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Advanced Methods for Fault Diagnosis and Fault-tolerant Control *Diagnosis and Fault-tolerant Control 1* Advanced methods for fault diagnosis and fault-tolerant control **Data-driven Methods for Fault Detection and Diagnosis in Chemical Processes** Data-driven Methods for Fault Localization in Process Technology **Intelligent Fault Diagnosis and Accommodation Control Data-Driven and Model-Based Methods for Fault Detection and Diagnosis Diagnosis and Fault-Tolerant Control Unsupervised Process Monitoring and Fault Diagnosis with Machine Learning Methods Fault Diagnosis of Nonlinear Systems Using a Hybrid Approach Fault Diagnosis and Reconfiguration in Flight Control Systems** Model-based Fault Diagnosis in Dynamic Systems Using Identification Techniques Fault Detection and Diagnosis in Industrial Systems *Issues of Fault Diagnosis for Dynamic Systems* **Data-driven Methods for Fault Detection and Diagnosis in Chemical Processes** A Artificial Intelligence Methods for Fault Diagnosis in Centrifugal Pumps **Fault-Diagnosis Systems Spectral Techniques and Fault Detection Fault-Tolerant Design and Control of Automated Vehicles and Processes** Advanced Test Methods for SRAMs **Fault Injection Techniques and Tools for Embedded Systems Reliability Evaluation** Automated Methods in Cryptographic Fault Analysis Performance Optimization of Fault Diagnosis Methods for Power Systems *A Study of Fault Determinations by Geophysical Methods in the Fluorspar Areas of Western Kentucky* **Fault Detection, Protection and Location on Transmission Line. A Review** Induction Motor Fault Diagnosis **Fault-Tolerant Process Control** A Neutrosophic Set Based Fault Diagnosis Method Based on Multi-Stage Fault Template Data Solving Fault Diagnosis Problems **Fault Diagnosis and Prognosis Techniques for Complex Engineering Systems Model-based Fault Diagnosis Techniques** *From Fault Classification to Fault Tolerance for Multi-Agent Systems* Model-Based Fault Diagnosis Techniques **Hybrid Fault Tolerance Techniques to Detect Transient Faults in Embedded Processors Robust Integration of Model-Based Fault Estimation and Fault-Tolerant Control** *Performance Assessment for Process Monitoring and Fault Detection Methods* **Methods, Models and Tools for Fault Tolerance** Fault-tolerant Control Systems On-Line Fault Detection and Supervision in the Chemical Process Industries 1998 Fault Detection & Reliability

Fault-tolerant Control Systems Aug 20 2019 The seriesAdvancesinIndustrialControl aims to report and encourage te- nologytransfer in controlengineering. The rapid development of controlte- nology 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 devel- ment work resides in industrial reports, feasibility study papers, and the - ports of advanced collaborative projects. The series o?ers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination. Control system design and technology continues to develop in many d- ferent directions. One theme that the Advances in Industrial Control series is following is the application of nonlinear control design methods, and the series has some interesting new commissions in progress. However, another theme of interest is how to endow the industrial controller with the ability to overcome faults and process degradation. Fault detection and isolation is a broad ?eld with a research literature spanning several decades. This topic deals with three questions: • How is the presence of a fault detected? • What is the cause of the fault? • Where is it located? However, there has been less focus on the question of how to use the control system to accommodate and overcome the performance deterioration caused by the identi?ed sensor or actuator fault.

Data-driven Methods for Fault Localization in Process Technology Jun 22 2022

Spectral Techniques and Fault Detection May 09 2021 Spectral Techniques and Fault Detection focuses on the spectral techniques for the analysis, testing, and design of digital devices. This book discusses the error detection and correction in digital devices. Organized into 10 chapters, this book starts with an overview of the concepts and tools to evaluate the applicability of various spectral approaches and fault-detection techniques to the design. This text then describes the class of generalized Programmable Logic Array configurations called Encoded PLAs. Other chapters consider the two-sided Chrestenson Transform to the analysis of some pattern properties. This book describes as well a certain type of cellular arrays for highly parallel processing, namely, three-dimensional arrays. The final chapter deals with the system design methods that allow and encourage designers to incorporate the necessary distributed error correction throughout any digital system. This book is a valuable resource for graduate students and engineers working in the fields of logic design, spectral techniques, testing, and self-testing of digital devices.

