Fault Diagnosis Of Induction Motor Esj

The reliability of induction motors is a major requirement in many industrial applications. It is especially important where an unexpected breakdown might result in the interruption of critical services such as military operations, transportation, aviation, and medical applications. Advanced Condition Monitoring and Fault Diagnosis of Electric Machines is a collection of innovative research on various issues related to machinery condition monitoring, signal processing and conditioning, instrumentation and measurements, and new trends in condition monitoring. It also pays special attention to the fault identification process. While highlighting topics including spectral analysis, electrical engineering, and bearing faults, this book is an ideal reference source for electrical engineers, mechanical engineers, researchers, and graduate-level students seeking current research on various methods of maintaining machinery.

The International Conference on Intelligent Computing (ICIC) was formed to p- vide an annual forum dedicated to the emerging and challenging topics in artificial intelligence, machine learning, bioinformatics, and computational biology, etc. It aims to bring together researchers and practitioners from both academia and ind- try to share ideas, problems and solutions related to the multifaceted aspects of intelligent computing. ICIC 2008, held in Shanghai, China, September 15–18, 2008,

constituted the 4th International Conference on Intelligent Computing. It built upon the success of ICIC 2007, ICIC 2006 and ICIC 2005 held in Qingdao, Kunming and Hefei, China, 2007, 2006 and 2005, respectively. This year, the conference concentrated mainly on the theories and methodologies as well as the emerging applications of intelligent computing. Its aim was to unify the picture of contemporary intelligent computing techniques as an integral concept that highlights the trends in advanced computational intelligence and bridges theoretical research with applications. Therefore, the theme for this conference was “Emerging Intelligent Computing Technology and Applications”. Papers focusing on this theme were solicited, addressing theories, methodologies, and applications in science and technology.

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.

In this fasting going world, mechanized industries of electrical machines are needy of an effortless and the untimely fault detection techniques as they are attire by the customers. However, many researchers have urbanized numerous fault diagnosing methods, comprehensible software with preset extensive measurement practice is needed so that the personnel

who are not aware of the software can also work on this to recognize the faults occurred. In this paper an induction motor is constructed in a stationary reference for handiness. Faulty conditions are incorporated in the replica to evaluate the consequence of fault in the motor using the software, Lab VIEW.

Induction motors are used in many industrial applications in a wide range of operating areas as they have simple and robust structure, and low production costs. The reliability of an induction motor is of great importance. The knowledge about fault mode behavior of an induction motor drive system is extremely important from the standpoint of improved system design, protection and fault tolerant control. In this book different problems are dealt, such as overvoltage, over current, over temperature, over speed, inrush current, vibration monitoring which are being faced by IM's during its course of operation. PLC based protection system of IM. In this book, a number of innovative fault diagnosis algorithms in recently years are introduced. These methods can detect failures of various types of system effectively, and with a relatively high significance.

This book covers the diagnosis and assessment of the various faults which can occur in a three phase induction motor, namely rotor broken-bar faults, rotor-mass unbalance faults, stator winding faults, single phasing faults and crawling. Following a brief introduction, the second chapter describes the construction and operation of an induction motor, then reviews the range of known motor faults, some existing techniques for fault analysis, and some useful signal processing techniques. It includes an extensive literature survey to establish the research trends in induction motor

fault analysis. Chapters three to seven describe the assessment of each of the five primary fault types. In the third chapter the rotor broken-bar fault is discussed and then two methods of diagnosis are described; (i) diagnosis of the fault through Radar analysis of stator current Concordia and (ii) diagnosis through envelope analysis of motor startup current using Hilbert and Wavelet Transforms. In chapter four, rotor-mass unbalance faults are assessed, and diagnosis of both transient and steady state stator current has been analyzed using different techniques. If both rotor broken-bar and rotor-mass unbalance faults occur simultaneously then for identification an algorithm is provided in this chapter. Chapter five considers stator winding faults and five different analysis techniques, chapter six covers diagnosis of single phasing faults, and chapter seven describes crawling and its diagnosis. Finally, chapter eight focuses on fault assessment, and presents a summary of the book together with a discussion of prospects for future research on fault diagnosis.
Induction motors are widely used in industries.some electric faults may cause malfunctioning of it, so protection of it against these incipient faults is very necessary. This monograph refers to an approach of protection of motor using micro-controller.It emphasizes on PIC 18F4431 family controller to detect the faults and protect them. some simulink modelling and simulations are done to find the tolerable limit values.

