Modelling Monitoring And Diagnostic Techniques For Fluid Power Systems

This monograph presents a variety of techniques that can be used for designing robust fault diagnosis schemes for non-linear systems. The introductory part of the book is of a tutorial value and can be perceived as a good starting point for the new-comers to this field. Subsequently, advanced robust observer structures are presented. Parameter estimation based techniques are discussed as well. A particular attention is drawn to experimental design for fault diagnosis. The book also presents a number of robust soft computing approaches utilizing evolutionary algorithms and neural networks. All approaches described in this book are illustrated by practical applications.

A one-of-a-kind presentation of the major achievements in statistical profile monitoring methods Statistical profile monitoring is an area of statistical quality control that is growing in significance for researchers and practitioners, specifically because of its range of applicability across various service and manufacturing settings. Comprised of contributions from renowned academicians and practitioners in the field, Statistical Analysis of Profile Monitoring presents the latest state-of-the-art research on the use of control charts to monitor process and product quality profiles. The book presents comprehensive coverage of profile monitoring definitions, techniques, models, and application examples, particularly in various areas of engineering and statistics. The book begins with an introduction to the concept of profile monitoring and its applications in practice. Subsequent chapters explore the fundamental concepts, methods, and issues related to statistical profile monitoring, with topics of coverage including: Simple and multiple linear profiles Binary response profiles Parametric and nonparametric nonlinear profiles Multivariate linear profiles monitoring Statistical process control for geometric specifications Correlation and autocorrelation in profiles Nonparametric profile monitoring Throughout the book, more than two dozen real-world case studies highlight the discussed topics along with innovative examples and applications of profile monitoring. Statistical Analysis of Profile Monitoring is an excellent book for courses on statistical quality control at the graduate level. It also serves as a valuable reference for quality engineers, researchers and anyone who works in monitoring and improving statistical processes.

A systematic approach to profit optimization utilizing strategic solutions and methodologies for the chemical process industry In the ongoing battle to reduce the cost of production and increase profit margin within the chemical process industry, leaders are searching for new ways to deploy profit optimization strategies. Profit Maximization Techniques For Operating Chemical Plants defines strategic planning and implementation techniques for managers, senior executives, and technical service consultants to help increase profit margins. The book provides in-depth insight and practical tools to help readers find new and unique opportunities to implement profit optimization strategies. From identifying where the large profit improvement projects are to increasing plant capacity and pushing plant operations towards multiple constraints while maintaining continuous improvements—there is a plethora of information to help keep plant operations on budget. The book also includes information on: ? Take away methods and techniques for identifying and exploiting potential areas to improve profit within the plant ? Focus on latest

Artificial Intelligence based modeling, knowledge discovery and optimization strategies to maximize profit in running plant. ? Describes procedure to develop advance process monitoring and fault diagnosis in running plant ? Thoughts on engineering design , best practices and monitoring to sustain profit improvements ? Step-by-step guides to identifying, building, and deploying improvement applications For leaders and technologists in the industry who want to maximize profit margins, this text provides basic concepts, guidelines, and step-by-step guides specifically for the chemical plant sector.

This book presents the most important tools, techniques, strategy and diagnostic methods used in industrial engineering. The current widely accepted methods of diagnosis and their properties are discussed. Also, the possible fruitful areas for further research in the field are identified.

Early and accurate fault detection and diagnosis for modern chemical plants can minimise downtime, increase the safety of plant operations, and reduce manufacturing costs. The process-monitoring techniques that have been most effective in practice are based on models constructed almost entirely from process data. The goal of the book is to present the theoretical background and practical techniques for data-driven process monitoring. Process-monitoring techniques presented include: Principal component analysis; Fisher discriminant analysis; Partial least squares; Canonical variate analysis. The text demonstrates the application of all of the data-driven process monitoring techniques to the Tennessee Eastman plant simulator - demonstrating the strengths and weaknesses of each approach in detail. This aids the reader in selecting the right method for his process application. Plant simulator and homework problems in which students apply the process-monitoring techniques to a nontrivial simulated process, and can compare their performance with that obtained in the case studies in the text are included. A number of additional homework problems encourage the reader to implement and obtain a deeper understanding of the techniques. The reader will obtain a background in data-driven techniques for fault detection and diagnosis, including the ability to implement the techniques and to know how to select the right technique for a particular application.