Fault Diagnosis of Nonlinear Systems Using a Hybrid Approach Jan 17 2022 Theincreasingcomplexityofspacevehiclessuchassatellites,andthecostreduction measures that have affected satellite operators are increasingly driving the need for more autonomy in satellite diagnostics and control systems. Current methods for detecting and correcting anomalies onboard the spacecraft as well as on the ground are primarily manual and labor intensive, and therefore, tend to be slow. Operators inspect telemetry

data to determine the current satellite health. They use various statisticaltechniques andmodels,buttheanalysisandevaluation ofthelargevolume of data still require extensive human intervention and expertise that is prone to error. Furthermore, for spacecraft and most of these satellites, there can be potentially unduly long delays in round-trip communications between the ground station and the satellite. In this context, it is desirable to have onboard fault-diagnosis system that is capable of detecting, isolating, identifying or classifying faults in the system withouttheinvolvementandinterventionofoperators.Towardthisend,theprinciple goal here is to improve the ef?ciency, accuracy, and reliability of the trend analysis and diagnostics techniques through utilization of intelligent-based and hybrid-based methodologies.

Fault Detection & Reliability Jun 17 2019 Provides an up-to-date review of the latest developments in system reliability maintenance, fault detection and fault-tolerant design techniques. Topics covered include reliability analysis and optimization, maintenance control policies, fault detection techniques, fault-tolerant systems, reliable controllers and robustness, knowledge based approaches and decision support systems. There are further applications papers on process control, robotics, manufacturing systems, communications and power systems. Contains 36 papers.

Advanced Test Methods for SRAMs Mar 07 2021 Modern electronics depend on nanoscaled technologies that present new challenges in terms of testing and diagnostics. Memories are particularly prone to defects since they exploit the technology limits to get the highest density. This book is an invaluable guide to the testing and diagnostics of the latest generation of SRAM, one of the most widely applied types of memory. Classical methods for testing memory are designed to handle the so-called "static faults," but these test solutions are not sufficient for faults that are emerging in the latest Very Deep Sub-Micron (VDSM) technologies. These new fault models, referred to as "dynamic faults", are not covered by classical test solutions and require the dedicated test sequences presented in this book.

From Fault Classification to Fault Tolerance for Multi-Agent Systems Feb 24 2020 Faults are a concern for Multi-Agent Systems (MAS) designers, especially if the MAS are built for industrial or military use because there must be some guarantee of dependability. Some fault classification exists for classical systems, and is used to define faults. When dependability is at stake, such fault classification may be used from the beginning of the system’s conception to define fault classes and specify which types of faults are expected. Thus, one may want to use fault classification for MAS; however, From Fault Classification to Fault Tolerance for Multi-Agent Systems argues that working with autonomous and proactive agents implies a special analysis of the faults potentially occurring in the system. Moreover, the field of Fault Tolerance (FT) provides numerous methods adapted to handle different kinds of faults. Some handling methods have been studied within the MAS domain, adapting to their specificities and capabilities but increasing the large amount of FT methods. Therefore, unless being an expert in fault tolerance, it is difficult to choose, evaluate or compare fault tolerance

methods, preventing a lot of developed applications from not only to being more pleasant to use but, more importantly, from at least being tolerant to common faults. From Fault Classification to Fault Tolerance for Multi-Agent Systems shows that specification phase guidelines and fault handler studies can be derived from the fault classification extension made for MAS. From this perspective, fault classification can become a unifying concept between fault tolerance methods in MAS.

Model-based Fault Diagnosis Techniques Mar 27 2020 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.

