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Issues in Fault Diagnosis and Fault Tolerant Control Springer Science & Business Media

This book presents the most recent concerns and research results in industrial fault diagnosis using intelligent techniques. It focuses on computational intelligence applications to fault diagnosis with real-world applications used in different chapters to validate the different diagnosis methods. The book includes one chapter dealing with a novel coherent fault diagnosis distributed methodology for complex systems.

Fault Diagnosis of Dynamic Systems CRC Press

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.

Fault Detection and Diagnosis in Industrial Systems Springer

With increasing demands for efficiency and product quality plus progress in the 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, it considers the reliability, availability, safety and systems integrity of technical processes. Then fault-detection methods for single signals without models such as limit and trend checking and with harmonic and stochastic models, such as Fourier analysis, correlation and wavelets are treated. This is followed by fault detection with process models using the relationships between signals such as 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. Several practical examples for fault detection and diagnosis of DC motor drives, a centrifugal pump, automotive suspension and tire demonstrate applications.

Machine Learning-Based Fault Diagnosis for Industrial Engineering Systems Springer Science & Business Media

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.

Special Issue On: Fault Diagnosis and Prognosis for Engineering Systems Springer Science & Business Media

Fault diagnosis has always been a concern for industry. In general, diagnosis in complex systems requires the acquisition of information from sensors and the processing and extracting of required features for the classification or identification of faults. Therefore, fault diagnosis of sensors is clearly important as faulty information from a sensor may lead to misleading conclusions about the whole system. As engineering systems grow in size and complexity, it becomes more and more important to diagnose faulty behavior before it can lead to total failure. In the light of above issues, this book is dedicated to trends and applications in modern-sensor fault diagnosis.

Knowledge-Driven Board-Level Functional Fault Diagnosis Createspace Independent Pub

This book presents 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, test fault detectability and reveal redundancies that can be used to ensure fault tolerance. Case studies demonstrate the methods presented. The second edition includes new material on reconfigurable control, diagnosis of nonlinear systems, and remote diagnosis, plus new examples and updated bibliography.

Data-driven Design of Fault Diagnosis and Fault-tolerant Control Systems Springer

"In this book, a result of several years of work in the area of fault diagnosis and fault-accommodation control is presented. 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"--

Diagnosis and Fault-tolerant Control Volume 2 Springer Nature

In many industrial applications early detection and diagnosis of abnormal behavior of the plant is of great importance. During the last decades, the complexity of process plants has been drastically increased, which imposes great challenges in development of model-based monitoring approaches and it sometimes becomes unrealistic for modern large-scale processes. The main objective of Adel Haghani Abandan Sari is to study efficient fault diagnosis techniques for complex industrial systems using process historical data and considering the nonlinear behavior of the process. To this end, different methods are presented to solve the fault diagnosis problem based on the overall behavior of the process and its dynamics. Moreover, a novel technique is proposed for fault isolation and determination of the root-cause of the faults in the system, based on the fault impacts on the process measurements.

Issues of Fault Diagnosis for Dynamic Systems Springer Science & Business Media

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.

Model-Based Fault Diagnosis Techniques John Wiley & Sons

The reliability of induction motors is a major requirement in many industrial applications. It is especially important where an unexpected breakdown might result in the interruption of critical services such as military operations, transportation, aviation, and medical applications. Advanced Condition Monitoring and Fault Diagnosis of Electric Machines is a collection of innovative research on various issues related to machinery condition monitoring, signal processing and conditioning, instrumentation and measurements, and new trends in condition monitoring. It also pays special attention to the fault identification process. While highlighting topics including spectral analysis, electrical engineering, and bearing faults, this book is an ideal reference source for electrical engineers, mechanical engineers, researchers, and graduate-level students seeking current research on various methods of maintaining machinery.

Fault Diagnosis and Fault Tolerance Springer Science & Business Media

With the rapid growth of integration scale of VLSI chips and the present need for reliable computers in space exploration, fault diagnosis and fault tolerance have become more important than before, and hence reveal a lot of interesting topics which attract many researchers to make a great number of contributions to this field. In recent years, many new and significant results have been achieved. A quick scan over the proceedings of the conferences on fault tolerant computing and design automation as well as on testing will convince the reader of that. But unfortunately these achievements have not been entirely reflected in the textbooks, so that there seems to be a gap for the new researcher who already has the basic knowledge and wants to begin research in this area. As a remedy for this deficiency, this book is intended for beginners, especially graduate students, as a textbook which will lead them to the frontier of some branches of the fault-tolerant computing field. The first chapter introduces the four-valued logic B4 and its applications. In 1966 Roth first proposed this four-valued logic as a technique to generate tests for logical circuits, but this work did not concern the mathematical basis of B4 itself.

