Motor Current Signature Analysis And Its Applications In

Today, switched reluctance machines (SRMs) play an increasingly important role in various sectors due to advantages such as robustness, simplicity of construction, low cost, insensitivity to high temperatures, and high fault tolerance. They are frequently used in fields such as aeronautics, electric and hybrid vehicles, and wind power generation. This book is a comprehensive resource on the design, modeling, and control of SRMs with methods that demonstrate their good performance as motors and generators.

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.

Developed for electricians, mechanics, students, academia, and reliability/maintenance managers, Electrical Motor Diagnostics provides the information, case studies, and materials necessary to interpret motor circuit analysis, motor current signature analysis, electrical signature analysis, and other standard testing technologies for AC/DC electric motors, transformers, machine tool motors, synchronous motors, and generators including pass/fail values. Information on the development of a motor management program and the SUCCESS by DESIGN Time to Failure Estimation methodology for any technology are covered in detail.

A motor current noise signature analysis method for remotely monitoring the operating characteristics of an electric motor-operated device such as a motor-operated valve. Frequency domain signal analysis techniques are applied to a conditioned motor current signal to distinctly identify various operating parameters of the motor driven device from the motor current signature. The signature may be recorded and compared with subsequent signatures to detect operating abnormalities and degradation of the device. This diagnostic method does not require special equipment to be installed on the motor-operated device, and the current sensing may be performed at remote control locations, e.g., where the motor-operated devices are used in inaccessible or hostile environments. 6 figs.

Current Signature Analysis for Condition Monitoring of Cage Induction MotorsIndustrial Application and Case HistoriesJohn Wiley & Sons

Non-destructive testing (NDT) is based on inspection methodologies that do not require the change or destruction of the component or system under evaluation. Numerous NDT techniques are increasingly used, thanks to the recent advances in sensing technologies, data acquisition, data storage and signal processing. Inspection information is widely employed in order to make effective maintenance decisions based on the defects identified, their location and severity. This book presents the main advances recently made on different NDT techniques, together with the principal approaches employed to process the signals obtained during inspection.

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.

Engineering Asset Management discusses state-of-the-art trends and developments in the emerging field of engineering asset management as presented at the Fourth World Congress on Engineering Asset Management (WCEAM). It is an excellent reference for practitioners, researchers and students in the multidisciplinary field of asset management, covering such topics as asset condition monitoring and intelligent maintenance; asset data warehousing, data mining and fusion; asset performance and level-of-service models; design and life-cycle integrity of physical assets; deterioration and preservation models for assets; education and training in asset management; engineering standards in asset management; fault diagnosis and prognostics; financial analysis methods for physical assets; human dimensions in integrated asset management; information quality management; information systems and knowledge management; intelligent sensors and devices; maintenance strategies in asset management; optimisation decisions in asset management; risk management in asset management; strategic asset management; and sustainability in asset management.

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.

Induction motors are considered to be the work horse in all types of today's industries. In all mechanical applications, using an induction motor is considered to be the preferable, if not the optimum selection. Their failures, on the other hand, cause an interruption equal to their volume of dependency in any plant. This has initiated different maintenance programs that can extend equipment's life time and reduce sudden equipment failure. The down time that is mandated by conventional maintenance methods is no longer acceptable with tight industrial competition. Condition Monitoring using Motor Current Signature Analysis (MCSA) is the demanding methods that can significantly reduce unscheduled

downtime and enable extended motor life. The potential of this method is very high especially for mechanical failure. The frequencies of components that reveal existence of any bearing or rotor-bars related faults are well defined. For other fault sources (e.g. Windings, Insulation) the analysis findings are not yet mature enough and there are uncertainties that make it less attractive. The research of this thesis looks at MCSA as a means to detect failure in stator windings of squirrel-cage induction machines. The approach in this thesis is to run the motors under various stator abnormality conditions and study the behavior of the frequency spectrum to correlate the changes that will appear due to specific faults. Different faults were simulated on two different motors (5 hp, 100 hp). The two machines were operated at normal operating condition and the indicator of stator abnormalities in the current spectrum was identified. The effect of loading on those components is one of the new aspects that are rarely mentioned in previous researches in the field of motor diagnostics.

