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Data-driven Fault Detection and Reasoning for Industrial Monitoring
Soft Sensors for Monitoring and Control of Industrial Processes
Dynamics and Control of Process Systems 2004
Advances of Computational Intelligence in Industrial Systems
Applied Predictive Control
Active Fault-Tolerant Control Systems
31st European Symposium on Computer Aided Process Engineering
Multivariate Statistical Process Control
Process Control Performance Assessment
Time Series Analysis
Data-driven Methods for Fault Detection and Diagnosis in Chemical Processes
Fault Detection, Supervision and Safety of Technical Processes 2003 (SAFEPROCESS 2003)
Data-driven Design of Fault Diagnosis and Fault-tolerant Control Systems
Data-Driven and Model-Based Methods for Fault Detection and Diagnosis
Methods in Chemical Process Safety, Volume Four focuses on the process of learning from experience, including elements of process safety management, human factors in the chemical process industries, and the regulation of chemical process safety, including current approaches. Users will find this book to be an informative tool and user manual for process safety for a variety of professionals with this new release focusing on Advanced Methods of Risk Assessment and Management, Logic Based Methods for Dynamic Risk Assessment, Bayesian Methods for Dynamic Risk
Assessment, Data Driven Methods, Rare Event Risk Assessment, Risk Management and Multi Criteria, and much more. Helps acquaint the reader/researcher with the fundamentals of process safety Provides the most recent advancements and contributions on the topic from a practical point-of-view Presents users with the views/opinions of experts in each topic Includes a selection of authors who are leading researchers and/or practitioners for each given topic

The volume LNCS 8866 constitutes the refereed proceedings of the 11th International Symposium on Neural Networks, ISNN 2014, held in Hong Kong and Macao, China on November/December 2014. The 71 revised full papers presented were carefully reviewed and selected from 119 submissions. These papers cover all major topics of the theoretical research, empirical study and applications of neural networks research as follows. The focus is on following topics such as analysis, modeling, and applications.

Fault Diagnosis of Dynamic Systems provides readers with a glimpse into the fundamental issues and techniques of fault diagnosis used by Automatic Control (FDI) and Artificial Intelligence (DX) research communities. The book reviews the standard techniques and approaches widely used in both communities. It also contains benchmark examples and case studies that demonstrate how the same problem can be solved using the presented approaches. The book also introduces advanced fault diagnosis approaches that are currently still being researched, including methods for non-linear, hybrid, discrete-event and software/business systems, as well as, an introduction to prognosis. Fault Diagnosis of Dynamic Systems is valuable source of information for researchers and engineers starting to work on fault diagnosis and willing to have a reference guide on the main concepts and standard approaches on fault diagnosis. Readers with experience on one of the two main communities will also find it useful to learn the fundamental concepts of the other community and the synergies between them. The book is also open to researchers or academics who are already familiar with the standard approaches, since they will find a collection of advanced approaches with more specific and advanced topics or with application to different domains. Finally, engineers and researchers looking for transferable fault diagnosis methods will also find useful insights in the book.

This book is a practical guide to the application of control benchmarking to real, complex, industrial processes. The variety of industrial case studies gives the benchmarking ideas presented a robust real-world attitude. The book deals with control engineering principles and economic and management aspects of benchmarking. It shows the reader how to avoid common problems in benchmarking and details the benefits of effective benchmarking.

A three-volume work bringing together papers presented at ‘SAFEPROCESS 2003’, including four plenary papers on statistical, physical-model-based and logical-model-based approaches to fault detection and diagnosis, as well as 178
regular papers.

Statistical Process Monitoring Using Advanced Data-Driven and Deep Learning Approaches tackles multivariate challenges in process monitoring by merging the advantages of univariate and traditional multivariate techniques to enhance their performance and widen their practical applicability. The book proceeds with merging the desirable properties of shallow learning approaches - such as a one-class support vector machine and k-nearest neighbours and unsupervised deep learning approaches - to develop more sophisticated and efficient monitoring techniques. Finally, the developed approaches are applied to monitor many processes, such as waste-water treatment plants, detection of obstacles in driving environments for autonomous robots and vehicles, robot swarm, chemical processes (continuous stirred tank reactor, plug flow reactor, and distillation columns), ozone pollution, road traffic congestion, and solar photovoltaic systems. Uses a data-driven based approach to fault detection and attribution Provides an in-depth understanding of fault detection and attribution in complex and multivariate systems Familiarises you with the most suitable data-driven based techniques including multivariate statistical techniques and deep learning-based methods Includes case studies and comparison of different methods