Fault-Diagnosis Systems Springer

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.

Robust Observer-Based Fault Diagnosis for Nonlinear Systems Using MATLAB® John

Wiley & Sons

This book provides recent theoretical developments in and practical applications of fault diagnosis and fault tolerant control for complex dynamical systems, including uncertain systems, linear and nonlinear systems. Combining adaptive control technique with other control methodologies, it investigates the problems of fault diagnosis and fault tolerant control for uncertain dynamic systems with or without time delay. As such, the book provides readers a solid understanding of fault diagnosis and fault tolerant control based on adaptive control technology. Given its depth and breadth, it is well suited for undergraduate and graduate courses on linear system theory, nonlinear system theory, fault diagnosis and fault tolerant control techniques. Further, it can be used as a reference source for academic research on fault diagnosis and fault tolerant control, and for postgraduates in the field of control theory and engineering.

Fault Diagnosis Academic Press

This book presents recent advances in fault diagnosis and fault-tolerant control of dynamic processes. Its impetus derives from the need for an overview of the challenges of the fault diagnosis technique and sustainable control, 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 2 also presents and compares different fault diagnosis and fault-tolerant schemes, using well established, innovative strategies for modeling the behavior of the dynamic process under investigation. An updated treatise of diagnosis and fault-tolerant control is addressed with the use of essential and advanced methods including signal-based, model-based and data-driven techniques. Another key feature is the application of these methods for dealing with robustness and reliability.

Fault Diagnosis and Fault-Tolerant Control Based on Adaptive Control Approach Springer Science & Business Media

Due to the increasing demand for security and reliability in manufacturing and mechatronic systems, early detection and diagnosis of faults are key points to reduce economic losses caused by unscheduled maintenance and downtimes, to increase safety, to prevent the endangerment of human beings involved in the process operations and to improve reliability and availability of autonomous systems. The development of algorithms for health monitoring and fault and anomaly detection, capable of the early detection, isolation, or even prediction of technical component malfunctioning, is becoming more and more crucial in this context. This Special Issue is devoted to new research efforts and results concerning recent advances and challenges in the application of "Algorithms for Fault Detection and Diagnosis", articulated over a wide range of sectors. The aim is to provide a collection of some of the current state-of-the-art algorithms within this context, together with new advanced theoretical solutions.

Intelligent Fault Diagnosis and Accommodation Control Springer

Online fault diagnosis is crucial to ensure safe operation of complex dynamic systems in spite of faults affecting the system behaviors. Consequences of the occurrence of faults can be severe and result in human casualties, environmentally harmful emissions, high repair costs, and economical losses caused by unexpected stops in production lines. The majority of real systems are hybrid dynamic systems (HDS). In HDS, the dynamical behaviors evolve continuously with time according to the discrete mode (configuration) in which the system is. Consequently, fault diagnosis approaches must take into account both discrete and continuous dynamics as well as the interactions between them in order to perform correct fault diagnosis. This book presents recent and advanced approaches and techniques that address the complex problem of fault diagnosis of hybrid dynamic and complex systems using different model-based and data-driven approaches in different application domains (inductor motors, chemical process formed by tanks, reactors and valves, ignition engine, sewer networks, mobile robots, planetary rover prototype etc.). These approaches cover the different aspects of performing single/multiple online/offline parametric/discrete abrupt/tear and wear fault diagnosis in incremental/non-incremental manner, using different modeling tools (hybrid automata, hybrid Petri nets, hybrid bond graphs, extended Kalman filter etc.) for different classes of hybrid dynamic and complex systems.

Algorithms for Fault Detection and Diagnosis Hindawi Publishing Corporation

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.

Computational Intelligence in Fault Diagnosis Springer Science & Business Media

This comprehensive work presents the status and likely development of fault diagnosis, an emerging discipline of modern control engineering. It covers fundamentals of model-based fault diagnosis in a wide context, providing a good introduction to the theoretical foundation and many

basic approaches of fault detection.

Model-Based Fault Diagnosis Techniques IGI Global

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 Springer Science & Business Media

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.

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