Diagnosis and Fault-Tolerant Control Mar 19 2022 Fault-tolerant control aims at a gradual shutdown response in automated systems when faults occur. It satisfies the industrial demand for enhanced availability and safety, in contrast to traditional reactions to faults, which bring about sudden shutdowns and loss of availability. The book presents effective model-based analysis and design methods for fault diagnosis and fault-tolerant control. Architectural and structural models are used to analyse the propagation of the fault through the process, to test the fault detectability and to find the redundancies in the process that can be used to ensure fault tolerance. It also introduces design methods suitable for diagnostic systems and fault-tolerant controllers for continuous processes that are described by analytical models of discrete-event systems represented by automata. The book is suitable for engineering students, engineers in industry and researchers who wish to get an overview of the variety of approaches to process diagnosis and fault-tolerant control. The authors have extensive teaching experience with graduate and PhD students, as well as with industrial experts. Parts of this book have been used in courses for this audience. The authors give a comprehensive introduction to the main ideas of diagnosis and fault-tolerant control and present some of their most recent research achievements obtained together with their research groups in a close cooperatio n with European research projects. The third edition resulted from a major re-structuring and re-writing of the former edition, which has been used for a decade by numerous research groups. New material includes distributed diagnosis of continuous and discrete-event systems, methods for reconfigurability analysis, and extensions of the structural methods towards fault-tolerant control. The bibliographical notes at the end of all chapters have been up-dated. The chapters end with exercises to be used in lectures.

Fault Injection Techniques and Tools for Embedded Systems Reliability Evaluation Feb 06 2021 Our society is faced with an increasing dependence on computing systems, not only in high tech consumer applications but also in areas (e.g., air and railway traffic control, nuclear plant control, aircraft and car control) where a failure can be critical for the safety of human beings. Unfortunately, it is accepted that

large digital systems cannot be fault-free. Some faults may be attributed to inaccuracy during the development, while others can come from external causes such as environmental stress. Radiations, electromagnetic interference and power glitches are some of the most common causes of transient faults. As a consequence, the past years have seen a growing interest in methods for studying the behaviour of computer-based systems when faults occur, and several approaches have been proposed to evaluate the dependability properties of a computer-based system. Fault Injection, i.e., the artificial injection of faults into a computer system in order to study its behaviour, emerged as a viable solution, and has been deeply investigated by both academia and industry. Different techniques have been proposed and some of them practically experimented. Fault Injection Techniques and Tools for Embedded Systems Reliability Evaluation intends to be a comprehensive guide to Fault Injection techniques used to evaluate the dependability of a digital system. The description and the critical analysis of different Fault Injection techniques and tools will be authored by key scientists in the field of system dependability and fault tolerance.

On-Line Fault Detection and Supervision in the Chemical Process Industries 1998 Jul 19 2019 The field of "On-Line Fault Detection and Supervision in the Chemical Process Industries" is relatively young. Major activity in this area has taken place only in the last fifteen years. The goals of the first workshop in Delaware were to discuss various methodologies necessary for solving industrial problems in fault diagnosis/supervision and to encourage interactions between academia and industry. This workshop also focused on development and evaluation of methodologies for on-line fault detection and supervision in the chemical process industries. It addressed theory, application, validation, performance and evaluation of methodologies such as parameter estimation, observers, parity equations, signal analysis methods, classification, rule-based systems with probabilistic approaches, fuzzy logic and neural networks. There are several trends that make the topic of this workshop especially relevant in today's world. The first is the tremendous advances made in automation and information technology that can potentially bring in an ever-increasing amount of information on to computer screens in the operating room of a plant. Avoiding problems of information overload and converting plant data to "on-line useful knowledge" is a key challenge. In some respects, one can draw parallels here to biological evolution where, over billions of years, human beings have evolved "mental models" to interpret the huge amount of information received through their senses. In the absence of the time advantage that evolution has had, we have to rely on methodologies such as those presented in this workshop to provide assistance to operators and engineers in interpreting plant information. A second trend that makes this field relevant in today's world is the increasing emphasis on environment and safety. Community activism and accidents such as those in Bhopal, India have caused media spotlights to be turned on the smallest of toxic releases or loss of life due to chemical accidents. The negative publicity generated by such events as well as the need to maintain the image of an environmentally conscious company make industry more

sensitive to the issues of early detection of faults. The third trend that makes this field very relevant is that of the globalization of the world economy. Increasing globalization of the chemical process industry puts pressure on economic competitiveness and higher productivity. This implies reduced down-time due to faults, quick and flexible response of production to supply and demand changes, increasing reliance on automation and reduced personnel.