Methods for the optimal selection of measurements and health parameters used for diagnostic purposes in aircraft gas turbine engines are presented. Principles of aerothermodynamic diagnostic techniques are first briefly reviewed. The problem of optimal selection of measurements and health parameters is examined from two different standpoints. (a) How to select out of all available measurements the minimum set that will be capable to provide sufficient information to assess engine health condition. (b) When a set of measurable quantities from an operating engine is given, how to select the combination of health parameters, in order to provide in an optimal way the information about the condition of the engine. The present paper concentrates mainly on the second type of problem since it is related to the handling of an existing fleet. Methods based on sensitivity analysis are discussed, but it is shown that the most substantial information is produced by analyzing the properties of the Jacobian matrix, interrelating parameters and measurement deviations. Finally, results of condition estimation for a number of turbofans in service are presented.

The objective of this book is to introduce basic model-based FDI schemes, advanced analysis and design algorithms,

and the needed mathematical and control theory tools at a level for graduate students and researchers as well as for engineers. This is a textbook with extensive examples and references. Most methods are given in the form of an algorithm that enables a direct implementation in a programme. Comparisons among different methods are included when possible.

This research addresses the problem of prolonging the life of aged structures of historical value that have already outlived their original designed lives many times. While a lot of research has been carried out in the field of structural monitoring, diagnostics and prognostics for high tech industries, this is not the case for historical aged structures. Currently most maintenance projects for aged structures have focused on the instrumentation and diagnostic techniques required to detect any damage with a certain degree of success. This research project involved the development of diagnostic and prognostic tools to be used for monitoring and predicting the 'health' of aged structures. The diagnostic and prognostic tools have been developed for the monitoring of Cutty Sark iron structures as a first application. The concept of canary and parrot sensor devices are developed where canary devices are small, accelerated devices, which will fail according to similar failure mechanisms occurring in an aged structures and parrot devices are designed to fail at the same rate as the structure, thus mimicking the structure. The model-driven prognostic tool uses a Physics-of-Failure (PoF) model to predict remaining life of a structure. It uses a corrosion model based on the decrease in corrosion rate over time to predict remaining life of an aged iron structures. The data-driven diagnostic tool developed uses Mahalanobis Distance analysis to detect anomalies in the behaviour of a structure. Bayesian Network models are then used as a fusion method, integrating remaining life predictions from the model-driven prognostic tool with information of possible anomalies from data-driven diagnostic tool to provide a probability distribution of predicted remaining life. The diagnostics and prognostic tools are validated and tested through demonstration example and experimental tests. This research primarily looks at applying diagnostic and prognostic technologies used in high-tech industries to aged iron structures. In order to achieve this, the model-driven and data-driven techniques commonly used had to be adapted taking into consideration the particular constraints of monitoring and maintaining aged structures. The fusion technique developed is a novel approach for prognostics for aged structures and provides the flexibility often needed for diagnostic and prognostic tools.

This book includes original, peer-reviewed research papers from the 11th International Conference on Modelling, Identification and Control (ICMIC2019), held in Tianjin, China on July 13-15, 2019. The topics covered include but are not limited to: System Identification, Linear/Nonlinear Control Systems, Data-driven Modelling and Control, Process Modelling and Process Control, Fault Diagnosis and Reliable Control, Intelligent Systems, and Machine Learning and

Artificial Intelligence.The papers showcased here share the latest findings on methodologies, algorithms and applications in modelling, identification, and control, integrated with Artificial Intelligence (AI), making the book a valuable asset for researchers, engineers, and university students alike.

