Fault Detection And Fault Tolerant Control Using Sliding Modes Advances In Industrial Control

**Fault-Diagnosis Systems** Rolf Isermann 2006-01-16 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.

**Fault Detection and Fault-Tolerant Control Using Sliding Modes** Halim Alwi 2011-06-07 Fault Detection and Fault-tolerant Control Using Sliding Modes is the first text dedicated to showing the latest developments in the use of sliding-mode concepts for fault detection and isolation (FDI) and fault-tolerant control in dynamical engineering systems. It begins with an introduction to the basic concepts of sliding modes to provide a background to the field. This is followed by chapters that describe the use and design of sliding-mode observers for FDI using robust fault reconstruction. The development of a class of sliding-mode observers is described from first principles through to the latest schemes that circumvent minimum-phase and relative-degree conditions. Recent developments have shown that the field of fault tolerant control is a natural application of the well-known robustness properties of sliding-mode control. A family of sliding-mode control designs incorporating control allocation, which can deal with actuator failures directly by exploiting redundancy, is presented. Various realistic case studies, specifically highlighting aircraft systems and including results from the implementation of these designs on a motion flight simulator, are described. A reference and guide for researchers in fault detection and fault-tolerant control, this book will also be of interest to graduate students working with nonlinear systems and with sliding modes in particular. 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.

**Data-driven Design of Fault Diagnosis and Fault-tolerant Control Systems** - Steven X. Ding 2014-04-12

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.

**Diagnosis and Fault-Tolerant Control** - Mogens Blanke 2015-08-11

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 cooperation 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.
Robust and Fault-Tolerant Control - Krzysztof Patan 2019-03-16 Robust and Fault-Tolerant Control proposes novel automatic control strategies for nonlinear systems developed by means of artificial neural networks and pays special attention to robust and fault-tolerant approaches. The book discusses robustness and fault tolerance in the context of model predictive control, fault accommodation and reconfiguration, and iterative learning control strategies. Expanding on its theoretical deliberations the monograph includes many case studies demonstrating how the proposed approaches work in practice. The most important features of the book include: a comprehensive review of neural network architectures with possible applications in system modelling and control; a concise introduction to robust and fault-tolerant control; step-by-step presentation of the control approaches proposed; an abundance of case studies illustrating the important steps in designing robust and fault-tolerant control; and a large number of figures and tables facilitating the performance analysis of the control approaches described. The material presented in this book will be useful for researchers and engineers who wish to avoid spending excessive time in searching neural-network-based control solutions. It is written for electrical, computer science and automatic control engineers interested in control theory and their applications. This monograph will also interest postgraduate students engaged in self-study of nonlinear robust and fault-tolerant control.

Advanced methods for fault diagnosis and fault-tolerant control - Steven X. Ding

Fault Detection and Fault-Tolerant Control for Dynamic Systems - Haibo Wang 2017-01-27 This dissertation, “Fault Detection and Fault-tolerant Control for Dynamic Systems” by Haibo, Wang, 王海波, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. DOI: 10.5353/th_b4257684 Subjects: Fault location (Engineering) Control theory

Fault Tolerant Control for Switched Linear Systems - Dongsheng Du 2015-01-29 This book presents up-to-date research and novel methodologies on fault diagnosis and fault tolerant control for switched linear systems. It provides a unified yet neat framework of filtering, fault detection, fault diagnosis and fault tolerant control of switched systems. It can therefore serve as a useful textbook for senior and/or graduate students who are interested in knowing the state-of-the-art of filtering, fault detection, fault diagnosis and fault tolerant control areas, as well as recent advances in switched linear systems.

Fault detection and fault - tolerant control using sliding modes - Halim Alwi 2011

Fault-tolerant Control Systems - Hassan Noura 2009-07-30 The series Advances in Industrial Control aims to report and encourage technologytransfer in...
controlengineering. The rapid development of controltechnology 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
ports 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. Control system design and technology continues to develop
in many different 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 field 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 identified sensor or actuator fault.