Data-Driven and Model-Based Methods for Fault Detection and Diagnosis Apr 20 2022 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

Performance Assessment for Process Monitoring and Fault Detection Methods Oct 22 2019 The objective of Kai Zhang and his research is to assess the existing process monitoring and fault detection (PM-FD) methods. His aim is to provide suggestions and guidance for choosing appropriate PM-FD methods, because the performance assessment study for PM-FD methods has become an area of interest in both academics and industry. The author first compares basic FD statistics, and then assesses different PM-FD methods to monitor the key performance indicators of static processes, steady-state dynamic processes and general dynamic processes including transient states. He validates the theoretical developments using both benchmark and real industrial processes.

Data-driven Methods for Fault Detection and Diagnosis in Chemical Processes Jul 23 2022 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, Models and Tools for Fault Tolerance Sep 20 2019 The growing complexity of modern software systems makes it increasingly difficult to ensure the overall dependability of software-intensive systems. Mastering system complexity requires design techniques that support clear thinking and rigorous validation and verification. Formal design methods together with fault-tolerant design techniques help to achieve this. Therefore, there is a clear need for methods that enable rigorous modeling and the development of complex fault-tolerant systems. This book is an outcome of the workshop on Methods, Models and Tools for Fault Tolerance, MeMoT 2007, held in conjunction with the 6th international conference on Integrated Formal Methods, iFM 2007, in Oxford, UK, in July 2007. The authors of the best workshop papers were asked to enhance and expand their work, and a number of well-established researchers working in the area contributed invited chapters in addition. From the 15 refereed and revised papers presented, 12 are versions reworked from the workshop and 3 papers are invited. The articles are organized in four topical sections on: formal reasoning about fault-tolerant systems and protocols; fault tolerance: modelling in B; fault tolerance in system development process; and fault-tolerant applications.

Solving Fault Diagnosis Problems May 29 2020 This book addresses fault detection and isolation topics from a computational perspective. Unlike most existing literature, it bridges the gap between the existing well-developed theoretical results and the realm of reliable computational synthesis procedures. The model-based approach to fault detection and diagnosis has been the subject of ongoing research for the past few decades. While the theoretical aspects of fault diagnosis on the basis of linear models are well understood, most of the computational methods proposed for the synthesis of fault detection and isolation filters are not satisfactory from a numerical standpoint. Several features make this book unique in the fault detection literature: Solution of standard synthesis problems in the most general setting, for both continuous- and discrete-time systems, regardless of whether they are proper or not; consequently, the proposed synthesis procedures can solve a specific problem whenever a solution exists Emphasis on the best numerical algorithms to solve the synthesis problems for linear

systems in generalized state-space form (also known as descriptor systems) Development of general synthesis procedures relying on new computational paradigms, such as factorization-based design based on filter updating techniques and nullspace-based synthesis Availability of a comprehensive set of free accompanying software tools for descriptor systems, which allows readers to easily implement all synthesis procedures presented in the book and ensures that all results are reproducible This book is primarily intended for researchers and advanced graduate students in the areas of fault diagnosis and fault-tolerant control. It will also appeal to mathematicians with an interest in control-oriented numerics.

A Neutrosophic Set Based Fault Diagnosis Method Based on Multi-Stage Fault Template Data Jun 29 2020 Fault diagnosis is an important issue in various fields and aims to detect and identify the faults of systems, products, and processes. The cause of a fault is complicated due to the uncertainty of the actual environment. Nevertheless, it is difficult to consider uncertain factors adequately with many traditional methods. In addition, the same fault may show multiple features and the same feature might be caused by different faults. In this paper, a neutrosophic set based fault diagnosis method based on multi-stage fault template data is proposed to solve this problem.

Advanced methods for fault diagnosis and fault-tolerant control Aug 24 2022 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.

Fault Detection and Diagnosis in Industrial Systems Oct 14 2021 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.

Fault-Tolerant Design and Control of Automated Vehicles and Processes Apr 08 2021 This book summarizes strategies, methods, algorithms, frameworks and systems for the fault-tolerant design and control of automated vehicles and processes. Intelligent systems may be able to accommodate inevitable faults, but this ability

