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Intelligent Data-Analytics for Condition Monitoring

CARLA NICHOLSON

Development of Automated Bearing Condition Monitoring Using Artificial Intelligence Techniques
Springer Science & Business Media
Tool failure is one of the probable faults during machining process which may cause unscheduled downtime and damage of tools, machines and work pieces. Therefore, developing an accurate and reliable online tool condition monitoring (TCM) system is in high demand. This research investigates TCM using time-frequency transformation methods and artificial intelligence. Multi-sensory monitoring systems and sensor fusion are investigated in the first step. Many different sensors at various locations are tested to determine the best input sets with most complimentary information. Three data fusion techniques 1) feature level, 2) score level, and 3) decision level are implemented and compared in this step. The result suggests that score level data fusion is superior for this application. Moreover, five advanced time-frequency transformation methods are employed due to superior ability of time-frequency transformation to reveal time variant characteristics of a signal as well as its frequency components. S-transform demonstrates the most accurate results among these methods. This research also proposes a novel feature extraction method to select the most discriminative information and reduce data's dimensionality and calculation cost. This method selects a local region of data in time-frequency domain using genetic algorithm optimization. The proposed method is also combined with 2D principal component analysis which has improved the systems in terms of accuracy and performance. Finally, three well-known artificial intelligence methods 1) multi-layer perceptron artificial neural network, 2) radial basis function artificial neural network and 3) adaptive neuro-

fuzzy inference system are applied to find a model between extracted features and system fault. Based on the results, radial basis function has the minimum mean error and adaptive neuro-fuzzy produces the lowest maximum error.
Artificial Intelligence: Concepts, Methodologies, Tools, and Applications CRC Press
During the last two decades, computer and information technologies have forced great changes in the ways businesses manage operations in meeting the desired quality of products and services, customer demands, competition, and other challenges. The Handbook of Computational Intelligence in Manufacturing and Production Management focuses on new developments in computational intelligence in areas such as forecasting, scheduling, production planning, inventory control, and aggregate planning, among others. This comprehensive collection of research provides cutting-edge knowledge on information technology developments for both researchers and professionals in fields such as operations and production management, Web engineering, artificial intelligence, and information resources management.
Cutting Tool Condition Monitoring Using Artificial Intelligence Springer Nature
In attempts to reduce greenhouse gas emissions, many alternatives to manufacturing have been recommended from a number of international organizations. Although challenges will arise, remanufacturing has the ability to transform ecological and business value. Computational Intelligence in Remanufacturing introduces various computational intelligence techniques that are applied to remanufacturing-related issues, results, and lessons from specific applications while highlighting future development and research. This book is an essential reference for students, researchers, and practitioners in mechanical, industrial, and electrical engineering.
Condition Monitoring and Assessment of Power Transformers Using Computational Intelligence LAP Lambert Academic Publishing
This thesis introduces a successfully designed and commissioned intelligent health monitoring system, specifically for use on any industrial robot, which is able to predict the onset of faults in the joints of the geared transmissions. However the developed embedded wireless condition monitoring system leads itself very well for applications on any power transmission equipment in which the loads and speeds are not constant, and access is restricted. As such this provides significant scope for future development. Three significant achievements are presented in this thesis. First, the development of a condition monitoring algorithm based on vibration analysis of an industrial robot for fault detection and diagnosis. The combined use of a statistical control chart with time-domain signal analysis for detecting a fault via an arm-mounted wireless processor system represents the first stage of fault detection. Second, the design and development of a sophisticated embedded microprocessor base station for online implementation of the

intelligent condition monitoring algorithm, and third, the implementation of a discrete wavelet transform, using an artificial neural network, with statistical feature extraction for robot fault diagnosis in which the vibration signals are first decomposed into eight levels of wavelet coefficients.

Condition Monitoring Using Computational Intelligence Methods IGI Global

On-line Cutting Tool Condition Monitoring in Machining Processes Using Artificial Intelligence.

Applications of Artificial Intelligence in Machine Condition Monitoring Springer Nature

Condition Monitoring Using Computational Intelligence MethodsSpringer Science & Business Media

Intelligent Data Analytics for Power and Energy Systems CRC Press

This book discusses condition based monitoring of rotating machines using intelligent adaptive systems. The book employs computational intelligence and fuzzy control principles to deliver a module that can adaptively monitor and optimize machine health and performance. This book covers design and performance of such systems and provides case studies and data models for fault detection and diagnosis. The contents cover everything from optimal sensor positioning to fault diagnosis. The principles laid out in this book can be applied across rotating machinery such as turbines, compressors, and aircraft engines. The adaptive fault diagnostics systems presented can be used in multiple time and safety critical applications in domains such as aerospace, automotive, deep earth and deep water exploration, and energy.