**Fault-Tolerant Process Control** - Prashant Mhaskar 2012-11-27 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.

**Fault Detection and Fault-Tolerant Control for Nonlinear Systems** - Linlin Li
2016-03-22 Linlin Li addresses the analysis and design issues of observer-based FD and FTC
for nonlinear systems. The author analyses the existence conditions for the nonlinear
observer-based FD systems to gain a deeper insight into the construction of FD systems.
Aided by the T-S fuzzy technique, she recommends different design schemes, among them
the $L_{\infty}/L_2$ type of FD systems. The derived FD and FTC approaches are verified by two
benchmark processes.
Fault Tolerant Control Design for Hybrid Systems - Hao Yang 2010-02-04 This book provides readers a good understanding on how to achieve Fault Tolerant Control goal of Hybrid Systems. It presents important theoretical results as well as their applications.

Diagnosis and Fault-Tolerant Control - Mogens Blanke 2006-08-03 Fault-tolerant control aims at a graceful degradation of the behaviour of automated systems in case of faults. It satisfies the industrial demand for enhanced availability and safety, in contrast to traditional reactions to faults that 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. Design methods for diagnostic systems and fault-tolerant controllers are presented for processes that are described by analytical models, by discrete-event models or that can be dealt with as quantised systems. Five case studies on pilot processes show the applicability of the presented methods. The theoretical results are illustrated by two running examples used throughout the book. The second edition includes new material about reconfigurable control, diagnosis of nonlinear systems, and remote diagnosis. The application examples are extended by a steering-by-wire system and the air path of a diesel engine, both of which include experimental results. The bibliographical notes at the end of all chapters have been up-dated. The chapters end with exercises to be used in lectures.

Fault Diagnosis and Fault-Tolerant Control Based on Adaptive Control Approach - Qikun Shen 2017-03-15 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 and Fault-Tolerant Control and Guidance for Aerospace Vehicles - Ali Zolghadri 2013-10-07 Fault Diagnosis and Fault-Tolerant Control and Guidance for Aerospace demonstrates the attractive potential of recent developments in control for resolving such issues as flight performance, self protection and extended-life structures. Importantly, the text deals with a number of practically significant considerations: tuning, complexity of design, real-time capability, evaluation of worst-case performance, robustness in harsh environments, and extensibility when development or adaptation is required. Coverage of such issues helps to draw the advanced concepts arising from academic research back towards the technological concerns of industry. Initial coverage of basic
definitions and ideas and a literature review gives way to a treatment of electrical flight control system failures: oscillatory failure, runaway, and jamming. Advanced fault detection and diagnosis for linear and linear-parameter-varying systems are described. Lastly recovery strategies appropriate to remaining actuator/sensor/communications resources are developed. The authors exploit experience gained in research collaboration with academic and major industrial partners to validate advanced fault diagnosis and fault-tolerant control techniques with realistic benchmarks or real-world aeronautical and space systems. Consequently, the results presented in Fault Diagnosis and Fault-Tolerant Control and Guidance for Aerospace, will be of interest in both academic and aerospatial-industrial milieux.

Fault Tolerant Flight Control - Christopher Edwards 2010-06-29 Written by leading experts in the field, this book provides the state-of-the-art in terms of fault tolerant control applicable to civil aircraft. The book consists of five parts and includes online material.

Observer-Based Fault Diagnosis and Fault-Tolerant Control for Switched Systems - Dongsheng Du 2020-10-21 This book focuses on the fault diagnosis observer design for the switched system. Model-based fault diagnosis and fault tolerant control are one of the most popular research directions in recent decades. It contains eight chapters. Every chapter is independent in the method of observer design, but all chapters are around the same topic. Besides, in each chapter, the model description and theoretical results are firstly provided, then some practical application examples are illustrated to prove the obtained results. The advanced theoretical methodologies will benefit researchers or engineers in the area of safety engineering and the arrangement of the structure will help the readers to understand the content easily.

Fault Diagnosis and Fault-Tolerant Control Strategies for Non-Linear Systems - Marcin Witczak 2013-12-11 This book presents selected fault diagnosis and fault-tolerant control strategies for non-linear systems in a unified framework. In particular, starting from advanced state estimation strategies up to modern soft computing, the discrete-time description of the system is employed Part I of the book presents original research results regarding state estimation and neural networks for robust fault diagnosis. Part II is devoted to the presentation of integrated fault diagnosis and fault-tolerant systems. It starts with a general fault-tolerant control framework, which is then extended by introducing robustness with respect to various uncertainties. Finally, it is shown how to implement the proposed framework for fuzzy systems described by the well-known Takagi–Sugeno models. This research monograph is intended for researchers, engineers, and advanced postgraduate students in control and electrical engineering, computer science, as well as mechanical and chemical engineering.