This six-volume set presents cutting-edge advances and applications of expert systems. Because expert systems combine the expertise of engineers, computer scientists, and computer programmers, each group will benefit from buying this important reference work. An "expert system" is a knowledge-based computer system that emulates the decision-making ability of a human expert. The primary role of the expert system is to perform appropriate functions under the close supervision of the human, whose work is supported by that expert system. In the reverse, this same expert system can monitor and double check the human in the performance of a task. Human-computer interaction in our highly complex world requires the development of a wide array of expert systems. Key Features * Expert systems techniques and applications are presented for a diverse array of topics including: * Experimental design and decision support * The integration of machine learning with knowledge acquisition for the design of expert systems * Process planning in design and manufacturing systems and process control applications * Knowledge discovery in large-scale knowledge bases * Robotic systems * Geograhphic information systems * Image analysis, recognition and interpretation * Cellular automata methods for pattern recognition * Real-time fault tolerant control systems * CAD-based vision systems in pattern matching processes * Financial systems * Agricultural applications * Medical diagnosis

Thermal power plants are one of the most important process industries for engineering professionals. Over the past few decades, the power sector has been facing a number of critical issues. However, the most fundamental challenge is meeting the growing power demand in sustainable and efficient ways. Practicing power plant engineers not only look after operation and maintenance of the plant, but also look after a range of activities, including research and development, starting from power generation, to environmental assessment of power plants. The book Thermal Power Plants covers features, operational issues, advantages, and limitations of power plants, as well as benefits of renewable power generation. It also introduces thermal performance analysis, fuel combustion issues, performance monitoring and modelling, plants health monitoring, including component fault diagnosis and prognosis, functional analysis, economics of plant operation and maintenance, and environmental aspects. This book addresses several issues related to both coal fired and gas turbine power plants. The book is suitable for both undergraduate and research for higher degree students, and of course, for practicing power plant engineers.

Industrial Prognostics predicts an industrial system's lifespan using probability measurements to determine the way a machine operates. Prognostics are essential in determining being able to predict and stop failures before they occur.

Therefore the development of dependable prognostic procedures for engineering systems is important to increase the system's performance and reliability. Diagnostics and Prognostics of Engineering Systems: Methods and Techniques provides widespread coverage and discussions on the methods and techniques of diagnosis and prognosis systems. Including practical examples to display the method's effectiveness in real-world applications as well as the latest trends and research, this reference source aims to introduce fundamental theory and practice for system diagnosis and prognosis.

There are multiple modalities available to evaluate health or stress status of animals. The objective of my research was to evaluate different modalities including behavior, rectal and nasal temperature, and blood samples to determine the relationship with these outcomes of interest in bovine respiratory disease (BRD) events, environmental conditions, transportation, and Mannheimia haemolytica challenge model. The objective for the final project was to determine whether diagnostic sensitivity or specificity resulted in greater economic value for the industry using simulation models for identification of BRD. There was a positive association with rectal temperature and probability of not finishing the production cycle normally, but this relationship was not linear. Rectal temperature of feedlot calves at first treatment for BRD had limited value as a prognostic indicator of whether those calves would finish the production cycle normally. A positive association between rectal temperature and ambient temperature and temperature-humidity index was determined. Environmental conditions must be considered when rectal temperature is used as a diagnostic tool. At 48 hours after initiation of transportation there were no differences in body weight, rectal temperature, and time spent at various locations in the pen detected between transported and non-transported control heifers. Transportation of heifers during periods of high ambient temperatures caused transient changes in physiologic and behavioral indices of heifers. Calves challenged with Mannheimia haemolytica had more changes in behavior, body weight, and blood biomarkers during high ambient temperatures compared to control calves. Results of this study may guide research in development of objective assessment tools for identification and management of cattle affected with BRD during extreme summer conditions. For both low and high apparent prevalence cohorts, increasing diagnostic specificity resulted in more rapid, positive change in net returns compared to change in increasing sensitivity. Improvement of diagnostic specificity, perhaps through a confirmatory test or pen-level diagnostics, can increase diagnostic value. Mortality risk was the primary driver for net returns. Results from this study are important for determining future research priorities to analyze diagnostic techniques for BRD and provide a novel way for modeling diagnostic tests.

This book is a printed edition of the Special Issue "Power Transformer Diagnostics, Monitoring and Design Features" that was published in Energies

"This publication addresses the research in theoretical foundations, practical techniques, software tools, applications and / or practical experiences in knowledge-based software engineering. The book also includes a new field: research in web services and

semantic web. This is a rapidly developing research area promising to give excellent practical outcome, and interesting for theoretically minded as well as for practically minded people. The largest part of the papers belongs to a traditional area of applications of artificial intelligence methods to various software engineering problems. Another traditional section is application of intelligent agents in software engineering. A separate section is devoted to interesting applications and special techniques related in one or another way to the topic of the conference."