requires targeted design processes and advanced control systems. This book explains the respective elements involved in automated vehicles and processes. It provides detailed descriptions of fault-tolerant design, not offered in the existent scientific literature. With regard to fault-tolerant control, the focus is on innovative methods, which can accommodate not only uncertainties, but also shared and flexible redundant elements. The book is intended to present a concise guide for researchers in the field of fault-tolerant design and control, and to provide concrete insights for design and control engineers working in the field of automated vehicles and processes.
Automated Methods in Cryptographic Fault Analysis Jan 05 2021 This book presents a collection of automated methods that are useful for different aspects of fault analysis in cryptography. The first part focuses on automated analysis of symmetric cipher design specifications, software implementations, and hardware circuits. The second part provides automated deployment of countermeasures. The third part provides automated evaluation of countermeasures against fault attacks. Finally, the fourth part focuses on automating fault attack experiments. The presented methods enable software developers, circuit designers, and cryptographers to test and harden their products.
Fault Detection, Protection and Location on Transmission Line. A Review Oct 02 2020 Research Paper (postgraduate) from the year 2020 in the subject Electrotechnology, grade: 1, Addis Ababa University (Addis Ababa Science and Technology University Addis Ababa, Ethiopia + Istanbul Sabahattin Zaim University Istanbul, Turkey), language: English, abstract: Electrical power transmission systems suffer from unexpected failures due to various random causes. Un-predicted faults that occur in power systems are required to prevent from propagation to other area in the protective system. The functions of the protective systems are to detect, then classify and finally determine the location of the faulty. This paper presents some techniques that helps to find, determine and diagnosing faults in transmission line. Artificial neural networks, impedance measurement based methods, fuzzy expert method, wavelet transform and so on have been used to achieve fault identification and classification.This paper will review the type of fault that possibly occurs in an electric power system, the type of fault detection and location technique that are available together with the protection device that can be utilized in the power system to protect the equipment from electric fault.
Induction Motor Fault Diagnosis Sep 01 2020 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.

Hybrid Fault Tolerance Techniques to Detect Transient Faults in Embedded Processors Dec 24 2019 This book describes fault tolerance techniques based on software and hardware to create hybrid techniques. They are able to reduce overall performance degradation and increase error detection when associated with applications implemented in embedded processors. Coverage begins with an extensive discussion of the current state-of-the-art in fault tolerance techniques. The authors then discuss the best trade-off between software-based and hardware-based techniques and introduce novel hybrid techniques. Proposed techniques increase existing fault detection rates up to 100%, while maintaining low performance overheads in area and application execution time.

Fault-Tolerant Process Control Jul 31 2020 Fault-Tolerant Process Control focuses on the development of general, yet practical, methods for the design of advanced fault-tolerant control systems; these ensure an efficient fault detection and a timely response to enhance fault recovery, prevent faults from propagating or developing into total failures, and reduce the risk of safety hazards. To this end, methods are presented for the design of advanced fault-tolerant control systems for chemical processes which explicitly deal with actuator/controller failures and sensor faults and data losses. Specifically, the book puts forward: · A framework for detection, isolation and diagnosis of actuator and sensor faults for nonlinear systems; · Controller reconfiguration and safe-parking-based fault-handling methodologies; · Integrated-data- and model-based fault-detection and isolation and fault-tolerant control methods; · Methods for handling sensor faults and data losses; and · Methods for monitoring the performance of low-level PID loops. The methodologies proposed employ nonlinear systems analysis, Lyapunov techniques, optimization, statistical methods and hybrid systems theory and are predicated upon the idea of integrating fault-detection, local feedback control, and supervisory control. The applicability and performance of the methods are demonstrated through a number of chemical process examples. Fault-Tolerant Process Control is a valuable resource for academic researchers, industrial practitioners as well as graduate students pursuing research in this area.

Robust Integration of Model-Based Fault Estimation and Fault-Tolerant Control Nov 22 2019 Robust Integration of Model-Based Fault Estimation and Fault-Tolerant Control is a systematic examination of methods used to overcome the inevitable system

uncertainties arising when a fault estimation (FE) function and a fault-tolerant controller interact as they are employed together to compensate for system faults and maintain robustly acceptable system performance. It covers the important subject of robust integration of FE and FTC with the aim of guaranteeing closed-loop stability. The reader's understanding of the theory is supported by the extensive use of tutorial examples, including some MATLAB®-based material available from the Springer website and by industrial-applications-based material. The text is structured into three parts: Part I examines the basic concepts of FE and FTC, providing extensive insight into the importance of and challenges involved in their integration; Part II describes five effective strategies for the integration of FE and FTC: sequential, iterative, simultaneous, adaptive-decoupling, and robust decoupling; and Part III begins to extend the proposed strategies to nonlinear and large-scale systems and covers their application in the fields of renewable energy, robotics and networked systems. The strategies presented are applicable to a broad range of control problems, because in the absence of faults the FE-based FTC naturally reverts to conventional observer-based control. The book is a useful resource for researchers and engineers working in the area of fault-tolerant control systems, and supplementary material for a graduate- or postgraduate-level course on fault diagnosis and FTC. 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.