The book presents high-quality research papers presented at the first international conference, ICICCD 2016, organised by the Department of Electronics, Instrumentation and Control Engineering of University of Petroleum and Energy Studies, Dehradun on 2nd and 3rd April, 2016. The book is broadly divided into three sections: Intelligent Communication, Intelligent Control and Intelligent Devices. The areas covered under these sections are wireless communication and radio technologies, optical communication, communication hardware evolution, machine-to-machine communication networks, routing techniques, network analytics, network applications and services, satellite and space communications, technologies for e-communication, wireless Ad-Hoc and sensor networks, communications and information security, signal processing for communications, communication software, microwave informatics, robotics and automation, optimization techniques and algorithms, intelligent transport, mechatronics system, guidance and navigation, algorithms, linear/non-linear control, home automation, sensors, smart cities, control systems, high performance computing, cognition control, adaptive control, distributed control, prediction models, hybrid control system, control applications, power system, manufacturing, agriculture cyber physical system, network control system, genetic control based, wearable devices, nano devices, MEMS, bio-inspired computing, embedded and real-time software, VLSI and embedded systems, FPGA, digital system and logic design, image and video processing, machine vision, medical imaging, and reconfigurable computing systems.

Muthireddy, Rajesh. M. S. The University of Memphis. May/2010. Condition Monitoring of electric motors using Motor Current Signature Analysis and Acoustic Emission. Gary Qi. Electric motors are critical components in industrial processes and rolling element bearings are an essential part of them. Studies show that most of the motors fail due to the failure of bearings inside them. The bearings are by nature subjected to various kinds of loads including eccentric forces due to the attachment of power transmission units such as gears, pulleys and fans, and as such bearing life depends on the load type, magnitude and operating conditions. Monitoring the bearing condition can greatly reduce manufacturing down-time and improve maintenance costs. In this thesis, I compare two non-invasive, online condition monitoring techniques for electric motors independently subjected to eccentric loading, bearing contamination and elevated temperatures. A test rig was built for the study. Results indicate that early electric motor bearing failure detection is best captured by Acoustic Emission (AE) where as Motor Current Signature Analysis (MCSA) can be used to assess and interpret the overall electrical condition of the motor.

As engineering processes are automated and manpower is reduced, condition monitoring of engineering plants has increased in importance. This is a first edition of this book, written by Taver & Penman was published in 1987. The economics of industry has now changed, as a result of the privatization and deregulation of the energy industry, placing far more emphasis on the importance of the reliable operation of a plant, throughout the whole life-cycle, regardless of first cost. The availability of advanced electronics and software in powerful instrumentation, computers and Digital Signal Processors (DSP) has simplified our ability to instrument and analyze machinery. As a result condition monitoring is now being applied to a wider range of systems, from fault-tolerant drives of a few hundred Watts in the aerospace industry, to machinery of a few hundred Megawatts in major capital plants.In this new book the original authors have been joined by Li Ran an expert in power electronics and control, and Sedding, an expert in the monitoring of electrical insulation systems. The first edition has been revised and expanded merging the authors' own experience with that of machine analysts to bring it up-to-date.

This conference proceeding contains papers presented at the 6th International Conference on Machinery, Materials Science and Engineering Applications (MMSE 2016), held 28-30 October, 2016 in Wuhan, China. The conference proceeding contributions cover a large number of topics, both theoretical and applied, including Material science, Electrical Engineering and Automation Control, Electronic Engineering, Applied Mechanics, Mechanical Engineering, Aerospace Science and Technology, Computer Science and Information technology and other related engineering topics. MMSE provides a perfect platform for scientists and engineering researchers to exchange ideas, build cooperative relationships and discuss the latest scientific achievements. MMSE will be of interest for academics and professionals working in a wide range of industrial, governmental and academic sectors, including Material Science, Electrical and Electronic Engineering, Information Technology and Telecommunications, Civil Engineering, Energy Production, Manufacturing, Mechanical Engineering, Nuclear Engineering, Transportation and Aerospace Science and Technology.

