

Get Free Robust Stability Of  
Uncertain Singular Time Delay  
Systems

# **Robust Stability Of Uncertain Singular Time Delay Systems**

This book deals with the  
application of new techniques

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based on multivariable control theory and optimisation theory to the study of robust stability of highly uncertain models of large interconnected power systems subject to real parameter variations. It focuses on the study

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of robust stability problems associated with parameter variations representing real physical quantities. The objective is to verify that critical system controllers of complex systems remain stable and achieve desired

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performance objectives for all predefined power system variations at selected operating conditions along its expected operating trajectory. A second related objective is to determine the stability robustness with

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respect to changes in power system parameters and the maximum loading condition for which the system will remain stable.

Stability, Control and Application of Time-Delay Systems gives a

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systematic description of these systems. It includes adequate designs of integrated modeling and control and frequency characterizations. Common themes revolve around creating certain synergies of modeling,

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analysis, control, computing and applications of time delay systems that achieve robust stability while retaining desired performance quality. The book provides innovative insights into the state-of-the-art of time-delay systems in

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both theory and practical aspects. It has been edited with an emphasis on presenting constructive theoretical and practical methodological approaches and techniques. Unifies existing and emerging



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concepts concerning time delay dynamical systems Provides a series of the latest results in large-delay analysis and multi-agent and thermal systems with delays Gives in each chapter numerical and simulation results in order to

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reflect the engineering practice  
Robustness analysis is considered  
for systems with structured  
uncertainty involving a  
combination of linear time-  
invariant and linear time-varying  
perturbations, and parametric

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uncertainty. A necessary and sufficient condition for robust stability in terms of the structured singular value  $\mu$  is obtained, based on a finite augmentation of the original problem. The augmentation corresponds to

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considering the system at a fixed number of frequencies. Sufficient conditions based on scaled small-gain are also considered and characterized. A substantial amount of research in recent years has been devoted to analysis and

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synthesis of control systems to achieve robust stability and performance in the presence of structured uncertainty. This implies a decentralized nature of the uncertain perturbation, which is a reasonable modeling choice

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for complex systems, where uncertainty may be introduced at the subsystem level (see Safonov [17] and Doyle [5] for early treatments of this). In addition to this "spatial" structure, different assumptions can be made on the

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dynamic properties of the uncertainty: real parametric, linear time invariant (LTI), linear time varying (LTV) or nonlinear perturbations. All these uncertainty classes arise naturally in modeling. Parametric

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uncertainty appears frequently in first principles models; LTI perturbations are well suited when.

This textbook aims to provide a clear understanding of the various tools of analysis and design for



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robust stability and performance of uncertain dynamic systems. In model-based control design and analysis, mathematical models can never completely represent the “real world” system that is being modeled, and thus it is imperative

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to incorporate and accommodate a level of uncertainty into the models. This book directly addresses these issues from a deterministic uncertainty viewpoint and focuses on the interval parameter

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characterization of uncertain systems. Various tools of analysis and design are presented in a consolidated manner. This volume fills a current gap in published works by explicitly addressing the subject of control of dynamic

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systems from linear state space framework, namely using a time-domain, matrix-theory based approach. This book also: Presents and formulates the robustness problem in a linear state space model framework. Illustrates

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various systems level methodologies with examples and applications drawn from aerospace, electrical and mechanical engineering. Provides connections between Lyapunov-based matrix approach and the

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transfer function based polynomial approaches. Robust Control of Uncertain Dynamic Systems: A Linear State Space Approach is an ideal book for first year graduate students taking a course in robust control in aerospace, mechanical,

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or electrical engineering.

Robust Stability and Performance

Analysis of Large Scale Power

Systems with Parametric

Uncertainty

Advances in Discrete Time

Systems

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2019 IEEE International  
Conference on Robotics and  
Biomimetics (ROBIO)  
Analysis and Synthesis of Delta  
Operator Systems with Actuator  
Saturation  
Robust Control Design with



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MATLAB®

Analysis, Design and Applications

**This book reports on the latest findings in the study of Stochastic Neural Networks (SNN). The book collects the**

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novel model of the  
disturbance driven by  
Levy process, the  
research method of M-  
matrix, and the adaptive  
control method of the  
SNN in the context of

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**stability and  
synchronization control.  
The book will be of  
interest to university  
researchers, graduate  
students in control  
science and engineering**

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and neural networks who wish to learn the core principles, methods, algorithms and applications of SNN. IT changes everyday's life, especially in

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education and medicine.