This three-volume set of books presents advances in the development of concepts and techniques in the area of new technologies and contemporary information system architectures. It guides readers through solving specific research and analytical problems to obtain useful knowledge and business value from the data. Each chapter provides an analysis of a specific technical problem, followed by the numerical analysis, simulation and implementation of the

solution to the problem. The books constitute the refereed proceedings of the 2017 38th International Conference “Information Systems Architecture and Technology,” or ISAT 2017, held on September 17–19, 2017 in Szklarska Por?ba, Poland. The conference was organized by the Computer Science and Management Systems Departments, Faculty of Computer Science and Management, Wroclaw University of Technology, Poland. The papers have been organized into topical parts: Part I— includes discourses on topics including, but not limited to, Artificial Intelligence Methods, Knowledge Discovery and Data Mining, Big Data, Knowledge Discovery and Data Mining, Knowledge Based Management, Internet of Things, Cloud Computing and High Performance Computing, Distributed Computer Systems, Content Delivery Networks, and Service Oriented Computing. Part II—addresses topics including, but not limited to, System Modelling for Control, Recognition and Decision Support, Mathematical Modelling in Computer System Design, Service Oriented Systems and Cloud Computing and Complex Process Modeling. Part III—deals with topics including, but not limited to, Modeling of Manufacturing Processes, Modeling an Investment Decision Process, Management of Innovation, Management of Organization.

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.

This chapter provides a comprehensive analysis of noninvasive methods to diagnose stator winding insulation faults of an induction motor. Further, a novel noninvasive method is proposed to diagnose the root cause of winding failure due to unbalanced voltage to avoid catastrophic failure. Therefore, a winding function approach is utilized to derive an analytical expression for stator winding distribution and magnetomotive force (MMF). This tactic qualifies the conductor segment that generates MMF, and it also helps to analyze a healthy current spectrum. One can easily observe higher order harmonics in current spectrum; therefore, a new series of rotor harmonics is introduced to diagnose unbalanced supply. The locus of these harmonics is dependent on the poles, rotor bars, and slip. Due to the rapid complexity in industrial plants, it is inconceivable to continue human inspection to diagnose the faults. Thus, to avoid human inspection, in addition to new series of rotor harmonic, a fully automatic method based on neural network is proposed. This method not only diagnoses unbalanced voltage but it also recognize the percentage of unbalanced voltage by use of feed-forward multilayer perceptron (MLP) trained by back propagation. Finally, the experimental results shows the validation of this research work proposed method.

A maintenance program must include several techniques of monitoring of the electric motor's conditions. Among these techniques, probably the two classic ones are related to megger and impulse test. Unfortunately, in both cases, inherent drawbacks can expose the electrical motor at a high

voltage that could deteriorate insulation condition making difficult its use on industrial environment. As the electrical machines have several different components (e.g., bearings, rotor bars, shaft, and stator windings), the fault frequencies can be excited by mechanical and/or electrical faults making the identification of the real condition difficult. This chapter describes several methods of the nondestructive tests for induction motors based on the motor current signature analysis (MCSA), magnetic flux, and vibration analysis. The method of analysis is a good alternative tool for destructive tests and fault detection in induction motors. Numerical and experimental results demonstrate the effectiveness of the proposed technique. This chapter also presents a model suitable for computer simulation of induction motor in a healthy state and with general asymmetries that can be analyzed simultaneously. The model makes it possible to conduct research on different characteristics of engines and outstanding effects produced by the faults.

Fault Diagnosis and Prognosis Techniques for Complex Engineering Systems gives a systematic description of the many facets of envisaging, designing, implementing, and experimentally exploring emerging trends in fault diagnosis and failure prognosis in mechanical, electrical, hydraulic and biomedical systems. The book is devoted to the development of mathematical methodologies for fault diagnosis and isolation, fault tolerant control, and failure prognosis problems of engineering systems. Sections present new techniques in reliability modeling, reliability analysis, reliability design, fault and failure detection, signal processing, and fault

