

Motor Current Signature Analysis

E Durkheim

Current Signature Analysis for Condition Monitoring of Cage Induction Motors William T. Thomson, Ian Culbert, 2016-11-30 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.

Condition Monitoring of Machinery Using Motor Current Signature Analysis, 1989 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 Method for Diagnosing Motor Operated Devices, 1990 A motor current noise signature analysis method and apparatus 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 accessible or hostile environments.

Motor Current Signature Analysis for Determining Operational Readiness of Motor-operated Valves (MOVs), 1987 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).

Current Signature Analysis for Condition Monitoring of Cage Induction Motors William T. Thomson, Ian Culbert, 2017-01-24 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.

Condition Monitoring Of Electric Motors Using Motor Current Signature Analysis And Acoustic Emission Rajesh Reddy Muthireddy, 2010 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.

Detection of Induction Motor Stator Abnormalities Using Motor Current Signature Analysis Ghassan A. Bin Eid, 2004 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.

High-vibration Detection Using Motor Current Signature Analysis, 1996 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.

Induction Motor Fault Diagnosis Subrata Karmakar, Surajit Chattopadhyay, Madhuchhanda Mitra, Samarjit Sengupta, 2016-04-04 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.

Motor current signature analysis interim report N. H. Brown, 1992

Fault diagnosis of induction motor fed by frequency converter. The signal signature analysis technique Hussain Mahdi, 2016-08-12 Thesis (M.A.) from the year 2013 in the subject Electrotechnology, Warsaw University of Technology (Electrical Engineering), language: English, abstract: 3-Phase induction motors are widely used as a source of mechanical power for effective operation and low costs. The abnormalities have to be detected in advance to avoid the motor breakdown and the cost associated restrain of plant production. This work discusses current and flux leakage spectral analysis techniques for the diagnosis of broken rotor bars and shortcircuited turns in induction motor fed from different AC sources. In spite of recent development of various types of models toward motor faults diagnosis and examining different problems associated with 3-phase induction motors the signal spectral analysis is considered as one of most important

approaches. Most of the models from simple equivalent circuit to more complex d-q and a-b-c models and lastly developed hybrid models are provided for the integration of different forms of current and/or voltage unbalance. Generally, techniques that relate to asymmetry identify asymmetrical motor faults. Frequency converters in many applications feed induction motors. Such applications, which play a major role in industry, are growing at a high rate, allow to use 3-phase induction motor as variable speed applications. This paper proposes application of spectral signature analysis for the detection and diagnosis of abnormal electrical and mechanical conditions, which indicates chosen faults in induction motor fed by frequency converter.

Proceedings of the American Power Conference ,1991

Instrumentation for Motor-current Signature Analysis Using Synchronous Sampling ,1996 Personnel in the Instrumentation and Controls Division at Oak Ridge National Laboratory, in association with the United States Enrichment Corporation, the U.S. Navy, and various Department of Energy sponsors, have been involved in the development and application of motor-current signature analysis for several years. In that time, innovation in the field has resulted in major improvements in signal processing, analysis, and system performance and capabilities. Recent work has concentrated on industrial implementation of one of the most promising new techniques. This report describes the developed method and the instrumentation package that is being used to investigate and develop potential applications.

Flow-induced Vibration of Power and Process Plant Components M. K. Au-Yang,2001 Information on the most common flow-induced vibration problems in power and process plant components. Based on the author's own experience that most errors in engineering analysis come from confusions in the units, the author begins with a short chapter on units and dimensions. He then provides step-by-step examples in dual US and SI units, leading to the final objective of design analysis, problem solving, diagnosis and trouble shooting.

Improved Speed Observer Performance Using Motor Current Signature Analysis Rajbabu Velmurugan,1998

Condition Monitoring and Faults Diagnosis of Induction Motors Nordin Saad,Muhammad Irfan,Rosdiazli Ibrahim,2018-07-11 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.

Tech Notes ,1990

Advances in Mechanical Engineering (ICME) Mark Zhou,2011-03-28 Selected, peer reviewed papers from 2011 First International Conference on Mechanical Engineering, April 3-4, Phuket, Thailand, 2011

The Systems Engineering Approach to Mechanical Failure Prevention Mechanical Failures Prevention Group. Meeting,1993 Session papers on concurrent engineering for mechanical systems, nondestructive evaluation and information processing, failure mechanisms and life extension, and condition based maintenance systems engineering.

Government Reports Announcements & Index ,1991

Unveiling the Power of Verbal Artistry: An Emotional Sojourn through **Motor Current Signature Analysis**

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each consonant is pronounced and

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in which the letter take shape as i

mentioned earlier letters tend to

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from right to left top to bottom you can

click on each letter to hear its name

basically all 29 letters are consonants

vowels are not part of the alphabet they

will be discussed later a b c d e f g h i j

k l m n o p q r s t u v w x y z each letter



has 4 forms which look very similar to

each other

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unknowns 6s and 15l as it contains a solid liquid mixture vacuum filtration

was conducted 6s is insoluble in 15l procedure 1 take the unknown binary mixture and make observations about

the mixture by stating its state odor color and solubility characteristics