Advanced Methods for Fault Diagnosis and Fault-tolerant Control Oct 26 2022 After the first two books have been dedicated to model-based and data-driven fault diagnosis respectively, this book addresses topics in both model-based and data-driven thematic fields with considerable focuses on fault-tolerant control issues and application of machine learning methods. The major objective of the book is to study basic fault diagnosis and fault-tolerant control problems and to build a framework for long-term research efforts in the fault diagnosis and fault-tolerant control domain. In this framework, possibly unified solutions and methods can be developed for general classes of systems. The book is composed of six parts. Besides Part I serving as a common basis for the subsequent studies, Parts II - VI are dedicated to five different thematic areas, including model-based fault diagnosis methods for linear time-varying systems, nonlinear systems and systems with model uncertainties, statistical and data-driven fault diagnosis methods, assessment of fault diagnosis systems, as well as fault-tolerant control with a strong focus on performance degradation monitoring and recovering. These parts are self-contained and so structured that they can also be used for self-study on the concerned topics. The content Basic requirements on fault detection and estimation - Basic methods for fault detection and estimation in static and dynamic processes - Feedback control, observer, and residual generation - Fault detection and estimation for linear time-varying systems - Detection and isolation of multiplicative faults in uncertain systems - Analysis, parameterisation and optimal

design of nonlinear observer-based fault detection systems - Data-driven fault detection methods for large-scale and distributed systems - Alternative test statistics and data-driven fault detection methods - Application of randomised algorithms to assessment and design of fault diagnosis systems - Performance-based fault-tolerant control - Performance degradation monitoring and recovering - Data-driven fault-tolerant control schemes The target groups This book would be valuable for graduate and PhD students as well as for researchers and engineers in the field. The author Prof. Dr.-Ing. Steven X. Ding is a professor and the head of the Institute for Automatic Control and Complex Systems (AKS), University of Duisburg-Essen, Germany. His research interests are model-based and data-driven fault diagnosis, control and fault-tolerant systems as well as their applications in industry with a focus on automotive systems, chemical processes and renewable energy systems.

Fault-Diagnosis Systems Jun 10 2021 With increasing demands for efficiency and product quality and progressing integration of automatic control systems in high-cost mechatronic and safety-critical processes, the field of supervision (or monitoring), fault detection and fault diagnosis plays an important role. The book gives an introduction into advanced methods of fault detection and diagnosis (FDD). After definitions of important terms, the reliability, availability, safety and systems integrity of technical processes is considered. Then fault-detection methods for single signals without models like limit and trend checking and with harmonic and stochastic models, like Fourier analysis, correlation and wavelets are treated. This is followed by fault detection with process models using the relationships between signals like parameter estimation, parity equations, observers and principal component analysis. The treated fault-diagnosis methods include classification methods from Bayes classification to neural networks with decision trees and inference methods from approximate reasoning with fuzzy logic to hybrid fuzzy-neuro systems.Especially for safety-critical processes fault-tolerant systems are required. Basic redundant structures like n-out-of-m systems, cold and hot standby are considered and ways to design fault-tolerant sensors, actuators and control systems are outlined.Several practical examples for fault detection and diagnosis of DC motor drives, a centrifugal pump, automotive suspension and tire show applications.

Issues of Fault Diagnosis for Dynamic Systems Sep 13 2021 Since the time our first book Fault Diagnosis in Dynamic Systems: The ory and Applications was published in 1989 by Prentice Hall, there has been a surge in interest in research and applications into reliable methods for diag nosing faults in complex systems. The first book sold more than 1,200 copies and has become the main text in fault diagnosis for dynamic systems. This book will follow on this excellent record by focusing on some of the advances in this subject, by introducing new concepts in research and new application topics. The work cannot provide an exhaustive discussion of all the recent research in fault diagnosis for dynamic systems, but nevertheless serves to sample some of the major issues. It has been valuable once again to have the co-operation of experts throughout the world working in industry, gov emment establishments and academic

institutions in writing the individual chapters. Sometimes dynamical systems have associated numerical models available in state space or in frequency domain format. When model infor mation is available, the quantitative model-based approach to fault diagnosis can be taken, using the mathematical model to generate analytically redun dant alternatives to the measured signals. When this approach is used, it becomes important to try to understand the limitations of the mathematical models i. e. , the extent to which model parameter variations occur and the effect of changing the systems point of operation.