The goal of ITME 2013 is to further explore the theoretical and practical issues of IT in education and medicine. It also aims

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to foster new ideas and  
collaboration between  
researchers and  
practitioners.

Analysis and Synthesis  
of Singular Systems  
provides a base for

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Further theoretical research and a design guide for engineering applications of singular systems. The book presents recent advances in analysis and

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synthesis problems,  
including state-feedback  
control, static output  
feedback control,  
filtering, dissipative  
control,  $H^{\infty}$  control,  
reliable control,



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sliding mode control and  
fuzzy control for linear  
singular systems and  
nonlinear singular  
systems. Less  
conservative and fresh  
novel techniques,

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combined with the linear matrix inequality (LMI) technique, the slack matrix method, and the reciprocally convex combination approach are applied to singular

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**systems. This book will  
be of interest to  
academic researchers,  
postgraduate and  
undergraduate students  
working in control  
theory and singular**

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**systems. Discusses  
recent advances in  
analysis and synthesis  
problems for linear  
singular systems and  
nonlinear singular  
systems Offers a base**

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for further theoretical  
research as well as a  
design guide for  
engineering applications  
of singular systems  
Presents several  
necessary and sufficient

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conditions for delay-  
free singular systems  
and some less  
conservative results for  
time-delay singular  
systems

This book presents the

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proceedings of the 6th  
International Conference  
on Frontier Computing,  
held in Kuala Lumpur,  
Malaysia on July 3-6,  
2018, and provides  
comprehensive coverage

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of the latest advances  
and trends in  
information technology,  
science and engineering.  
It addresses a number of  
broad themes, including  
communication networks,



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**business intelligence  
and knowledge  
management, web  
intelligence, and  
related fields that  
inspire the development  
of information**

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technology. The  
contributions cover a  
wide range of topics:  
database and data  
mining, networking and  
communications, web and  
internet of things,

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embedded systems, soft  
computing, social  
network analysis,  
security and privacy,  
optical communication,  
and ubiquitous/pervasive  
computing. Many of the

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**papers outline promising  
future research  
directions. The book is  
a valuable resource for  
students, researchers  
and professionals, and  
also offers a useful**

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reference guide for  
newcomers to the field.  
Distributed Sensing and  
Intelligent Systems  
Analysis and Synthesis  
of Singular Systems with  
Time-Delays

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**Robust Control**

**Stability Analysis and**

**Design for Nonlinear**

**Singular Systems**

**Analysis and Design of**

**Singular Markovian Jump**

**Systems**

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## **Proceedings of the 2015 Chinese Intelligent Systems Conference**

Many plants have large variations in operating conditions. To ensure smooth running it is essential to find a simple fixed gain controller that guarantees

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rapidly decaying and well-damped transients for all admissible operating conditions. Robust Control presents design tools, developed by the authors, for the solution of this design problem. Examples of simple and complex cases such as a crane, a flight control problem and the automatic and active four-wheel



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steering of a car illustrate the use of these tools. This book is intended for anyone who has taken an undergraduate course in feedback control systems and who seeks an advanced treatment of robust control with applications. Drawing on the resources and authoritative research of a leading aerospace institute, it will mainly

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be of interest to mechanical and electrical engineers in universities, institutes and industrial research centres.

Control and Dynamic Systems: Advances in Theory and Applications, Volume 50: Robust Control System Techniques and Applications, Part 1 of 2 is a two-volume sequence devoted to the issues and

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application of robust control systems techniques. This volume is composed of 10 chapters and begins with a presentation of the important techniques for dealing with conflicting design objectives in control systems. The subsequent chapters describe the robustness techniques of systems using differential-difference equations; the

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design of a wide class of robust nonlinear systems, the techniques for dealing with the problems resulting from the use of observers in robust systems design, and the effective techniques for the robust control on non-linear time varying of tracking control systems with uncertainties. These topics are followed by

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discussions of the effective techniques for the robust control on non-linear time varying of tracking control systems with uncertainties and for incorporating adaptive control techniques into a (non-adaptive) robust control design. Other chapters present techniques for achieving exponential and robust stability for a

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rather general class of nonlinear systems, techniques in modeling uncertain dynamics for robust control systems design, and techniques for the optimal synthesis of these systems. The last chapters provide a generalized eigenproblem solution for both singular and nonsingular system cases. These

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chapters also look into the stability robustness design for discrete-time systems. This book will be of value to process and systems engineers, designers, and researchers.