tolerant control of engineering systems. Sections focus on the development of mathematical methodologies for diagnosis and prognosis of faults or failures, providing a unified platform for understanding and applicability of advanced diagnosis and prognosis methodologies for improving reliability purposes in both theory and practice, such as vehicles, manufacturing systems, circuits, flights, biomedical systems. This book will be a valuable resource for different groups of readers – mechanical engineers working on vehicle systems, electrical engineers working on rotary machinery systems, control engineers working on fault detection systems, mathematicians and physician working on complex dynamics, and many more. Presents recent advances of theory, technological aspects, and applications of advanced diagnosis and prognosis methodologies in engineering applications Provides a series of the latest results, including fault detection, isolation, fault tolerant control, failure prognosis of components, and more Gives numerical and simulation results in each chapter to reflect engineering practices Artificial intelligence (AI) techniques have proved their ability in detection of incipient faults in electrical machines. In this project, the fault diagnosis of three phase induction motors is studied detailed in unbalance voltage and stator inter turn fault using simulation models and neural networks have been

used to train the data using Radial Basis Function Neural Network (RBFNN) in MATLAB with Graphical User Interface Development Environment (GUIDE) structured. Nowadays artificial intelligence is implemented to improve traditional techniques. The results can be obtained instantaneously after it analyzes the input data of the motor. The increased in demand has greatly improved the approach of fault detection in polyphase induction motor. Data is taken from the experiment checking the induction motor fault and is simulated into MATLAB using RBFNN. The first stage is to collect the data by experimental and simulating a Simulink model using MATLAB. Three Simulink model will be created where each of the model represent the motor condition. The result of the simulation will then be the data used to create an ANN.The second stage creates and trains an ANN. From the data obtained during the first section, a target output will determine the motor condition whether the motor is in a healthy state or fault occurred. In the third stage the development Graphical User Interface (GUI) is carried out this system. The GUI is developed by using MATLAB for the purpose of evaluating and testing the ANN. The purpose of this final year project, the development of Fault Detection in Three-Phase Induction Motor Using Artificial Intelligence is to satisfy the increased in demand to improve the approach of fault detection in polyphase induction

motor. Artificial intelligence is implemented to improve traditional techniques, as the results can be obtained instantaneously after it analyzes the input data of the motor where it can be accomplished without an expert.

AC motors play a major role in modern industrial applications. Squirrel-cage induction motors (SCIMs) are probably the most frequently used when compared to other AC motors because of their low cost, ruggedness, and low maintenance. The material presented in this book is organized into four sections, covering the applications and structural properties of induction motors (IMs), fault detection and diagnostics, control strategies, and the more recently developed topology based on the multiphase (more than three phases) induction motors. This material should be of specific interest to engineers and researchers who are engaged in the modeling, design, and implementation of control algorithms applied to induction motors and, more generally, to readers broadly interested in nonlinear control, health condition monitoring, and fault diagnosis.

Fault Diagnosis of Induction Motor Fed by Frequency Converter. The Signal Signature Analysis TechniqueInduction MotorsApplications, Control and Fault DiagnosticsBoD – Books on Demand

Early fault diagnosis can increase machinery availability and performance, reduce consequential

damage, prolong machine life, and reduce spare parts inventories and breakdown maintenance. In this book, one intelligent fault diagnostic system is proposed based on feature extraction and selection techniques. Features are calculated from many domains: time domain, frequency domain, cepstrum domain and wavelet domain. In this way, the information of raw data is kept at best to meet different analysis methods in future. Principal component analysis and linear discriminant analysis, two feature extraction methods are introduced. Feature selection methods, individual feature evaluation and genetic algorithm, are compared. They are used to reduce feature dimensionality and improve system performance. The proposed system is applied to fault diagnosis of induction motors as a real application. The results show that the proposed system, combining feature extraction with feature selection, has fast training procedure, high classification rate and compact structure. It is suitable for motor condition monitoring and fault diagnosis.

Fault diagnosis is useful for technicians to detect, isolate, identify faults, and troubleshoot. Bayesian network (BN) is a probabilistic graphical model that effectively deals with various uncertainty problems. This model is increasingly utilized in fault diagnosis. This unique compendium presents bibliographical review on the use of BNs in fault diagnosis in the last

decades with focus on engineering systems. Subsequently, eleven important issues in BN-based fault diagnosis methodology, such as BN structure modeling, BN parameter modeling, BN inference, fault identification, validation, and verification are discussed in various cases. Researchers, professionals, academics and graduate students will better understand the theory and application, and benefit those who are keen to develop real BN-based fault diagnosis system.