Model-Based Fault Diagnosis Techniques Jan 25 2020 Guaranteeing a high system performance over a wide operating range is an important issue surrounding the design of automatic control systems with successively increasing complexity. As a key technology in the search for a solution, advanced fault detection and identification (FDI) is receiving considerable attention. This book introduces basic model-based FDI schemes, advanced analysis and design algorithms, and mathematical and control-theoretic tools. This second edition of Model-Based Fault Diagnosis Techniques contains: • new material on fault isolation and identification and alarm management; • extended and revised treatment of systematic threshold determination for systems with both deterministic unknown inputs and stochastic noises; • addition of the continuously-stirred tank heater as a representative process-industrial benchmark; and • enhanced discussion of residual evaluation which now deals with stochastic processes. Model-based Fault Diagnosis Techniques will interest academic researchers working in fault identification and diagnosis and as a text it is suitable for graduate students in a formal university-based course or as a self-study aid for practising engineers working with automatic control or mechatronic systems from backgrounds as diverse as chemical process and power engineering.

Intelligent Fault Diagnosis and Accommodation Control May 21 2022 Control systems include many components, such as transducers, sensors, actuators and mechanical parts. These components are required to be operated under some specific conditions. However, due to prolonged operations or harsh operating environment, the properties of these devices may degrade to an unacceptable level, causing more regular fault occurrences. It is therefore necessary to diagnose faults and provide the fault-accommodation control which compensates for the fault of the component by substituting a configuration of redundant elements so that the system continues to operate satisfactorily. In this book, we present a result of several years of work in the area of fault diagnosis and fault-accommodation control. It aims at information estimate methods when faults occur. The book uses the model built from the plant or process, to detect and isolate failures, in contrast to traditional hardware or statistical technologies dealing with failures. It presents model-based learning and design technologies for fault detection, isolation and identification as well as fault-tolerant control. These models are also used to analyse the fault detectability and isolability conditions and discuss the stability of the closed-loop system. It is intended to report new technologies in the area of fault diagnosis, covering fault analysis and control

strategies of design for various applications. The book addresses four main schemes: modelling of actuator or sensor faults; fault detection and isolation; fault identification, and fault reconfiguration (accommodation) control. It also covers application issues in the monitoring control of actuators, providing several interesting case studies for more application-oriented readers.

Model-based Fault Diagnosis in Dynamic Systems Using Identification Techniques Nov 15 2021 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.

Unsupervised Process Monitoring and Fault Diagnosis with Machine Learning Methods Feb 18 2022 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.

Performance Optimization of Fault Diagnosis Methods for Power Systems Dec 04 2020 This book focuses on the performance optimization of fault diagnosis methods for power systems including both model-driven ones, such as the linear parameter varying algorithm, and data-driven ones, such as random matrix theory. Studies on fault diagnosis of power systems have long been the focus of electrical engineers and scientists. Pursuing a holistic approach to improve the accuracy and efficiency of existing methods, the underlying concepts toward several algorithms are introduced and then further applied in various situations for fault diagnosis of power systems in this book. The primary audience for the book would be the scholars and graduate students whose research topics including the control theory, applied mathematics, fault

detection, and so on.

Diagnosis and Fault-tolerant Control 1 Sep 25 2022 This book presents recent advances in fault diagnosis strategies for complex dynamic systems. Its impetus derives from the need for an overview of the challenges of the fault diagnosis technique, especially for those demanding systems that require reliability, availability, maintainability and safety to ensure efficient operations. Moreover, the need for a high degree of tolerance with respect to possible faults represents a further key point, primarily for complex systems, as modeling and control are inherently challenging, and maintenance is both expensive and safety-critical. Diagnosis and Fault-tolerant Control 1 also presents and compares different diagnosis schemes using established case studies that are widely used in related literature. The main features of this book regard the analysis, design and implementation of proper solutions for the problems of fault diagnosis in safety critical systems. The design of the considered solutions involves robust data-driven, model-based approaches.