The major objective of this book is to introduce advanced design and (online) optimization methods for fault diagnosis and fault-tolerant control from different aspects. Under the aspect of system types, fault diagnosis and fault-tolerant issues are dealt with for linear time-invariant and time-varying systems as well as for nonlinear and distributed (including networked) systems. From the methodological point of view, both model-based and data-driven schemes are investigated. To allow for a self-contained study and enable an easy implementation in real applications, the necessary knowledge as well as tools in mathematics and control theory are included in this book. The main results with the fault diagnosis and fault-tolerant schemes are presented in form of algorithms and demonstrated by means of benchmark case studies. The intended audience of this book are process and control engineers, engineering students and researchers with control engineering background.

This book is a collection of representative and novel works in the field of data mining, knowledge discovery, clustering and classification. Discussing both theoretical and practical aspects of “Knowledge Discovery and Management” (KDM), it is intended for researchers interested in these fields, including PhD and MSc students, and researchers from public or private laboratories. The contributions included are extended and reworked versions of six of the best papers that were originally presented in French at the EGC’2016 conference held in Reims (France) in January 2016. This was the 16th edition of this successful conference, which takes place each year, and also featured workshops and other events with the aim of promoting exchanges between researchers and companies concerned with KDM and its applications in
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business, administration, industry and public organizations. For more details about the EGC society, please consult egc.asso.fr.

Improvement of injection molding processes remains a topic of great interest in both industry and research institutions. This book introduces the analysis of the molding process from a systems technology point of view. It is divided into four parts: the first part provides general background to introduce the injection molding process, the second covers the control of the process, the third is on the monitoring technology, and the fourth is concerned with the optimization of the process. Most the results within are from real engineering implementations and experimental tests.

This unique text/reference describes in detail the latest advances in unsupervised process monitoring and fault diagnosis with machine learning methods. Abundant case studies throughout the text demonstrate the efficacy of each method in real-world settings. The broad coverage examines such cutting-edge topics as the use of information theory to enhance unsupervised learning in tree-based methods, the extension of kernel methods to multiple kernel learning for feature extraction from data, and the incremental training of multilayer perceptrons to construct deep architectures for enhanced data projections. Topics and features: discusses machine learning frameworks based on artificial neural networks, statistical learning theory and kernel-based methods, and tree-based methods; examines the application of machine learning to steady state and dynamic operations, with a focus on unsupervised learning; describes the use of spectral methods in process fault diagnosis.

Provides an extensive, up-to-date treatment of techniques used for machine condition monitoring. Clear and concise throughout, this accessible book is the first to be wholly devoted to the field of condition monitoring for rotating machines using vibration signals. It covers various feature extraction, feature selection, and classification methods as well as their applications to machine vibration datasets. It also presents new methods including machine learning and compressive sampling, which help to improve safety, reliability, and performance. Condition Monitoring with Vibration Signals: Compressive Sampling and Learning Algorithms for Rotating Machines starts by introducing readers to Vibration Analysis Techniques and Machine Condition Monitoring (MCM). It then offers readers sections covering: Rotating Machine Condition Monitoring using Learning Algorithms; Classification Algorithms; and New Fault Diagnosis Frameworks designed for MCM. Readers will learn signal processing in the time-frequency domain, methods for linear subspace learning, and the basic principles of the learning method Artificial Neural Network (ANN). They will also discover recent trends of deep learning in the field of machine condition monitoring, new feature learning frameworks based on compressive sampling, subspace learning techniques for machine condition monitoring, and much more. Covers the fundamental as well as the state-of-the-art approaches to machine condition monitoring, guiding readers from
the basics of rotating machines to the generation of knowledge using vibration signals. Provides new methods, including machine learning and compressive sampling, which offer significant improvements in accuracy with reduced computational costs. Features learning algorithms that can be used for fault diagnosis and prognosis. Includes previously and recently developed dimensionality reduction techniques and classification algorithms. Condition Monitoring with Vibration Signals: Compressive Sampling and Learning Algorithms for Rotating Machines is an excellent book for research students, postgraduate students, industrial practitioners, and researchers.

This monograph presents new methodologies to improve power plants' efficiency, by using automatic control algorithms. This will lead to an improvement in companies' profit and also in the quality of their final product. A trans-Atlantic combination of authors ensures an unusually wide range of perspectives.