Observer-Based Fault Estimation and Accomodation for Dynamic Systems - Ke Zhang 2012-10-16 Due to the increasing security and reliability demand of actual industrial process control systems, the study on fault diagnosis and fault tolerant control of dynamic
systems has received considerable attention. Fault accommodation (FA) is one of effective methods that can be used to enhance system stability and reliability, so it has been widely and in-depth investigated and become a hot topic in recent years. Fault detection is used to monitor whether a fault occurs, which is the first step in FA. On the basis of fault detection, fault estimation (FE) is utilized to determine online the magnitude of the fault, which is a very important step because the additional controller is designed using the fault estimate. Compared with fault detection, the design difficulties of FE would increase a lot, so research on FE and accommodation is very challenging. Although there have been advancements reported on FE and accommodation for dynamic systems, the common methods at the present stage have design difficulties, which limit applications of respective design approaches. Therefore, the problems of FE and accommodation are needed to be further studied. This book considers the theory and technology of FE and accommodation for dynamic systems, and establishes a systemic and comprehensive framework of FE and accommodation for continuous/discrete-time systems.

**Advanced Solutions in Diagnostics and Fault Tolerant Control** - Jan M. Kościelny
2017-07-29 This book highlights the latest achievements concerning the theory, methods and practice of fault diagnostics, fault tolerant systems and cyber safety. When considering the diagnostics of industrial processes and systems, increasingly important safety issues cannot be ignored. In this context, diagnostics plays a crucial role as a primary measure of the improvement of the overall system safety integrity level. Obtaining the desired diagnostic coverage or providing an appropriate level of inviolability of the integrity of a system is now practically inconceivable without the use of fault detection and isolation methods. Given the breadth and depth of its coverage, the book will be of interest to researchers faced with the challenge of designing technical and medical diagnosis systems, as well as junior researchers and students in the fields of automatic control, robotics, computer science and artificial intelligence.

**Fault-Diagnosis Applications** - Rolf Isermann 2011-04-06 Supervision, condition-monitoring, fault detection, fault diagnosis and fault management play an increasing role for technical processes and vehicles in order to improve reliability, availability, maintenance and lifetime. For safety-related processes fault-tolerant systems with redundancy are required in order to reach comprehensive system integrity. This book is a sequel of the book “Fault-Diagnosis Systems” published in 2006, where the basic methods were described. After a short introduction into fault-detection and fault-diagnosis methods the book shows how these methods can be applied for a selection of 20 real technical components and processes as examples, such as: Electrical drives (DC, AC) Electrical actuators Fluidic actuators (hydraulic, pneumatic) Centrifugal and reciprocating pumps Pipelines (leak detection) Industrial robots Machine tools (main and feed drive, drilling, milling, grinding) Heat exchangers Also realized fault-tolerant systems for electrical drives, actuators and sensors are presented. The book describes why and how the various signal-model-based and process-model-based methods were applied and which experimental results could be achieved. In several cases a combination of different methods was most successful. The book is dedicated to graduate students of electrical, mechanical, chemical engineering and computer science and for engineers.
Hybrid Fault Tolerance Techniques to Detect Transient Faults in Embedded Processors-José Rodrigo Azambuja 2014-07-07 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.


Diagnosis, Fault Detection & Tolerant Control-Nabil Derbel 2020-02-20 This book focuses on unhealthy cyber-physical systems. Consisting of 14 chapters, it discusses recognizing the beginning of the fault, diagnosing the appearance of the fault, and stopping the system or switching to a special control mode known as fault-tolerant control. Each chapter includes the background, motivation, quantitative development (equations), and case studies/illustration/tutorial (simulations, experiences, curves, tables, etc.). Readers can easily tailor the techniques presented to accommodate their ad hoc applications.

Advanced methods for fault diagnosis and fault-tolerant control-Steven X. Ding 2020-11-24 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.