A Artificial Intelligence Methods for Fault Diagnosis in Centrifugal Pumps Jul 11 2021 This important book offers a foundation for use of artificial intelligence (AI) in fault diagnosis and classification for centrifugal pumps. It outlines methods for operators to identify and classify faults that are not easily detectable using traditional techniques like time domain and frequency domain methods. It brings together different AI approaches that are integrated with Wavelet Transform (WT) and Genetic Algorithm (GA) into a single reference-making advanced diagnostic methods accessible to engineers who may not have a computer science background. Covering a wide range of AI applications for mechanical systems, the book: -- Advances readers from description of the problem to application of AI methods for diagnostics -- Outlines ways for operators to identify and classify faults that are not easily detectable using traditional techniques -- Offers new data from a novel experimental rig not previously available Artificial Intelligence Methods for Fault Diagnosis in Centrifugal Pumps is an ideal reference for academics, engineers, and industry professionals working in plant and operations maintenance. Undergraduate and graduate students of artificial intelligence systems will find this an invaluable reference.

Fault Diagnosis and Reconfiguration in Flight Control Systems Dec 16 2021 The problem of fault diagnosis and reconfigurable control is a new and actually developing field of science and engineering. The subject becomes more interesting since there is an increasing demand for the navigation and control systems of aerospace vehicles, automated actuators etc. to be more safe and reliable. Nowadays, the problems of fault detection and isolation and reconfigurable control attract the attention the scientists in the world. The subject is emphasized in the recent international congresses such as IF AC World Congresses (San Francisco-1996, Beijing-1999, and Barcelona-2002) and lMEKO World Congresses (Tampere-1997, Osaka-1999, Vienna-2000), and also in the international conferences on fault diagnosis such as SAFEPROCESS Conferences (Hull-1997, Budapest-2000). The presented methods in the book are based on linear and nonlinear dynamic mathematical models of the systems. Technical objects and

systems stated by these models are very large, and include various control systems, actuators, sensors, computer systems, communication systems, and mechanical, hydraulic, pneumatic, electrical and electronic devices. The analytical fault diagnosis techniques of these objects have been developed for several decades. Many of those techniques are based on the use of the results of modem control theory. This is natural, because it is known that fault diagnosis process in control systems is considered as a part of general control process. xxii In organization of fault diagnosis of control systems, the use of the concepts and methods of modem control theory including concepts of state space, modeling, controllability, observability, estimation, identification, and filtering is very efficient.

Data-driven Methods for Fault Detection and Diagnosis in Chemical Processes Aug 12 2021 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.

A Study of Fault Determinations by Geophysical Methods in the Fluorspar Areas of Western Kentucky Nov 03 2020

Fault Diagnosis and Prognosis Techniques for Complex Engineering Systems Apr 27 2020 Fault Diagnosis and Prognosis Techniques for Complex Engineering Systems gives a systematic description of the many facets of envisaging, designing, implementing, and experimentally exploring emerging trends in fault diagnosis and failure prognosis in mechanical, electrical, hydraulic and biomedical systems. The book is devoted to the development of mathematical methodologies for fault diagnosis and isolation, fault tolerant control, and failure prognosis problems of engineering systems. Sections present new techniques in reliability modeling, reliability analysis, reliability design, fault and failure detection, signal processing, and fault tolerant control of engineering systems. Sections focus on the development of mathematical methodologies for diagnosis and prognosis of faults or failures, providing a unified

platform for understanding and applicability of advanced diagnosis and prognosis methodologies for improving reliability purposes in both theory and practice, such as vehicles, manufacturing systems, circuits, flights, biomedical systems. This book will be a valuable resource for different groups of readers – mechanical engineers working on vehicle systems, electrical engineers working on rotary machinery systems, control engineers working on fault detection systems, mathematicians and physician working on complex dynamics, and many more. Presents recent advances of theory, technological aspects, and applications of advanced diagnosis and prognosis methodologies in engineering applications Provides a series of the latest results, including fault detection, isolation, fault tolerant control, failure prognosis of components, and more Gives numerical and simulation results in each chapter to reflect engineering practices