Advanced Analysis of Motor Development explores how research is conducted in testing major issues and questions in motor development. It also looks at the evolution of research in the field, its current status, and possible future directions. This text is one of the few to examine motor development models and theories analytically while providing a context for advanced students in motor development so they can understand current and classic research in the field. Traditionally, graduate study in motor development has been approached through a compilation of readings from various sources. This text meets the need for in-depth study in a more cohesive manner by presenting parallels and highlighting relationships among research studies that independent

readings might not provide. In addition, Advanced Analysis of Motor Development builds a foundation in the theories and approaches in the field and demonstrates how they drive contemporary research in motor development. A valuable text for graduate students beginning their own research projects or making the transition from student to researcher, this text focuses on examining and interpreting research in the field. Respected researchers Haywood, Roberton, and Getchell explain the history and evolution of the field and articulate key research issues. As they examine each of the main models and theories that have influenced the field, they share how motor development research can be applied to the fields of physical education, special education, physical therapy, and rehabilitation sciences. With its emphasis on critical inquiry, Advanced Analysis of Motor Development will help students examine important topics and questions in the field in a more sophisticated manner. They will learn to analyze research methods and results as they deepen their understanding of developmental phenomena. For each category of movement skills covered (posture and balance, foot locomotion, ballistic skills, and manipulative skills), the authors first offer a survey of the pertinent research and then present an in-depth discussion of the landmark studies. In analyzing these studies, students will come to appreciate the detail of research and begin to explore possibilities for their own future research. Throughout the text, special elements help students focus on analysis. Tips for Novice Researchers sidebars highlight issues and questions raised by research and offer suggestions for further exploration and study. Comparative tables detail the differences in the purpose, methods, and results of key studies to help students understand not only what the studies found but also the relevance of those findings. With Advanced Analysis of Motor Development, readers will discover how research focusing on the major issues and central questions in motor development is produced and begin to conceptualize their own research. Readers will encounter the most important models and theories; dissect some of the seminal and recent articles that test these models and theories; and examine issues such as nature and nurture, discontinuity and continuity, and progression and regression. Advanced Analysis of Motor Development will guide students to a deeper understanding of research in life span motor development and enable them to examine how the complexities of motor development can be addressed in their respective professions.

Motor current signature analysis (MCSA) is a novel diagnostic process for condition monitoring of electric-motor-driven mechanical equipment (e.g., pumps, motor-operated valves, compressors, and processing machinery). The MCSA process identifies, characterizes, and trends over time the instantaneous load variations of mechanical equipment in order to diagnose changes in the condition of the equipment (e.g., due to degradation or service wear), which, if allowed to continue, may lead to failure. It monitors the instantaneous variations (noise content) in the electric current flowing through the power leads to the electric motor that drives the equipment. The motor itself thereby acts as a transducer, sensing both large and small, long-term and rapid, mechanical load variations and converting them to variations in the induced current generated in the motor windings. This motor current noise signature is detected, amplified, and further processed as needed to examine its time domain and frequency domain (spectral) characteristics. The operational principles of MCSA and the nonintrusive data collection apparatus and procedure used with MOVs will be described. Data collected from MOVs in both laboratory and in-plant environments will also be shown to illustrate the ability of MCSA to "see" the detailed inner workings of the valve and operator and thus to detect degraded performance at an incipient stage. (Set of 18 vugraphs).

This book covers topics such as AeroSpace Systems, Intelligent Systems, Machine Learning and Analytics, Internet of Things, Applied Media Informatics and Technology, Adaptive Control Systems, Software Engineering and Cyber-Physical Systems. Research in the discipline of Systems Engineering is an important concept in the advancement of engineering and information sciences. Systems Engineering attempts to integrate many of the traditional engineering disciplines to solve large complex functioning engineering systems, dependent on components from all the disciplines. The research papers contained in these proceedings reflect the state of the art in Systems Engineering from all over the world and serve as vital references to researchers to follow. This book is a very good resource for graduate students, researchers and scholars who want to learn about the most recent development in the fields. .

Scope of interest consists of automotive engineering, transportation, computer vision, and Internet of Things, material and manufacturing engineering