Sensor Fault Detection and Fault Tolerant Control with Application to Vehicle Lateral Control Systems-Te-Sheng Hsaio 2005

Fault-tolerant Control and Diagnosis for Integer and Fractional-order Systems- Rafael Martínez-Guerra 2021-02-12 This book is about algebraic and differential methods, as well as fractional calculus, applied to diagnose and reject faults in nonlinear systems,
which are of integer or fractional order. This represents an extension of a very important and widely studied problem in control theory, namely fault diagnosis and rejection (using differential algebraic approaches), to systems presenting fractional dynamics, i.e. systems whose dynamics are represented by derivatives and integrals of non-integer order. The authors offer a thorough overview devoted to fault diagnosis and fault-tolerant control applied to fractional-order and integer-order dynamical systems, and they introduce new methodologies for control and observation described by fractional and integer models, together with successful simulations and real-time applications. The basic concepts and tools of mathematics required to understand the methodologies proposed are all clearly introduced and explained. Consequently, the book is useful as supplementary reading in courses of applied mathematics and nonlinear control theory. This book is meant for engineers, mathematicians, physicists and, in general, to researchers and postgraduate students in diverse areas who have a minimum knowledge of calculus. It also contains advanced topics for researchers and professionals interested in the area of states and faults estimation.

Analysis and Synthesis of Fault-Tolerant Control Systems-Magdi S. Mahmoud 2013-10-28 In recent years, control systems have become more sophisticated in order to meet increased performance and safety requirements for modern technological systems. Engineers are becoming more aware that conventional feedback control design for a complex system may result in unsatisfactory performance, or even instability, in the event of malfunctions in actuators, sensors or other system components. In order to circumvent such weaknesses, new approaches to control system design have emerged which can tolerate component malfunctions while maintaining acceptable stability and performance. These types of control systems are often known as fault-tolerant control systems (FTCS). More precisely, FTCS are control systems which possess the ability to accommodate component failure automatically. Analysis and Synthesis of Fault-Tolerant Control Systems comprehensively covers the analysis and synthesis methods of fault-tolerant control systems. It unifies the methods for developing controllers and filters for a wide class of dynamical systems and reports on the recent technical advances in design methodologies. MATLAB® is used throughout the book, to demonstrate methods of analysis and design. Key features: • Provides advanced theoretical methods and typical practical applications • Provides access to a spectrum of control design methods applied to industrial systems • Includes case studies and illustrative examples • Contains end-of-chapter problems Analysis and Synthesis of Fault-Tolerant Control Systems is a comprehensive reference for researchers and practitioners working in this area, and is also a valuable source of information for graduates and senior undergraduates in control, mechanical, aerospace, electrical and mechatronics engineering departments.

Fault Diagnosis and Fault-tolerant Control in Nonlinear Systems-Xiaodong Zhang 2002 Fault-tolerance is an essential property of many modern intelligent control systems. This dissertation presents a general framework for fault diagnosis and fault-tolerant control in nonlinear dynamical systems in the presence of possibly unstructured modeling uncertainty. The overall architecture is based on a learning approach, where the unknown fault is estimated using adaptive and on-line approximation techniques. First, the problem of
Fault detection and isolation in nonlinear uncertain systems is investigated. A novel fault isolation scheme is presented with its robustness and sensitivity properties enhanced by the use of adaptive thresholds in the residual evaluation stage. The fault isolation scheme is rigorously analyzed for its fault isolability condition and fault isolation time. Then we integrate the fault diagnosis (fault detection and isolation) scheme with fault-tolerant control design. Based on the fault information obtained during the diagnosis procedure, the system controller is reconfigured after fault detection and fault isolation, respectively, to compensate the effects of the fault. The closed-loop stability of the integrated fault-tolerant control system is established for different modes of the controlled plant. The effectiveness of the proposed fault diagnosis and fault-tolerant control scheme is illustrated via simulations in the three-tank system, a rigid-link robotic manipulator and the van der Pol oscillator system.

**Fault Detection, Supervision and Safety of Technical Processes 2003 (SAFEPROCESS 2003)** - Marcel Staroswiecki 2004-03-12 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.

**Fault Detection, Supervision and Safety of Technical Processes 2006** - Hong-Yue Zhang 2007-03-01 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

**Fault Diagnosis and Fault Tolerance for Mechatronic Systems: Recent Advances** - Fabrizio Caccavale 2003-09-05 This book will play a central role in ensuring safe and reliable behaviour of intelligent and autonomous systems. It collects some of the most recent results in fault diagnosis and fault tolerant systems, with particular emphasis on
mechatronic systems.