Master the art of vibration monitoring of induction motors with this unique guide to on-line condition assessment and fault diagnosis, building on the author's fifty years of investigative expertise. It includes: *Robust techniques for diagnosing of a wide range of common faults, including shaft misalignment and/or soft foot, rolling element bearing faults, sleeve bearing faults, magnetic and vibrational issues, resonance in vertical motor drives, and vibration and acoustic noise from inverters. *Detailed technical coverage of thirty real-world industrial case studies, from initial vibration spectrum analysis through to fault diagnosis and final strip-down. *An introduction to real-world vibration spectrum analysis for fault diagnosis, and practical guidelines to reduce bearing failure through effective grease management. This definitive book is essential reading for industrial end-users, engineers, and technicians working in motor design,

manufacturing, and condition monitoring. It will also be of interest to researchers and graduate students working on condition monitoring.

The safe and reliable operation of technical systems is of great significance for the protection of human life and health, the environment, and of the vested economic value. The correct functioning of those systems has a profound impact also on production cost and product quality. The early detection of faults is critical in avoiding performance degradation and damage to the machinery or human life. Accurate diagnosis then helps to make the right decisions on emergency actions and repairs. Fault detection and diagnosis (FDD) has developed into a major area of research, at the intersection of systems and control engineering, artificial intelligence, applied mathematics and statistics, and such application fields as chemical, electrical, mechanical and aerospace engineering. IFAC has recognized the significance of FDD by launching a triennial symposium series dedicated to the subject. The SAFEPROCESS Symposium is organized every three years since the first symposium held in Baden-Baden in 1991. SAFEPROCESS 2006, the 6th IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes was held in Beijing, PR China. The program included three plenary papers, two semi-plenary papers, two industrial talks by internationally recognized experts and 258

regular papers, which have been selected out of a total of 387 regular and invited papers submitted. * Discusses the developments and future challenges in all aspects of fault diagnosis and fault tolerant control * 8 invited and 36 contributed sessions included with a special session on the demonstration of process monitoring and diagnostic software tools Artificial intellegence (AI) techniques have proved their ability in detection of incipient faults in electrical machines. in this project, the fault diagnosis of three phase induction motors is studied detailed in unbalance voltage and stator inter turn fault using simulation models and neural networks have been used to train the data using Radial Basis Function Neural Network (RBFNN) in MATLAB with Graphical USer Interface Development Environment (GUIDE) structured.

This is Volume III of a three volume set constituting the refereed proceedings of the Third International Symposium on Neural Networks, ISNN 2006. 616 revised papers are organized in topical sections on neurobiological analysis, theoretical analysis, neurodynamic optimization, learning algorithms, model design, kernel methods, data preprocessing, pattern classification, computer vision, image and signal processing, system modeling, robotic systems, transportation systems, communication networks, information security, fault detection, financial analysis, bioinformatics, biomedical and

industrial applications, and more.

Wireless sensor network (WSN), one of the featured technologies that the U.S. Department of Energy (DOE) has identified to help improve the overall energy efficiency of US industry, provides a potentially low-cost approach for the health monitoring and fault diagnosis of induction motors. The reduction of machine failures increases plant efficiency and productivity. Low-cost wireless sensor systems can help the health monitoring of manufacturing equipments by eliminating the cost of installation and increasing the flexibility of system diagnosis. This research focuses on developing a nonintrusive, condition based health monitory system for drive connected induction motors using the wireless sensor network method. A hierarchical classification system is designed for motor fault diagnosis. To simulate and analyze a wide range of fault conditions that may arise in induction motors, an experimental test bed is also developed. Three major branches of induction motor faults are studied, both individually and in combination. Wired sensors are first used to find optimal features for motor fault classification. After performing feasibility studies of wireless sensors in electric machinery, two wireless sensor nodes are developed and implemented in the motor health monitoring and fault diagnosis system. The experimental results demonstrate the effectiveness and generalizability of the wireless

sensor system for motor health monitoring and fault classification.

The ability to forecast motor mechanical faults at incipient stages is vital to reducing maintenance costs, operation downtime and safety hazards. This paper synthesized the progress in the research and development in condition monitoring and fault diagnosis of induction motors. The motor condition monitoring techniques are mainly classified into two categories that are invasive and non-invasive techniques. The invasive techniques are very basic, but they have some implementation difficulties and high cost. The non-invasive methods, namely MCSA, PVA and IPA, overcome the disadvantages associated to invasive methods. This book chapter reviews the various non-invasive condition monitoring methods for diagnosis of mechanical faults in induction motor and concludes that the instantaneous power analysis (IPA) and Park vector analysis (PVA) methods are best suitable for the diagnosis of small fault signatures associated to mechanical faults. Recommendations for the future research in these areas are also presented.