Provides coverage of Motor Current Signature Analysis (MCSA) for cage induction motors This book is primarily for industrial engineers. It has 13 chapters and contains a unique data base of 50 industrial case histories on the application of MCSA to diagnose broken rotor bars or unacceptable levels of airgap eccentricity in cage induction motors with ratings from 127 kW (170 H.P.) up to 10,160 kW (13,620 H.P.). There are also unsuccessful case histories, which is another unique feature of the book. The case studies also illustrate the effects of mechanical load dynamics downstream of the motor on the interpretation of current signatures. A number of cases are presented where abnormal operation of the driven load was diagnosed. Chapter 13 presents a critical appraisal of MCSA including successes, failures and lessons learned via industrial case histories. The case histories are presented in a step by step format, with predictions and outcomes supported by current spectra and photographic evidence to confirm a correct or incorrect diagnosis The case histories are presented in detail so readers fully understand the diagnosis The authors have 108 years of combined experience in the installation, maintenance, repair, design, manufacture, operation and condition monitoring of SCIMs There are 10 questions at the end of chapters 1 to 12 and answers can be obtained via the publisher Current Signature Analysis for Condition Monitoring of Cage Induction Motors serves as a reference for professional engineers, head electricians and technicians working with induction motors. To obtain the solutions manual for this book, please send an email to pressbooks@ieee.org. William T. Thomson is Director and Consultant with EM Diagnostics Ltd, in Scotland. Prof. Thomson received a BSc (Hons) in Electrical Engineering in 1973 and an MSc in 1977 from the University of Strathclyde. He has published 72 papers on condition monitoring of induction motors in a variety of engineering journals such as IEEE Transactions (USA), IEE Proceedings (UK), and also at numerous International IEEE and IEE conferences. He is a senior member of the IEEE, a fellow of the IEE (IET) in the UK and a Chartered Professional Engineer registered in the UK. Ian Culbert was a Rotating Machines Specialist at Iris Power Qualitrol since April 2002 until his very untimely death on 8th September, 2015. At this company he provided consulting services to customers, assisted in product development, trained sales and field service staff and reviewed stator winding partial discharge reports. He has co-authored two books on electrical machine insulation design, evaluation, aging, testing and repair and was principal author of a number of Electric Power Research Institute reports on motor repair. Ian was a Registered Professional Engineer in the Province of Ontario, Canada and a Senior Member of IEEE.

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.

Methods of diagnosis and prognosis play a key role in the reliability and safety of industrial systems. Failure diagnosis requires the use of suitable sensors, which provide signals that are processed to monitor features (health indicators) for defects. These features are required to distinguish between operating states, in order to inform the operator of the severity level, or even the type, of a failure. Prognosis is defined as the estimation of a system's lifespan, including how long remains and how long has passed. It also encompasses the prediction of impending failures. This is a challenge that many researchers are currently trying to address. Electrical Systems, a book in two volumes, informs readers of the theoretical solutions to this problem, and the results obtained in several laboratories in France, Spain and further afield. To this end, many researchers from the scientific community have contributed to this book to share their research results.

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.

This volume contains the proceedings of the 13th International Conference on Damage Assessment of Structures DAMAS 2019, 9-10 July 2019, Porto, Portugal. It presents the expertise of scientists and engineers in academia and industry in the field of damage assessment, structural health monitoring and non-destructive evaluation. The proceedings covers all research topics relevant to damage assessment of engineering structures and systems including numerical simulations, signal processing of sensor measurements and theoretical techniques as well as experimental case studies. Scope of the conference includes technology advances in design, analysis, manufacturing and measurements for electrical machines and drives

The Illustrated Wavelet Transform Handbook: Introductory Theory and Applications in Science, Engineering, Medicine and Finance provides an overview of the theory and practical applications of wavelet transform methods. The author uses several hundred illustrations, some in color, to convey mathematical concepts and the results of applications. The first chapter presents a brief overview of the wavelet transform, including a short history. The remainder of the book is split into two parts: the first part discusses the mathematics of both discrete and continuous wavelet transforms while the second part deals with applications in a variety of subject areas, such as geophysics, medicine, fluid turbulence, engineering testing, speech and sound analysis, image analysis, and data compression. These application chapters make the reader aware of the similarities that exist in the use of wavelet transform analysis across disciplines. A comprehensive list of more than 700 references provides a valuable resource for further study. The book is designed specifically for the applied reader in science, engineering, medicine, finance, or any other of the growing number of application areas. Newcomers to the subject will find an accessible and clear account of the theory of continuous and discrete wavelet transforms, providing a large number of examples of their use across a wide range of disciplines. Readers already acquainted with wavelets can use the book to broaden their perspective.