A Comprehensive Study on Tool Condition Monitoring Using Time-Frequency Transformation and Artificial Intelligence Springer Science & Business Media

Using computational intelligence, induction machine health is being monitored.

Condition Monitoring of Transformer Bushings Using Computational Intelligence Academic Press

In recent years, rapid changes and improvements have been witnessed in the field of transformer condition monitoring and assessment, especially with the advances in computational intelligence techniques. Condition Monitoring and Assessment of Power Transformers Using Computational Intelligence applies a broad range of computational intelligence techniques to deal with practical transformer operation problems. The approaches introduced are presented in a concise and flowing manner, tackling complex transformer modelling problems and uncertainties occurring in transformer fault diagnosis. Condition Monitoring and Assessment of Power Transformers Using Computational Intelligence covers both the fundamental theories and the most up-to-date research in this rapidly changing field. Many examples have been included that use real-world measurements and realistic operating scenarios of power transformers to fully illustrate the use of computational intelligence techniques for a variety of transformer modelling and fault diagnosis

problems. Condition Monitoring and Assessment of Power Transformers Using Computational Intelligence is a useful book for professional engineers and postgraduate students. It also provides a firm foundation for advanced undergraduate students in power engineering.
On-line Cutting Tool Condition Monitoring in Machining Processes Using Artificial Intelligence Springer Nature
Interaction of various components in rotating machinery like gearboxes may generate excitation forces at various frequencies. These frequencies may sometimes overlap with the frequencies of the forces generated by other components in the system. Conventional vibration spectrum analysis does not attenuate noise and spectral frequency band overlapping, which in many applications masks the changes in the structural response caused by the deterioration of certain components in the machine. This problem is overcome by the use of time domain averaging (dsynchronous averaging). In time domain averaging, the vibration signal is sampled at a frequency that is synchronized with the rotation of the gear of interest and the samples obtained for each singular position of the gear are ensemble-averaged. When sufficient averages are taken, all the vibration from the gearbox, which is asynchronous with the vibration of the gear, is attenuated. The resulting time synchronously averaged signal obtained through this process indicates the vibration produced during one rotation of the monitored gear. This direct time domain averaging process essentially acts as a broadband noise synchronous filter, which filters out the frequency content that is asynchronous with the vibration of the gear of interest provided that enough averages are taken. The time domain averaging procedure requires an enormous amount of vibration data to execute, making it very difficult to develop online gearbox condition monitoring systems that make use of time domain averaging to enhance their diagnostic capabilities since data acquisition and analysis cannot be done simultaneously. The objective of this research was to develop a more efficient way for calculating the time domain average of a gear vibration signal. A study of Artificial Neural Networks (ANNs) and Support Vector Machines (SVMs) was conducted to assess their suitability for use in time domain averaging. Two time domain averaging models that use ANNs and SVMs were developed. Model 1 uses a single feedforward network configuration to map the input which are rotation synchronized gear vibration signals to the output which is the time domain average of the gear vibration signal, using only a section of the input space. Model 2 operates in two stages. In the first stage, it uses a feedforward network to predict the instantaneous time domain average of the gear vibration after 10 inputs (10 rotation synchronized gear vibration signals) to predict the instantaneous average of the gear rotation. The outputs from the first state are used as inputs to the second stage, where a second feedforward network is used to predict the time domain average of the

