoring Clear and concise throughout this accessible book is the first to be wholly devoted to the field of condition monitoring for rotating machines using vibration

signals It covers various feature extraction feature selection and classification methods as well as their applications to machine vibration datasets It also presents new methods including machine learning and compressive sampling which help to improve safety reliability and performance Condition Monitoring with Vibration Signals Compressive Sampling and Learning Algorithms for Rotating Machines starts by introducing readers to Vibration Analysis Techniques and Machine Condition Monitoring MCM It then offers readers sections covering Rotating Machine Condition Monitoring using Learning Algorithms Classification Algorithms and New Fault Diagnosis Frameworks designed for MCM Readers will learn signal processing in the time frequency domain methods for linear subspace learning and the basic principles of the learning method Artificial Neural Network ANN They will also discover recent trends of deep learning in the field of machine condition monitoring new feature learning frameworks based on compressive sampling subspace learning techniques for machine condition monitoring and much more Covers the fundamental as well as the state of the art approaches to machine condition monitoring guiding readers from the basics of rotating machines to the generation of knowledge using vibration signals Provides new methods including machine learning and compressive sampling which offer significant improvements in accuracy with reduced computational costs Features learning algorithms that can be used for fault diagnosis and prognosis Includes previously and recently developed dimensionality reduction techniques and classification algorithms Condition Monitoring with Vibration Signals Compressive Sampling and Learning Algorithms for Rotating Machines is an excellent book for research students postgraduate students industrial practitioners and researchers 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 **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 **Condition Monitoring and Nonlinear Frequency Analysis Based Fault Detection of Mechanical Vibration Systems** Hogir Rafiq, 2023-08-26 Hogir Rafiq proposes two approaches the signal processing based condition monitoring approaches with applications to fault detection in gear systems and application of deep mathematical and system theoretical methods to fault detection The author develops the multivariate empirical mode decomposition MEMD algorithm to enhance the capability of extracting fault features and

theoretical problems in nonlinear frequency analysis methods respectively The effectiveness has been demonstrated by an experimental study on a wind turbine gearbox test rig

Reviewing **Machinery Fault Diagnosis And Advanced Signal Processing**: Unlocking the Spellbinding Force of Linguistics

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