This book gathers select contributions from the 32nd International Congress and Exhibition on Condition Monitoring and Diagnostic Engineering Management (COMADEM 2019), held at the University of Huddersfield, UK in September 2019, and jointly organized by the University of Huddersfield and COMADEM International. The aim of the Congress was to promote awareness of the rapidly emerging interdisciplinary areas of condition monitoring and diagnostic engineering management. The contents discuss the latest tools and techniques in the multidisciplinary field of performance monitoring, root cause failure modes analysis, failure diagnosis, prognosis, and proactive management of industrial systems. There is a special focus on digitally enabled asset management and covers several topics such as condition monitoring, maintenance, structural health monitoring, non-destructive testing and other allied areas. Bringing together expert contributions from academia and industry, this book will be a valuable resource for those interested in latest condition monitoring and asset management techniques.

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.

Motor current signature analysis (MCSA) is a powerful monitoring tool for motor-driven equipment that provides a nonintrusive means for detecting the presence of mechanical and electrical abnormalities in the motor and the driven equipment, including altered conditions in the process "downstream" of the motor-driven equipment. It was developed at the Oak Ridge National Laboratory as a means for determining the effects of aging and service wear systems, but it is applicable to a broad range of machinery. MCSA is based on the recognition that an electric motor (ac or dc) driving a mechanical load acts as an efficient and permanently available transducer by sensing mechanical load variations, large and small, long-term and rapid, and converting them into variations in the induced current generated in the motor windings. These motor current variations are carried by the electrical cables processes as desired. Motor current signatures, obtained in both time and over time to provide early indication of degradation. Successful applications of MCSA technology (patent applied for) include not only motor-operated valves but also pumps of various designs, blowers, and air conditioning systems. Examples are presented briefly, and speculation regarding the applicability of MCSA to a broader range of equipment monitoring and production line testing is also given. 1 ref., 13 figs.

Motor current signature analysis (CSA) has been used for several years as a diagnostic tool for electrical problems in ac, induction motors. Personnel at Oak Ridge National Laboratory have found that CSA can also provide information about system vibrations and imbalances similar to the information provided by an accelerometer. As a result, CSA techniques for monitoring the status of the equipment, such as pumps and compressors, driven by induction motors have been developed and used in dedicated monitoring systems. In this work, researchers have found that CSA responds proportionately to imbalances in rotating equipment and can be used to detect the In high-vibration conditions that can result. This report describes how vibration monitoring with CSA can be implemented and presents test data to support that use.

Mass production companies have become obliged to reduce their production costs and sell more products with lower profit margins in order to survive in competitive market conditions. The complexity and automation level of machinery are continuously growing. This development calls for some of the most critical issues that are reliability and dependability of automatic systems. In the future, machines will be monitored remotely, and computer-aided techniques will be employed to detect faults in the future, and also there will be unmanned factories where machines and systems communicate to each other, detect their own faults, and can remotely intercept their faults. The pioneer studies of such systems are fault diagnosis studies. Thus, we hope that this book will contribute to the literature in this regard.

The book contains six chapters. The use of the progressive regressive strategy for biometrical authentication through the use of human gait and face images was investigated. A new lossy image compression technique that uses singular value decomposition and wavelet difference reduction technique was proposed. The best wavelet packet based selection algorithm and its application in image denoising was discussed. The scaling factor threshold estimator in different color models using a discrete wavelet transform for steganographic algorithms was presented. The extraction of features appearing in current signal using wavelet analysis when there is rotor fault of eccentricity and broken rotor bar was debated. The application of the empirical wavelet transform for seismic anomalies detection in ultralow-frequency geomagnetic signals was illustrated.

This book shows how condition monitoring can be applied to detect internal degradation in pumps so that appropriate maintenance can be decided upon based on actual condition rather than arbitrary time scales. The book focuses on the main condition monitoring techniques particularly relevant to pumps (vibration analysis, performance analysis). The philosophy of condition monitoring is briefly summarised and field examples show how condition monitoring is applied to detect internal degration in pumps. * The first book devoted to condition monitoring and predictive maintenance in pumps. * Explains how to minimise energy costs, limit overhauls and reduce maintenance expenditure. * Includes material not found anywhere else.

The book is a collection of high-quality peer-reviewed research papers presented in the first International Conference on Signal, Networks, Computing, and Systems (ICSNCS 2016) held at Jawaharlal Nehru University, New Delhi, India during February 25–27, 2016. The book is organized in to two volumes and primarily focuses on theory and applications in the broad areas of communication technology, computer science and information security. The book aims to bring together the latest scientific research works of academic scientists, professors, research scholars and students in the areas of signal, networks, computing and systems detailing the practical challenges encountered and the solutions adopted.