entire vibration signal. When ANNs and SVMs were implemented, the results indicated that the amount of gear vibration date that is required to calculate the time domain average using Model 1 can be reduced by 75 percent and the amount of gear vibration data that needs to be stored in the data acquisition system when Model 2 is used can be reduced by 83 percent.
Smart Computing Applications in Crowdfunding Springer Science & Business Media
The book focuses on smart computing for crowdfunding usage, looking at the crowdfunding landscape, e.g., reward-, donation-, equity-, P2P-based and the crowdfunding ecosystem, e.g., regulator, asker, backer, investor, and operator. The increased complexity of fund raising scenario, driven by the broad economic environment as well as the need for using alternative funding sources, has sparked research in smart computing techniques. Covering a wide range of detailed topics, the authors of this book offer an outstanding overview of the current state of the art; providing deep insights into smart computing methods, tools, and their applications in crowdfunding; exploring the importance of smart analysis, prediction, and decision-making within the fintech industry. This book is intended to be an authoritative and valuable resource for professional practitioners and researchers alike, as well as finance engineering, and computer science students who are interested in crowdfunding and other emerging fintech topics.
Intelligent Condition Based Monitoring IGI Global
Ongoing advancements in modern technology have led to significant developments in artificial intelligence. With the numerous applications available, it becomes imperative to conduct research and make further progress in this field. Artificial Intelligence: Concepts, Methodologies, Tools, and Applications provides a comprehensive overview of the latest breakthroughs and recent progress in artificial intelligence. Highlighting relevant technologies, uses, and techniques across various industries and settings, this publication is a pivotal reference source for researchers, professionals, academics, upper-level students, and practitioners interested in emerging perspectives in the field of artificial intelligence.
Computational Intelligence in Emerging Technologies for Engineering Applications Springer Science & Business Media
Condition Monitoring Using Computational Intelligence Methods promotes the various approaches gathered under the umbrella of computational intelligence to show how condition monitoring can be used to avoid equipment failures and lengthen its useful life, minimize downtime and reduce maintenance costs. The text introduces various signal-processing and pre-processing techniques, wavelets and principal component analysis, for example, together with their uses in condition monitoring and details the development of effective feature extraction techniques classified into frequency-, time-frequency- and time-domain analysis. Data generated by these techniques can then be used for condition classification employing tools such as: • fuzzy

systems; rough and neuro-rough sets; neural and Bayesian networks;hidden Markov and Gaussian mixture models; and support vector machines.

Development of Health Monitoring of Induction Machine Using Computational Intelligence IGI Global

The subject of machine condition monitoring and fault diagnosis as a part of system maintenance has gained a lot of interest due to the potential benefits to be learned from reduced maintenance budgets, enhanced productivity and improved machine availability. Artificial intelligence (AI) is a successful method of machine condition monitoring and fault diagnosis since these techniques are used as tools for routine maintenance. This chapter attempts to summarize and review the recent research and developments in the field of signal analysis through artificial intelligence in machine condition monitoring and fault diagnosis. Intelligent systems such as artificial neural network (ANN), fuzzy logic system (FLS), genetic algorithms (GA) and support vector machine (SVM) have previously developed many different methods. However, the use of acoustic emission (AE) signal analysis and AI techniques for machine condition monitoring and fault diagnosis is still rare. In the future, the applications of AI in machine condition monitoring and fault diagnosis still need more encouragement and attention due to the gap in the literature.

Computational Intelligence in Remanufacturing Springer Science & Business Media

Intelligent Data-Analytics for Condition Monitoring: Smart Grid Applications looks at intelligent and meaningful uses of data required for an optimized, efficient engineering processes. In addition, the book provides application perspectives of various deep learning models for the condition monitoring of electrical equipment. With chapters discussing the fundamentals of machine learning and data analytics, the book is divided into two parts, including i) The application of intelligent data analytics in Solar PV fault diagnostics, transformer health monitoring and faults diagnostics, and induction motor faults and ii) Forecasting issues using data analytics which looks at global solar radiation forecasting, wind data forecasting, and more. This reference is useful for all engineers and researchers who need preliminary knowledge on data analytics fundamentals and the working methodologies and architecture of smart grid systems. Features deep learning methodologies in smart grid deployment and maintenance applications Includes coding for intelligent data analytics for each application Covers advanced problems and solutions of smart grids using advance data analytic techniques Springer

Artificial intelligent systems, which offer great improvement in healthcare sector assisted by machine learning, wireless communications, data analytics, cognitive computing, and mobile computing provide more intelligent and convenient solutions and services. With the help of the advanced techniques, now a days it is possible to understand human body and to handle & process the health data anytime and anywhere. It