This book focuses on the importance of human factors in the development of safe and reliable unmanned systems. It discusses current challenges such as how to improve the perceptual and cognitive abilities of robots, develop suitable synthetic vision systems, cope with degraded reliability in unmanned systems, predict robotic behavior in case of a loss of communication, the vision for future soldier-robot teams, human-agent teaming, real-world implications for human-robot interaction, and approaches to standardize both the display and control of technologies across unmanned systems. Based on the AHFE 2017 International Conference on Human Factors in Robots and Unmanned Systems, held on July 17-21 in Los Angeles, California, USA, this book is expected to foster new discussion and stimulate new advances in the development of more reliable, safer, and highly functional devices for carrying out automated and concurrent tasks.

This open access book assesses the potential of data-driven methods in industrial process monitoring engineering. The process modeling, fault detection, classification, isolation, and reasoning are studied in detail. These methods can be used to improve the safety and reliability of industrial processes. Fault diagnosis, including fault detection and reasoning, has attracted engineers and scientists from various fields such as control, machinery, mathematics, and automation engineering. Combining the diagnosis algorithms and application cases, this book establishes a basic framework for this topic and implements various statistical analysis methods for process monitoring. This book is intended for senior undergraduate and graduate students who are interested in fault diagnosis technology, researchers investigating automation and industrial security, professional practitioners and engineers working on engineering modeling and data processing applications.

Applications of Artificial Intelligence in Process Systems Engineering offers a broad perspective on the issues related to artificial intelligence technologies and their applications in chemical and process engineering. The book
comprehensively introduces the methodology and applications of AI technologies in process systems engineering, making it an indispensable reference for researchers and students. As chemical processes and systems are usually non-linear and complex, thus making it challenging to apply AI methods and technologies, this book is an ideal resource on emerging areas such as cloud computing, big data, the industrial Internet of Things and deep learning. With process systems engineering's potential to become one of the driving forces for the development of AI technologies, this book covers all the right bases. Explains the concept of machine learning, deep learning and state-of-the-art intelligent algorithms Discusses AI-based applications in process modeling and simulation, process integration and optimization, process control, and fault detection and diagnosis Gives direction to future development trends of AI technologies in chemical and process engineering

Zhiwen Chen aims to develop advanced fault detection (FD) methods for the monitoring of industrial processes. With the ever increasing demands on reliability and safety in industrial processes, fault detection has become an important issue. Although the model-based fault detection theory has been well studied in the past decades, its applications are limited to large-scale industrial processes because it is difficult to build accurate models. Furthermore, motivated by the limitations of existing data-driven FD methods, novel canonical correlation analysis (CCA) and projection-based methods are proposed from the perspectives of process input and output data, less engineering effort and wide application scope. For performance evaluation of FD methods, a new index is also developed.

Safety in industrial process and production plants is a concern of rising importance but because the control devices which are now exploited to improve the performance of industrial processes include both sophisticated digital system design techniques and complex hardware, there is a higher probability of failure. Control systems must include automatic supervision of closed-loop operation to detect and isolate malfunctions quickly. A promising method for solving this problem is "analytical redundancy", in which residual signals are obtained and an accurate model of the system mimics real process behaviour. If a fault occurs, the residual signal is used to diagnose and isolate the malfunction. This book focuses on model identification oriented to the analytical approach of fault diagnosis and identification covering: choice of model structure; parameter identification; residual generation; and fault diagnosis and isolation. Sample case studies are used to demonstrate the application of these techniques.

The 31st European Symposium on Computer Aided Process Engineering: ESCAPE-31, Volume 50 contains the papers presented at the 31st European Symposium of Computer Aided Process Engineering (ESCAPE) event held in Istanbul, Turkey. It is a valuable resource for chemical engineers, chemical process engineers, researchers in industry and academia, students and consultants in the chemical industries. Presents findings and discussions from the 31st
European Symposium of Computer Aided Process Engineering (ESCAPE) event

This focused treatment includes the fundamentals and some state-of-the-art developments in the field of predictive control. A substantial part of the book addresses application issues in predictive control, providing several interesting case studies for more application-oriented readers.

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.

This book aims to provide readers with the current information, developments, and trends in a time series analysis, particularly in time series data patterns, technical methodologies, and real-world applications. This book is divided into three sections and each section includes two chapters. Section 1 discusses analyzing multivariate and fuzzy time series. Section 2 focuses on developing deep neural networks for time series forecasting and classification. Section 3 describes solving real-world domain-specific problems using time series techniques. The concepts and techniques contained in this book cover topics in time series research that will be of interest to students, researchers, practitioners, and professors in time series forecasting and classification, data analytics, machine learning, deep learning, and artificial intelligence.