The detection of motor faults at their incipient stage is of prime importance to any industrial plant. The introduction of adjustable speed drives has improved the control and the efficiency of induction motors, however, this has changed the nature of motor faults and how they can be detected. Current signature

analysis has caught the attention of researchers as a mature and simple technique for motor fault diagnosis. In this research three main ways of analyzing the current signature for fault detection have been investigated. These are: the power spectral density analysis, the current negative- and positive-sequence components, and the Park?s vector approach. Three major induction motor faults have been experimentally tested for the above diagnosis techniques: the bearing fault, the broken rotor bar, and the air gap dynamic eccentricity. Using an adjustable speed drive for controlling the motor while applying these fault detection techniques has been compared to the supply of the motor directly from the "mains" source and to a pure sinusoidal supply through a programmable source. This research has proved that using the power spectral density analysis is a good tool for induction motor fault detection regardless of the source of supply. This technique can be easily implemented in standard commercial adjustable speed drives, with no additional hardware requirements.

This book is a comprehensive, structural approach to fault diagnosis strategy. The different fault types, signal processing techniques, and loss characterisation are addressed in the book. This is essential reading for work with induction motors for transportation and energy.

This research aimed at investigating the relationship

between three phase induction motors vibration (MVS) and current signatures (MCS). This is essential due to the cost of vibration measuring equipment and in cases where vibration of interest point is not accessible; such as electrical submersible pumps (ESP) used in oil industry. A mathematical model was developed to understand the effects of two types of induction motors common faults; rotor bar imperfections and phase imbalance on the motor vibration and current signatures. An automated test facility was developed in which 1.1 kW three phase motor could be tested under varying shaft rotation speeds and loads for validating the developed model. Time and frequency domains statistical parameters of the measured signals were calculated for fault detection and assessing its severity. The measured signals were also processed using the short time Fourier transform (STFT), the Wigner-Ville distribution (WVD), the continuous wavelet transform (CWT) and discrete wavelet transform (DWT) and wavelet multi-resolution analysis (MRA). The non-stationary components, representing faults within induction motor measured vibration and current signals, were successfully detected using wavelet decomposition technique. An effective alternative to direct vibration measurement scheme, based on radial basis function networks, was developed to the reconstruction of motor vibration using measurements of one phase of the

motor current. It was found that this method captured the features of induction motor faults with reasonable degrees of accuracy. Another method was also developed for the early detection and diagnosis of faults using an enhanced power factor method. Experimental results confirmed that the power factor can be used successfully for induction motor fault diagnosis and is also promising in assessing fault severity. The suggested two methods offer inexpensive, reliable and non-intrusive condition monitoring tools that suits real-time applications. Directions for further work were also outlined. Motivated by the need of energy-efficiency improvements, process optimization, soft-start capability and numerous other environmental benefits, it may be desirable to operate induction motors for many applications at continuously adjustable speeds. The induction motor drives can provide high productivity with energy efficiency in different industrial applications and are the basis for modern automation. This book provides an account of this developing subject through such topics as modelling, noise, control techniques used for high-performance applications and diagnostics. Compiled from contributions by international researchers, this is not a textbook, but the result is an interesting exploration of this technology, that provides a combination of theory, implementation issues and practical examples.

This two-volume set CCIS 173 and CCIS 174 constitutes the extended abstracts of the posters presented during the 14th International Conference on Human-Computer Interaction, HCII 2011, held in Orlando, FL, USA in July 2011, jointly with 12 other thematically similar conferences. A total of 4039 contributions was submitted to HCII 2011, of which 232 poster papers were carefully reviewed and selected for presentation as extended abstracts in the two volumes.

The book covers various issues related to machinery condition monitoring, signal processing and conditioning, instrumentation and measurements, faults for induction motors failures, new trends in condition monitoring, and the fault identification process using motor currents electrical signature analysis. It aims to present a new non-invasive and non-intrusive condition monitoring system, which has the capability to detect various defects in induction motor at incipient stages within an arbitrary noise conditions. The performance of the developed system has been analyzed theoretically and experimentally under various loading conditions of the motor. Covers current and new approaches applied to fault diagnosis and condition monitoring. Integrates concepts and practical implementation of electrical signature analysis. Utilizes LabVIEW tool for condition monitoring problems. Incorporates real-world case studies. Paves way a technology

potentially for prescriptive maintenance via IIoT.