is a smart healthcare system which includes patient, hospital management, doctors, monitoring, diagnosis, decision making modules, disease prevention to meet the challenges and problems arises in healthcare industry. Furthermore, the advanced healthcare systems need to upgrade with new capabilities to provide human with more intelligent and professional healthcare services to further improve the quality of service and user experience. To explore recent advances and disseminate state-of-the-art techniques related to intelligent healthcare services and applications. This edited book involved in designing systems that will permit the societal acceptance of ambient intelligence including signal processing, imaging, computing, instrumentation, artificial intelligence, internet of health things, data analytics, disease detection, telemedicine, and their applications. As the book includes recent trends in research issues and applications, the contents will be beneficial to Professors, researchers, and engineers. This book will provide support and aid to the researchers involved in designing latest advancements in communication and intelligent systems that will permit the societal acceptance of ambient intelligence. This book presents the latest research being conducted on diverse topics in intelligence technologies with the goal of advancing knowledge and applications healthcare sector and to present the latest snapshot of the ongoing research as well as to shed further light on future directions in this space. The aim of publishing the book is to serve for educators, researchers, and developers working in recent advances and upcoming technologies utilizing computational sciences.

Condition Monitoring of Outdoor Insulation Using Artificial Intelligence Techniques Independent Author

This book addresses a range of complex issues associated with condition monitoring (CM), fault diagnosis and detection (FDD) in smart buildings, wide area monitoring (WAM), wind energy conversion systems (WECSs), photovoltaic (PV) systems, structures, electrical systems, mechanical systems, smart grids, etc. The book's goal is to develop and combine all advanced nonintrusive CMFD approaches on a common platform. To do so, it explores the main components of various systems used for CMFD purposes. The content is divided into three main parts, the first of which provides a brief introduction, before focusing on the state of the art and major research gaps in the area of CMFD. The second part covers the step-by-step implementation of novel soft computing applications in CMFD for electrical and mechanical systems. In the third and final part, the simulation codes for each chapter are included in an extensive appendix to support newcomers to the field.

A Synchronous Filter for Gear Vibration Monitoring Using Computational Intelligence Condition Monitoring Using Computational Intelligence Methods Artificial Intelligence Tools: Decision Support Systems in Condition Monitoring and Diagnosis discusses various white- and black-box approaches

to fault diagnosis in condition monitoring (CM). This indispensable resource:Addresses nearest-neighbor-based, clustering-based, statistical, and information theory-based techniquesConsiders the merits of e

Computational Intelligence in Healthcare Springer Nature

This book provides readers with a snapshot of recent methods for non-stationary vibration analysis of machinery. It covers a broad range of advanced techniques in condition monitoring of machinery, such as mathematical models, signal processing and pattern recognition methods and artificial intelligence methods, and their practical applications to the analysis of nonstationarities. Each chapter, accepted after a rigorous peer-review process, reports on a selected, original piece of work presented and discussed at the International Conference on Condition Monitoring of Machinery in Non-Stationary Operations, CMMNO'2016, held on September 12 – 16, 2016, in Gliwice, Poland. The contributions cover advances in both theory and practice in a variety of subfields, such as: smart materials and structures; fluid-structure interaction; structural acoustics as well as computational vibro-acoustics and numerical methods. Further topics include: engines control, noise identification, robust design, flow-induced vibration and many others. By presenting state-of-the-art in predictive maintenance solutions and discussing important industrial issues the book offers a valuable resource to both academics and professionals and is expected to facilitate communication and collaboration between the two groups.

Handbook of Computational Intelligence in Manufacturing and Production Management Springer Science & Business Media

To engineer and manufacture is human. Manufactured goods are subjected to severe international competitive forces. Consumers' perceptions towards total quality, reliable performance, health and safety, environmental issues, energy conservation and cost of ownership are changing day by day. Manufacturers have no alternative but to satisfy the consumer's increasing demands with maximum efficiency and profitability with minimum delay. Failure to meet such a challenge is clearly undesirable and will, no doubt, result in the closure of manufacturing activities, which is still regarded by many as the backbone of our national economy. Manufacturing for profitability should be the number one concern of all serious minded and responsible people. To help the industries to meet these challenges and to manage efficiently well into 1990s and beyond, the Technical Advisory Committee in their wisdom decided the appropriate theme, Profitable Condition Monitoring, for this year's International Conference, to coincide with the great European market to be opened in 1993. The benefits from condition monitoring are well documented. Condition monitoring is now an affordable technology which is waiting to be fully exploited by all sectors of industry, both big and small. Many companies have realised the following benefits from condition monitoring: •

optimisation of profits • maximisation of production • cost-effective maintenance • minimisation of product liability • maximisation of total quality. As the contents of this proceedings reveal, there have been a number of significant advances in condition monitoring of which companies ought to be taking full advantage.

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