This monograph is an up-to-date presentation of the analysis and design of singular Markovian jump systems (SMJSs)

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in which the transition rate matrix of the underlying systems is generally uncertain, partially unknown and designed. The problems addressed include stability, stabilization,  $H^2$  control and filtering, observer design, and adaptive control. applications of Markov process are investigated by using Lyapunov theory,



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linear matrix inequalities (LMIs), S-procedure and the stochastic Barbalat's Lemma, among other techniques. Features of the book include: · study of the stability problem for SMJSs with general transition rate matrices (TRMs); · stabilization for SMJSs by TRM design, noise control, proportional-derivative and partially

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mode-dependent control, in terms of LMIs with and without equation constraints; · mode-dependent and mode-independent  $H_2$  control solutions with development of a type of disordered controller; · observer-based controllers of SMJSs in which both the designed observer and controller are either mode-dependent or mode-

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independent; · consideration of robust  $H_2$  filtering in terms of uncertain TRM or filter parameters leading to a method for totally mode-independent filtering · development of LMI-based conditions for a class of adaptive state feedback controllers with almost-certainly-bounded estimated error and almost-certainly-

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asymptotically-stable corresponding closed-loop system states · applications of Markov process on singular systems with norm bounded uncertainties and time-varying delays Analysis and Design of Singular Markovian Jump Systems contains valuable reference material for academic researchers wishing to explore

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the area. The contents are also suitable for a one-semester graduate course.

Nonlinear Dynamical Systems and Control presents and develops an extensive treatment of stability analysis and control design of nonlinear dynamical systems, with an emphasis on Lyapunov-based methods. Dynamical system theory lies at

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the heart of mathematical sciences and engineering. The application of dynamical systems has crossed interdisciplinary boundaries from chemistry to biochemistry to chemical kinetics, from medicine to biology to population genetics, from economics to sociology to psychology, and from physics to mechanics to engineering.

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The increasingly complex nature of engineering systems requiring feedback control to obtain a desired system behavior also gives rise to dynamical systems. Wassim Haddad and VijaySekhar Chellaboina provide an exhaustive treatment of nonlinear systems theory and control using the highest standards of

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exposition and rigor. This graduate-level textbook goes well beyond standard treatments by developing Lyapunov stability theory, partial stability, boundedness, input-to-state stability, input output stability, finite-time stability, semistability, stability of sets and periodic orbits, and stability theorems via vector



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Lyapunov functions. A complete and thorough treatment of dissipativity theory, absolute stability theory, stability of feedback systems, optimal control, disturbance rejection control, and robust control for nonlinear dynamical systems is also given. This book is an indispensable resource for applied mathematicians,

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dynamical systems theorists, control theorists, and engineers.

Advances and Applications in Sliding Mode Control systems

Fuzzy Systems and Knowledge Discovery  
A Methodology for Computing

Uncertainty Bounds of Multivariable Systems Based on Sector Stability Theory

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Concepts

Proceedings of ICDSIS 2020

Stability, Control and Application of Time-Delay Systems

***Robust Control Design with  
MATLAB® (second edition)  
helps the student to learn***

*Page 67/169*

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*how to use well-developed  
advanced robust control  
design methods in practical  
cases. To this end, several  
realistic control design  
examples from teaching-  
laboratory experiments, such  
as a two-wheeled, self-*

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*balancing robot, to complex systems like a flexible-link manipulator are given detailed presentation. All of these exercises are conducted using MATLAB® Robust Control Toolbox 3, Control System Toolbox and*

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*Simulink®. By sharing their experiences in industrial cases with minimum recourse to complicated theories and formulae, the authors convey essential ideas and useful insights into robust industrial control systems*

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*design using major H-infinity optimization and related methods allowing readers quickly to move on with their own challenges. The hands-on tutorial style of this text rests on an abundance of examples and*

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*features for the second edition: • rewritten and simplified presentation of theoretical and methodological material including original coverage of linear matrix inequalities; • new Part II*