This two-volume set of LNCS 12736-12737 constitutes the refereed proceedings of the 7th International Conference on Artificial Intelligence and Security, ICAIS 2021, which was held in Dublin, Ireland, in July 2021. The conference was
formerly called “International Conference on Cloud Computing and Security” with the acronym ICCCS. The total of 93 full papers and 29 short papers presented in this two-volume proceedings was carefully reviewed and selected from 1013 submissions. Overall, a total of 224 full and 81 short papers were accepted for ICAIS 2021; the other accepted papers are presented in CCIS 1422-1424. The papers were organized in topical sections as follows: Part I: Artificial intelligence; and big data Part II: Big data; cloud computing and security; encryption and cybersecurity; information hiding; IoT security; and multimedia forensics

Reliability Analysis and Asset Management of Engineering Systems explains methods that can be used to evaluate reliability and availability of complex systems, including simulation-based methods. The increasing digitization of mechanical processes driven by Industry 4.0 increases the interaction between machines and monitoring and control systems, leading to increases in system complexity. For those systems the reliability and availability analyses are increasingly challenging, as the interaction between machines has become more complex, and the analysis of the flexibility of the production systems to respond to machinery failure may require advanced simulation techniques. This book fills a gap on how to deal with such complex systems by linking the concepts of systems reliability and asset management, and then making these solutions more accessible to industry by explaining the availability analysis of complex systems based on simulation methods that emphasise Petri nets. Explains how to use a monitoring database to perform important tasks including an update of complex systems reliability Shows how to diagnose probable machinery-based causes of system performance degradation by using a monitoring database and reliability estimates in an integrated way Describes practical techniques for the application of AI and machine learning methods to fault detection and diagnosis problems

The book highlights recent developments in the field of biomedical systems covering a wide range of technological aspects, methods, systems and instrumentation techniques for diagnosis, monitoring, treatment, and assistance. Biomedical systems are becoming increasingly important in medicine and in special areas of application such as supporting people with disabilities and under pandemic conditions. They provide a solid basis for supporting people and improving their health care. As such, the book offers a key reference guide about novel medical systems for students, engineers, designers, and technicians.

In Canada, acceptance sampling has been used in legal metrology applications for nearly four decades. One of its principal uses has been in the quality control of utility meters that measure electricity or natural gas supplied to consumers. By law, such meters must be inspected for conformance to specification requirements prior to use and be periodically inspected while in use. With few exceptions, due to the numerous utility companies in the country and their
varied practices, the meters exist in the form of isolated lots for inspection purposes. The proportion of nonconforming meters in a lot has traditionally defined lot quality for utility meter sampling inspection purposes. Another principal application of acceptance sampling has been in the quality control of the net contents of packaged products sold in the marketplace. Such products include those sold on the basis of such measures as weight, volume, length, and area. In this particular application, products are also usually inspected on an isolated-lot basis for regulatory purposes. However, lot quality is usually measured on the basis of two criteria for such products: the proportion of non-conforming packages in the lot and the lot mean quantity. This section reviews Canadian quality control practices in these two areas of application, highlighting some of the deficiencies and issues. Three-class sampling plans are proposed as a possible solution to some of these deficiencies and issues.

The book introduces novel algorithms for designing fault-tolerant control (FTC) systems using the behavioral system theoretic approach, and presents a demonstration of successful novel FTC mechanisms on several benchmark examples. The authors also discuss a new transient management scheme, which is an essential requirement for the implementation of active FTC systems, and two data-driven methodologies that are broadly classified as active FTC systems: the projection-based approach and the online-redesign approach. These algorithms do not require much a priori information about the plant in real-time, and in addition this novel implementation of active FTC systems circumvents various weaknesses induced by using a diagnostic module in real-time. The book provides graduate students taking masters and doctoral courses in mathematics, control, and electrical engineering an excellent stepping-stone for their research. It also appeals to practitioners interested to apply innovative fail-safe control techniques.

This book reviews current design paths for soft sensors, and guides readers in evaluating different choices. The book presents case studies resulting from collaborations between the authors and industrial partners. The solutions presented, some of which are implemented on-line in industrial plants, are designed to cope with a wide range of applications from measuring system backup and what-if analysis through real-time prediction for plant control to sensor diagnosis and validation.