An adjunct to the increased emphasis on developing students' critical thinking and higher order skills is the need for methods to monitor and evaluate these abilities. These papers provide insight into current techniques and examine possibilities for the future. The contributors to Diagnostic Monitoring of Skill and Knowledge Acquisition focus on two beliefs: that new kinds of tests and assessment methods are needed; and that instruction and learning can be improved by developing new assessment methods based on work in cognitive science.

Now in its Eighth Edition, this leading comprehensive manual helps nurses deliver safe, effective, and informed care for patients undergoing diagnostic tests and procedures. The book covers a broad range of laboratory and diagnostic tests and studies that are delivered to varied patient populations in varied settings. Tests are grouped according to specimen and function/test type (e.g. blood, urine, stool, cerebrospinal fluid, etc.). Each test is described in detail, with step-by-step guidance on correct procedure, tips for accurate interpretation, and instructions for patient preparation and aftercare. Clinical Alerts highlight critical safety information.

In spite of its high cost and technical importance, plasma equipment is still largely designed empirically, with little help from computer simulation. Plasma process control is rudimentary. Optimization of plasma reactor operation, including adjustments to deal with increasingly stringent controls on plant emissions, is performed predominantly by trial and error. There is now a strong and growing economic incentive to improve on the traditional methods of plasma reactor and process design, optimization, and control. An obvious strategy for both chip manufacturers and plasma equipment suppliers is to employ large-scale modeling and simulation. The major roadblock to further development of this promising strategy is the lack of a database for the many physical and chemical processes that occur in the plasma. The data that are currently available are often scattered throughout the scientific literature, and assessments of their reliability are usually unavailable. Database Needs for Modeling and Simulation of Plasma Processing identifies strategies to add data to the existing database, to improve access to the database, and to assess the reliability of the available data. In addition to identifying the most important needs, this report assesses the experimental and theoretical/computational techniques that can be used, or must be developed, in order to begin to satisfy these needs.

This book focuses on the analysis and design of advanced techniques for on-line automatic computational monitoring of pipelines and pipe networks. It discusses how to improve the systems' security considering mathematical models of the flow, historical flow rate and pressure data, with the main goal of reducing the number of sensors installed along a pipeline. The techniques presented in the book have been implemented in digital systems to enhance the abilities of the pipeline network's operators in recognizing anomalies. A real leak scenario in a Mexican water pipeline is used to

illustrate the benefits of these techniques in locating the position of a leak. Intended for an interdisciplinary audience, the book addresses researchers and professionals in the areas of mechanical, civil and control engineering. It covers topics on fluid mechanics, instrumentation, automatic control, signal processing, computing, construction and diagnostic technologies.

The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. New theory, new controllers, actuators, sensors, new industrial processes, computer methods, new applications, new philosophies. . . , new challenges. Much of this development work resides in industrial reports, feasibility study papers and the reports of advanced collaborative projects. The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for widerand rapid dissemination. Benchmarking is a technique first applied by Rank Xerox in the late 1970s for business processes. As a subject in the commercial arena, benchmarking thrives with, for example, a European Benchmarking Forum. It has taken rather longer for benchmarking to make the transfer to the technical domain and even now the subject is making a slow headway. Akey research step in this direction was taken by Harris (1989) who used minimum variance control as a benchmark for controller loop assessment. This contribution opened up the area and a significant specialist literature has now developed. Significant support for the methodologywas given by Honeywell who have controller assessment routines in their process control applications software; therefore, it is timely to welcome a (first) monograph on controller performance assessment by Biao Huang and Sirish Shah to the Advances in Industrial Control series.

This book constitutes the refereed proceedings of the 19th International Conference on Industrial and Engineering Applications of Artificial Intelligence and Expert Systems, IEA/AIE 2006, held in Annecy, France, June 2006. The book presents 134 revised full papers together with 3 invited contributions, organized in topical sections on multi-agent systems, decision-support, genetic algorithms, data-mining and knowledge discovery, fuzzy logic, knowledge engineering, machine learning, speech recognition, systems for real life applications, and more.