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*forming a tutorial on Robust Control Toolbox 3; • fresh design problems including the control of a two-rotor dynamic system; and • end-of-chapter exercises.*

*Electronic supplements to the written text that can be*

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*downloaded from  
extras.springer.com/isbn  
include: • M-files developed  
with MATLAB® help in  
understanding the essence of  
robust control system design  
portrayed in text-based  
examples; • MDL-files for*

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*simulation of open- and closed-loop systems in Simulink®; and • a solutions manual available free of charge to those adopting Robust Control Design with MATLAB® as a textbook for courses. Robust Control*

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*Design with MATLAB® is for graduate students and practising engineers who want to learn how to deal with robust control design problems without spending a lot of time in researching complex theoretical*

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*developments.*

*This volume brings about the contemporary results in the field of discrete-time systems. It covers papers written on the topics of robust control, nonlinear systems and recent*

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*applications. Although the technical views are different, they all geared towards focusing on the up-to-date knowledge gain by the researchers and providing effective developments along the*

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*systems and control arena.  
Each topic has a detailed  
discussions and suggestions  
for future perusal by  
interested investigators.  
This book presents selected  
research papers from the  
2015 Chinese Intelligent*

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*Systems Conference*

*(CISC'15), held in Yangzhou,  
China. The topics covered  
include multi-agent systems,  
evolutionary computation,  
artificial intelligence,  
complex systems, computation  
intelligence and soft*



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*computing, intelligent control, advanced control technology, robotics and applications, intelligent information processing, iterative learning control, and machine learning.*

***Engineers and researchers***

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*from academia, industry and the government can gain valuable insights into solutions combining ideas from multiple disciplines in the field of intelligent systems.*

*Although LMI has emerged as*

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*a powerful tool with applications across the major domains of systems and control, there has been a need for a textbook that provides an accessible introduction to LMIs in control systems analysis and*

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*design. Filling this need,  
LMIs in Control Systems:  
Analysis, Design and  
Applications focuses on the  
basic analysis and d  
Frontier and Future  
Development of Information  
Technology in Medicine and*

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*Education*

*Communications and  
Information Processing*

*A Linear State Space*

*Approach*

*Theory, Technologies and  
Applications (FC 2018)*

*Nonlinear Dynamical Systems*

# Get Free Robust Stability Of Uncertain Singular Time Delay Systems *and Control*

*Manufacturing Science and  
Technology, ICMST2011*

This coherent introduction  
to the theory and methods  
of robust control system  
design clarifies and

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unifies the presentation of significant derivations and proofs. The book contains a thorough treatment of important material of uncertainties and robust control

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otherwise scattered throughout the literature. In industrial engineering and manufacturing, control of individual processes and systems is crucial to developing a quality final



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product. Rapid  
developments in technology  
are pioneering new  
techniques of research in  
control and automation  
with multi-disciplinary  
applications in

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electrical, electronic,  
chemical, mechanical,  
aerospace, and  
instrumentation  
engineering. The Handbook  
of Research on Advanced  
Intelligent Control

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Engineering and Automation  
presents the latest  
research into intelligent  
control technologies with  
the goal of advancing  
knowledge and applications  
in various domains. This

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text will serve as a reference book for scientists, engineers, and researchers, as it features many applications of new computational and mathematical tools for

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solving complicated  
problems of mathematical  
modeling, simulation, and  
control.

Singular time-delay  
systems are very suitable  
to describe a lot of

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practical systems such as manufacturing systems, networked control systems, power systems and electrical circuits. Thus, the past two decades have witnessed a significant

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progress on the theory of  
singular time-delay  
systems, and many  
fundamental and important  
topics have been  
successfully investigated  
including stability

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analysis, stabilization,  
guaranteed cost control,  
filtering, observer  
design, sliding mode  
control and so on. The  
main objective of this  
book is to present the



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latest developments and references in the analysis and synthesis of singular time-delay systems with or without Markov jumping parameters in a unified framework. The materials

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adopted in this book are mainly based on research results of the authors. This book will be of interest to academic researchers working in singular systems, time-

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delay systems and Markov  
jump systems and to  
graduate students  
interested in systems and  
control theory.  
Structured Controllers for  
Uncertain Systems focuses