**Fault Tolerant Control for Switched Linear Systems** - Dongsheng Du 2015-02-28

**Sampled-data Fault Detection and Fault-tolerant Control of Particulate Processes** - Trina G. Napasindayao 2015 Particulate processes comprise about 60% of commercial products. These processes are defined by the co-presence of both a continuous and a dispersed phase. As a result, there is a distributed characterization of the product properties. These differences across particles are described using a particle size distribution which is an important product quality index since controlling the shape of this distribution leads to quality control of the end product. A high-dimensional population balance model is used to describe the particle size distribution which makes it difficult to design control systems for these applications. There are limited studies on fault accommodation and fault tolerant control for particulate processes. Moreover, various implementation issues arise in the design of any fault-tolerant control system. These include model uncertainty, incomplete state measurements, measurement sampling and delays. Measurement availability is constrained by inherent limitations on data collection and the processing and transmission capabilities of the measurement sensors. In particulate processes, sensor measurements are typically delayed and available only at discrete times. These restrict controller implementation and process tracking which can, in turn, erode the diagnostic capabilities of the fault-tolerant control system. Hence, it is crucial that these are explicitly accounted for in designing the control system and in monitoring the process. Motivated by the above considerations, this dissertation provides a unified framework for fault-tolerant control of particulate processes with implementation issues. This framework integrates fault detection/identification followed by fault accommodation wherein a supervisor determines the best strategy for preserving closed-loop stability after a potentially destabilizing fault has occurred. This strategy is based on a stability analysis on the closed-loop system wherein the stability properties are given as functions of the control configuration, actuator gain, model uncertainty, fault parameters, and/or sampling period. Fault accommodation is then carried out by controller reconfiguration, model update, or actuator switching. These techniques are illustrated to be effective for a wide range of fault scenarios using a simulated continuous crystallizer but may be generalized for particulate processes.

**Diagnosis and Fault-tolerant Control Using Set-based Methods** - Feng Xu 2015 The fault-tolerant capability is an important performance specification for most of technical systems. The examples showing its importance are some catastrophes in civil aviation. According to some official investigations, some air incidents are technically avoidable if the pilots can take right measures. But, relying on the skill and experience of the pilots, it cannot be guaranteed that reliable flight decisions are always made. Instead, if fault-tolerant strategies can be included in the decision-making procedure, it will be very useful
Fault-tolerant control is generally classified into passive and active fault-tolerant control. Passive fault-tolerant control relies on robustness of controller, which can only provide limited fault-tolerant ability, while active fault-tolerant control turns to a fault detection and isolation module to obtain fault information and then actively take actions to tolerate the effect of faults. Thus, active fault-tolerant control generally has stronger fault-tolerant ability. In this dissertation, one focuses on active fault-tolerant control, which for this case considers model predictive control and set-based fault detection and isolation. Model predictive control is a successful advanced control strategy in process industry and has been widely used for processes such as chemistry and water treatment, because of its ability to deal with multivariable constrained systems. However, the performance of model predictive control has deep dependence on system-model accuracy. Realistically, it is impossible to avoid the effect of modelling errors, disturbances, noises and faults, which always result in model mismatch. Comparatively, model mismatch induced by faults is possible to be effectively handled by suitable fault-tolerant strategies. The objective of this dissertation is to endow model predictive control with fault-tolerant ability to improve its effectiveness. In order to reach this objective, set-based fault detection and isolation methods are used in the proposed fault-tolerant schemes. The important advantage of set-based fault detection and isolation is that it can make robust fault detection and isolation decisions, which is key for taking right fault-tolerant measures. This dissertation includes four parts. The first part introduces this research, presents the state of the art and gives an introduction of used research tools. The second part proposes set-based fault detection and isolation for actuator or sensor faults, which are involved in interval observers, invariant sets and set-membership estimation. First, the relationship between interval observers and invariant sets is investigated. Then, actuator and sensor faults are separately coped with depending on their own features. The third part focuses on actuator or sensor fault-tolerant model predictive control, where the control strategy is robust model predictive control (tube-based and min-max approaches). The last part draws some conclusions, summarizes this research and gives clues for the further work.


Fault Detection and Fault-Tolerant Control for Nonlinear Systems-Linlin Li 2016-02-19 Linlin Li addresses the analysis and design issues of observer-based FD and FTC for nonlinear systems. The author analyses the existence conditions for the nonlinear observer-based FD systems to gain a deeper insight into the construction of FD systems. Aided by the T-S fuzzy technique, she recommends different design schemes, among them the L_inf/L_2 type of FD systems. The derived FD and FTC approaches are verified by two benchmark processes.

Fault-Tolerant Process Control-Prashant Mhaskar 2014-12-14 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.
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