This book covers the background theory of fluid power and indicates the range of concepts needed for a modern approach to condition monitoring and fault diagnosis. The theory is leavened by 15-years-worth of practical measurements by the author, working with major fluid power companies, and real industrial case studies. Heavily supported with examples drawn from real industrial plants – the methods in this book have been shown to work. Clinicians are taught masses of facts, but not how to use them inthe messy reality of patient care. This book provides a missinglink between evidence and the clinical coalface. Though there areplenty of guides to evidence-based medicine,

few explain how tobuild the information into patient oriented decision-making.Clinical Thinking allows you to think both logically andlaterally about daily clinical issues and look at problems fromdifferent angles. Uses realistic scenarios, frameworks and models Takes you through the whole decision-making process, fromobservation and narrative to evaluating the best evidence for theindividual situation Illustrations and flow charts help clarify this newapproach These methods have been tried and tested by the authors,internationally respected general practitioners and teachers inprimary care – all leaders in the evidence-based medicinemovement This book takes clinical medicine a big step forward in thedirection of patient-focused practice!

Modelling, Monitoring and Diagnostic Techniques for Fluid Power SystemsSpringer Science & Business Media

Getting the right diagnosis is a key aspect of health care - it provides an explanation of a patient's health problem and informs subsequent health care decisions. The diagnostic process is a complex, collaborative activity that involves clinical reasoning and information gathering to determine a patient's health problem. According to Improving Diagnosis in Health Care, diagnostic errors-inaccurate or delayed diagnoses-persist throughout all settings of care and continue to harm an unacceptable number of patients. It is likely that most people will experience at least one diagnostic error in their lifetime, sometimes with devastating consequences. Diagnostic errors may cause harm to patients by preventing or delaying appropriate treatment, providing unnecessary or harmful treatment, or resulting in psychological or financial repercussions. The committee concluded that improving the diagnostic process is not only possible, but also represents a moral, professional, and public health imperative. Improving Diagnosis in Health Care a continuation of the landmark Institute of Medicine reports To Err Is Human (2000) and Crossing the Quality Chasm (2001) finds that diagnosis-and, in particular, the occurrence of diagnostic errorsâ€"has been largely unappreciated in efforts to improve the quality and safety of health care. Without a dedicated focus on improving diagnosis, diagnostic errors will likely worsen as the delivery of health care and the diagnostic process continue to increase in complexity. Just as the diagnostic process is a collaborative activity, improving diagnosis will require collaboration and a widespread commitment to change among health care professionals, health care organizations, patients and their families, researchers, and policy makers. The recommendations of Improving Diagnosis in Health Care contribute to the growing momentum for change in this crucial area of health care quality and safety.

Concerns over energy resources and the environmental impact of energy use will continue to be part of the polical agenda across the globe. World Scientific's unique series of books on Current Energy Issues is intended, in part, as an expansion and update of the material contained in the World Scientific Handbook of Energy but in part each volume will focus on related energy resources or issues that contain a broader range of topics plus more explanatory text than was possible in the Handbook. The authors will also take the opportunity to update the data presented in the Handbook since in many cases the field is rapidly changing. The Fossil Fuels volume focuses on the main fossil resources, viz. coal, oil and natural gas. Coal is still an extremely important

resource especially for electricity production around the world and the book discussed methods for making coal a cleaner resource, including carbon sequestration. There has been a rapid change in the mix of fossil fuels mainly because of hydraulic fracturing which enables oil and gas to be extracted from previously inaccessible formations. The book describes this changing situation including the precautions required to make the production of these fuels safe and environmentally benign. Alternative fossil fuels such as methane hydrates are also discussed. Contents:Coal Resources, Production, and Use Worldwide (Thomas Sarkus and William Ellis)Coal Gasification and Advances in Clean Coal Technology (Thomas Sarkus and Adrian Radziwon)Geologic Carbon Storage (Thomas Sarkus, Michael Tennyson and Derek Vikara)Environmental Impacts of Coal Production (Thomas Sarkus and William Ellis)Petroleum Liquids (William L Fisher and Christopher G St C Kendall)Unconventional Petroleum Liquids: Tar Sands and Shale Oil (Vello A Kuuskraa)Oil Spills: Causes, Consequences, Prevention, and Countermeasures (Jacqueline Michel and Merv Fingas)Natural Gas (John B Curtis)Hydraulic Fracturing (Randy F LaFollette and Robert Samuel Hurt)Methane Hydrates (Yoshihiro Masuda, Tsutomu Uchida, Sadao Nagakubo and Mikio Satoh) Readership: Scientists, engineers, policy makers, graduate students and researchers on the field of energy studies.