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on the development of easy-  
to-use design strategies  
for robust low-order or  
fixed-structure  
controllers (particularly  
the industrially  
ubiquitous PID

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controller) . These strategies are based on a recently-developed stochastic optimization method termed the "Heuristic Kalman Algorithm" (HKA) the use

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of which results in a simplified methodology that enables the solution of the structured control problem without a profusion of user-defined parameters. An overview of

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the main stochastic  
methods employable in the  
context of continuous non-  
convex optimization  
problems is also provided  
and various optimization  
criteria for the design of

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a structured controller  
are considered;  $H^\infty$ ,  $H_2$ ,  
and mixed  $H_2/H^\infty$  each  
merits a chapter to  
itself. Time-domain-  
performance specifications  
can be easily incorporated



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Systems  
in the design.

NASA Technical Paper

Volume 1

LMIs in Control Systems

Control and Dynamic

Systems V50: Robust

Control System Techniques

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Systems  
and Applications

Stability and Control of  
Nonlinear Time-varying  
Systems

Robust Control and  
Filtering of Singular  
Systems

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*The aim of this collection of papers was to bring together innovative academics and industrial experts in the field of Advanced Materials and Computer Science, and to gather together their current*

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*expertise in this field.*

*Volume is indexed by*

*Thomson Reuters CPCI-S*

*(WoS). The 450 peer-*

*reviewed papers are grouped*

*into the chapters: 1:*

*Advanced Materials and*

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*Computer Science - 2:  
Materials Science and  
Mechatronics - 3:  
Automation, Mechatronics  
and Robotics. Overall, the  
contents provide a timely  
guide to the subject.*

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*This book presents special systems derived from industrial models, including the complex saturation nonlinear functions and the delay nonlinear functions. It also presents typical*

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*methods, such as the  
classical Liapunov and  
Integral Inequalities  
methods. Providing  
constructive qualitative and  
stability conditions for linear  
systems with saturated*

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*inputs in both global and local contexts, it offers practitioners more concise model systems for modern saturation nonlinear techniques, which have the potential for future*



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*applications. This book is a valuable guide for researchers and graduate students in the fields of mathematics, control, and engineering.*

*The two volume set, CCIS*

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*288 and 289, constitutes the  
thoroughly refereed post-  
conference proceedings of  
the First International  
Conference on  
Communications and  
Information Processing, ICCIP*

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*2012, held in Aveiro,  
Portugal, in March 2012. The  
168 revised full papers of  
both volumes were carefully  
reviewed and selected from  
numerous submissions. The  
papers present the state-of-*

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*the-art in communications  
and information processing  
and feature current research  
on the theory, analysis,  
design, test and deployment  
related to communications  
and information processing*

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*Robotics, biomimetics,  
perception, artificial  
intelligence, electrical  
engineering, computer  
science, mechanical  
engineering, automation*

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*science and engineering,  
biomedical engineering,  
robotic devices and systems*

*A Structured Singular Value  
Approach*

*Volume 4b*

*European Control*

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*Conference 1995*

*Dynamics and Control of  
Chemical Reactors,  
Distillation Columns and  
Batch Processes  
(DYCORD'95)*

*A Lyapunov-Based Approach*

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## *Robust Control of Uncertain Dynamic Systems*

Robust Control and Filtering of  
Singular Systems Lecture Notes in  
Control and Information Sciences  
This book deals with the class of  
singular systems with random



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abrupt changes also known as singular Markovian jump systems. Various problems and their robustness are tackled. The book examines both the theoretical and practical aspects of the control problems from the angle of the structural properties of

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linear systems. It can be used as a textbook as well as a reference for researchers in control or mathematics with interest in control theory.