The two-volume set LNCS 3644 and LNCS 3645 constitute the refereed proceedings of the International Conference on Intelligent Computing, ICIC 2005, held in Hefei, China, in August 2005. The program committee selected 215 carefully revised full papers for presentation in two volumes from over 2000 submissions, based on rigorous peer reviews. The first volume includes all the contributions related with perceptual and pattern recognition, informatics theories and applications computational neuroscience and bioscience, models and methods, and learning systems. The second volume collects the papers related with genomics and proteomics, adaptation and decision making, applications and hardware,
and other applications.

This thesis develops a systematic, data-based dynamic modeling framework for industrial processes in keeping with the slowness principle. Using said framework as a point of departure, it then proposes novel strategies for dealing with control monitoring and quality prediction problems in industrial production contexts. The thesis reveals the slowly varying nature of industrial production processes under feedback control, and integrates it with process data analytics to offer powerful prior knowledge that gives rise to statistical methods tailored to industrial data. It addresses several issues of immediate interest in industrial practice, including process monitoring, control performance assessment and diagnosis, monitoring system design, and product quality prediction. In particular, it proposes a holistic and pragmatic design framework for industrial monitoring systems, which delivers effective elimination of false alarms, as well as intelligent self-running by fully utilizing the information underlying the data. One of the strengths of this thesis is its integration of insights from statistics, machine learning, control theory and engineering to provide a new scheme for industrial process modeling in the era of big data.

Dr.-Ing. Hao Luo demonstrates the developments of advanced plug-and-play (PnP) process monitoring and control systems for industrial automation processes. With aid of the so-called Youla parameterization, a novel PnP process monitoring and control architecture (PnP-PMCA) with modularized components is proposed. To validate the developments, a case study on an industrial rolling mill benchmark is performed, and the real-time implementation on a laboratory brushless DC motor is presented.

Computational Intelligence (CI) has emerged as a rapidly growing field over the past decade. This volume reports the exploration of CI frontiers with an emphasis on a broad spectrum of real-world applications. Such a collection of chapters has presented the state-of-the-art of CI applications in industry and will be an essential resource for professionals and researchers who wish to learn and spot the opportunities in applying CI techniques to their particular problems.

The safe and reliable operation of technical systems is of great significance for the protection of human life and health, the environment, and of the vested economic value. The correct functioning of those systems has a profound impact also on production cost and product quality. The early detection of faults is critical in avoiding performance degradation and damage to the machinery or human life. Accurate diagnosis then helps to make the right decisions on emergency actions and repairs. Fault detection and diagnosis (FDD) has developed into a major area of research, at the intersection of systems and control engineering, artificial intelligence, applied mathematics and statistics, and such application fields
as chemical, electrical, mechanical and aerospace engineering. IFAC has recognized the significance of FDD by launching a triennial symposium series dedicated to the subject. The SAFEPROCESS Symposium is organized every three years since the first symposium held in Baden-Baden in 1991. SAFEPROCESS 2006, the 6th IFAC Symposium on Fault Detection, Supervision and Safety of Technical Processes was held in Beijing, PR China. The program included three plenary papers, two semi-plenary papers, two industrial talks by internationally recognized experts and 258 regular papers, which have been selected out of a total of 387 regular and invited papers submitted. * Discusses the developments and future challenges in all aspects of fault diagnosis and fault tolerant control * 8 invited and 36 contributed sessions included with a special session on the demonstration of process monitoring and diagnostic software tools

This book presents recent results on fault diagnosis and condition monitoring of airborne electromechanical actuators, illustrating both algorithmic and hardware design solutions to enhance the reliability of onboard more electric aircraft. The book begins with an introduction to the current trends in the development of electrically powered actuation systems for aerospace applications. Practical examples are proposed to help present approaches to reliability, availability, maintainability and safety analysis of airborne equipment. The terminology and main strategies for fault diagnosis and condition monitoring are then reviewed. The core of the book focuses on the presentation of relevant case studies of fault diagnosis and monitoring design for airborne electromechanical actuators, using different techniques. The last part of the book is devoted to a summary of lessons learned and practical suggestions for the design of fault diagnosis solutions of complex airborne systems. The book is written with the idea of providing practical guidelines on the development of fault diagnosis and monitoring algorithms for airborne electromechanical actuators. It will be of interest to practitioners in aerospace, mechanical, electronic, reliability and systems engineering, as well as researchers and postgraduates interested in dynamical systems, automatic control and safety-critical systems. Advances in Industrial Control reports and encourages the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