Condition monitoring (CM) data, or simply monitoring data, is defined as a dataset that has been collected from individuals along the time, and it implicitly manifests the underlying unobservable system status. Due to the advances in sensory devices and information technology, prognosis and diagnosis in various fields can take enormous advantages from the rich condition monitoring data. However, at the same time, it also creates new challenges for research in data analytics as to how this vast and complex data could be utilized to retrieve accurate diagnosis and meaningful prognosis. Many existing techniques fall short of addressing this issue because most of them are developed when the data were collected in a well-controlled experimental setting. However, the monitoring data often involves many factors that are uncontrollable and, inevitably, has severe heterogeneity. This research simultaneously addresses multiple challenges that arise from the monitoring data. i. An Individualized model is crucial for effective diagnosis and prognosis based on the monitoring data. The primary focus of collecting the monitoring data is to understand the specific in-service unit rather than studying the population behavior. Therefore, the predictions or diagnostic decisions based on the monitoring data needs to be highly individualized. Collecting monitoring data happens in the on-line stage at the real time. Thus, the model should be able to update or adjust itself according to the newly-collected data points from the specific individual. ii. A non-parametric framework that can account for heterogeneity and handle high dimensionality in the data is needed. CM signals may not follow any parametric form, and if the specified form is far from the truth, the modeling and prognosis results will be misleading. For instance, parametric representations are typically based on physical or chemical theories; however, in most cases, such theories are unknown. Therefore, functional forms should be derived through empirical evaluation or visual observation, making them sensitive to model misspecification iii. A flexible modeling strategy that can handle multiple data types simultaneously is needed. Specifically incorporating qualitative data and introducing a distance measure between such data is essential for better prognosis. The monitoring data comes in various data types. In the literature, there are many statistical

methods that are developed for a specific type of data which is not suitable for the monitoring data that includes various data types at the same time. Thus, a novel statistical model fusion needs to be investigated. iv. A scalable approach specifically when the number of CM signals/functional outputs is large. Further, the integrative analysis of multiple outputs implicitly assumes that these outputs share some commonalities. However, if this does not hold, negative transfer of knowledge may occur, which leads to decreased performance relative to learning tasks separately. Therefore, the model needs to possess excellent scalability when the number of outputs is large and simultaneously minimizes the negative transfer of knowledge between uncorrelated outputs. To address those issues listed above, four tasks are investigated in this report. (a) To build a mixture mixed effects model which is able to account for imbalance (early vs late failure) in the data. This technique greatly improves prognostics specifically for systems where most units are reliable and only few tend to fail at early stages of their life cycle. (b) To propose an alternative view on modeling CM data using multivariate Gaussian process. This view draws its roots from multitask learning and is based on treating each CM signal as an individual task. This technique is non-parametric, scalable and is able to account for heterogeneity in the data. (c) To incorporate qualitative features in non-parametric prognostics through a reparametrization technique called hypersphere decomposition. This technique allows incorporating external factors into prognostic models through defining a distance measure based on a unit hypercube. (d) To provide scalability for the multivariate Gaussian process when the number of outputs is large and to minimize the negative transfer of knowledge between uncorrelated outputs. This technique utilizes a distributed estimation scheme which allows scaling to arbitrarily large datasets through parallelization.

The idea of preparing this volume originated from the ever increasing importance of computational modelling of complex problems in medicine. Considerable advances have been made in this area as demonstrated by the continued success of the International Conference on Modelling in Medicine and Biology organised by the Wessex Institute of Technology.The work reported at those meetings and the research carried out at the Wessex Institute of Technology indicated the increasing interaction and collaboration between medical and engineering scientists. Advances presented at these conferences are now being used in practice for a wide range of medical and surgical applications.The considerable improvements and evolution of the field has led to some of the best scientists, who have participated in our conferences, to write an article on their most recent research. This has led to thirteen outstanding articles published in this volume which encompass important areas of biomedical modelling.

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