Given their key position in the process control industry, process monitoring techniques have been extensively investigated by industrial practitioners and academic control researchers. Multivariate statistical process control (MSPC) is one of the most popular data-based methods for process monitoring and is widely used in various industrial areas. Effective routines for process monitoring can help operators run industrial processes efficiently at the same time as maintaining high product quality. Multivariate Statistical Process Control reviews the developments and improvements that have been made to MSPC over the last decade, and goes on to propose a series of new MSPC-based
approaches for complex process monitoring. These new methods are demonstrated in several case studies from the chemical, biological, and semiconductor industrial areas. Control and process engineers, and academic researchers in the process monitoring, process control and fault detection and isolation (FDI) disciplines will be interested in this book. It can also be used to provide supplementary material and industrial insight for graduate and advanced undergraduate students, and graduate engineers. Advances in Industrial Control aims to report and encourage the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

The major objective of this book is to introduce advanced design and (online) optimization methods for fault diagnosis and fault-tolerant control from different aspects. Under the aspect of system types, fault diagnosis and fault-tolerant issues are dealt with for linear time-invariant and time-varying systems as well as for nonlinear and distributed (including networked) systems. From the methodological point of view, both model-based and data-driven schemes are investigated. To allow for a self-contained study and enable an easy implementation in real applications, the necessary knowledge as well as tools in mathematics and control theory are included in this book. The main results with the fault diagnosis and fault-tolerant schemes are presented in form of algorithms and demonstrated by means of benchmark case studies. The intended audience of this book are process and control engineers, engineering students and researchers with control engineering background.

Data-driven Design of Fault Diagnosis and Fault-tolerant Control Systems presents basic statistical process monitoring, fault diagnosis, and control methods and introduces advanced data-driven schemes for the design of fault diagnosis and fault-tolerant control systems catering to the needs of dynamic industrial processes. With ever increasing demands for reliability, availability and safety in technical processes and assets, process monitoring and fault-tolerance have become important issues surrounding the design of automatic control systems. This text shows the reader how, thanks to the rapid development of information technology, key techniques of data-driven and statistical process monitoring and control can now become widely used in industrial practice to address these issues. To allow for self-contained study and facilitate implementation in real applications, important mathematical and control theoretical knowledge and tools are included in this book. Major schemes are presented in algorithm form and demonstrated on industrial case systems. Data-driven Design of Fault Diagnosis and Fault-tolerant Control Systems will be of interest to process and control engineers, engineering students and researchers with a control engineering background.

Data-Driven and Model-Based Methods for Fault Detection and Diagnosis covers techniques that improve the quality of
fault detection and enhance monitoring through chemical and environmental processes. The book provides both the theoretical framework and technical solutions. It starts with a review of relevant literature, proceeds with a detailed description of developed methodologies, and then discusses the results of developed methodologies, and ends with major conclusions reached from the analysis of simulation and experimental studies. The book is an indispensable resource for researchers in academia and industry and practitioners working in chemical and environmental engineering to do their work safely. Outlines latent variable based hypothesis testing fault detection techniques to enhance monitoring processes represented by linear or nonlinear input-space models (such as PCA) or input-output models (such as PLS). Explains multiscale latent variable based hypothesis testing fault detection techniques using multiscale representation to help deal with uncertainty in the data and minimize its effect on fault detection. Includes interval PCA (IPCA) and interval PLS (IPLS) fault detection methods to enhance the quality of fault detection. Provides model-based detection techniques for the improvement of monitoring processes using state estimation-based fault detection approaches. Demonstrates the effectiveness of the proposed strategies by conducting simulation and experimental studies on synthetic data.

Early and accurate fault detection and diagnosis for modern chemical plants can minimize downtime, increase the safety of plant operations, and reduce manufacturing costs. This book presents the theoretical background and practical techniques for data-driven process monitoring. It demonstrates the application of all the data-driven process monitoring techniques to the Tennessee Eastman plant simulator, and looks at the strengths and weaknesses of each approach in detail. A plant simulator and problems allow readers to apply process monitoring techniques.

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 wider and rapid dissemination. The last decade has seen considerable interest in reviving the fortunes of non-linear control. In contrast to the approaches of the 60S, 70S and 80S a very pragmatic agenda for non-linear control is being pursued using the model-based predictive control paradigm. This text by R. Ansari and M. Tade gives an excellent synthesis of this new direction. Two strengths emphasized by the text are: (i) four applications found in refinery processes are used to give the text a firm practical continuity; (ii) a non-linear model-based control architecture is used to give the method a coherent theoretical framework.