Three important areas of process dynamics and control: chemical reactors, distillation columns and

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batch processes are the main topics of discussion and evaluation at the IFAC Symposium on Dynamics and Control of Chemical Reactors, Distillation Columns and Batch Processes (DYCORD '95). This valuable publication was

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produced from the latest in the series, providing a detailed assessment of developments of key technologies within the field of process dynamics and control. This is the biggest, most comprehensive, and most prestigious compilation of articles

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on control systems imaginable. Every aspect of control is expertly covered, from the mathematical foundations to applications in robot and manipulator control. Never before has such a massive amount of authoritative, detailed, accurate, and well-organized

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*International Conference  
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*knowledge discovery,  
finance, operations  
research, and more.  
Singular systems have  
been widely studied in  
the past two decades due  
to their extensive*

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*applications in  
modelling and control of  
electrical circuits,  
power systems, economics  
and other areas.*

*Interest has grown  
recently in the*

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*stability analysis and control of singular systems with parameter uncertainties due to their frequent presence in dynamic systems, which is much more*

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*complicated than that of  
state-space systems  
because controllers must  
be designed so that the  
closed-loop system is  
not only robustly  
stable, but also regular*

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*and impulse-free (in the continuous case) or causal (in the discrete case), while the latter two issues do not arise in the state-space case. This monograph aims to*



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*present up-to-date  
research developments  
and references on robust  
control and filtering of  
uncertain singular  
systems in a unified  
matrix inequality*

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*setting. It provides a coherent approach to studying control and filtering problems as extensions of state-space systems without the commonly used slow-*

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*fast decomposition. It contains valuable reference material for researchers wishing to explore the area of singular systems, and its contents are also*

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course.*

*2010 First International  
Conference on Electrical  
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*Engineering was held in*

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*Wuhan, China December  
4-5. Advanced Electrical  
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Engineering book  
contains 72 revised and  
extended research  
articles written by*

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*prominent researchers  
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*circuits, Nonlinear  
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Electrical and  
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Proceedings of the  
European Control*

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*Conference 1995, Rome,  
Italy 5-8 September 1995*

*ITME 2013*

*Control of Singular  
Systems with Random  
Abrupt Changes*

*The Control Handbook*

*Page 147/169*

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*A Stochastic*

*Optimization Approach*

*Uncertain Models and*

*Robust Control*

*Third International*

*Conference, FSKD 2006,*

*Xi'an, China, September*

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*24-28, 2006, Proceedings*

This book presents basic research on delta operator systems (DOS) with actuator saturation. It proposes null controllable regions of delta operator systems, introduces

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the enlarging of the domain of attraction and analyzes the performance of DOSs subject to actuator saturation. It also discusses the domain of attraction on different systems in delta domain, and

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investigates the applications in complicated systems using delta operator approaches.

This book describes the advances and applications in Sliding mode control (SMC) which is widely used as a

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powerful method to tackle uncertain nonlinear systems. The book is organized into 21 chapters which have been organised by the editors to reflect the various themes of sliding mode control. The



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book provides the reader with a broad range of material from first principles up to the current state of the art in the area of SMC and observation presented in a clear, matter-of-fact style. As such it is

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appropriate for graduate students with a basic knowledge of classical control theory and some knowledge of state-space methods and nonlinear systems. The resulting design procedures

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are emphasized using  
Matlab/Simulink software.  
Volume is indexed by  
Thomson Reuters CPCI-S  
(WoS). The objective of ICMST  
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Engineering is divided into the  
chapters: 1: Materials

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Automotive Engineering and  
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Analysis and Synthesis of  
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Advances in Theory and  
Applications

Frontier Computing

First International Conference,

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ICCIP 2012, Aveiro, Portugal,  
March 7-11, 2012,  
Proceedings, Part I  
Systems with Uncertain  
Physical Parameters

Singular systems which are also referred to  
as descriptor systems, semi-state systems,

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differential- algebraic systems or generalized state-space systems have attracted much attention because of their extensive applications in the Leontief dynamic model, electrical and mechanical models, etc. This monograph presented up-to-date research developments and references on stability analysis and design

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of nonlinear singular systems. It investigated the problems of practical stability, strongly absolute stability, input-state stability and observer design for nonlinear singular systems and the problems of absolute stability and multi-objective control for nonlinear singularly perturbed systems by using Lyapunov

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stability theory, comparison principle, S-procedure and linear matrix inequality (LMI), etc. Practical stability, being quite different from stability in the sense of Lyapunov, is a significant performance specification from an engineering point of view. The basic concepts and results on practical stability for standard state-space

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systems were generalized to singular systems. For Lur'e type descriptor systems (LDS) which were the feedback interconnection of a descriptor system with a static nonlinearity, strongly absolute stability was defined and Circle criterion and Popov criterion were derived. The notion of input-state stability (ISS) for

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nonlinear singular systems was defined based on the concept of ISS for standard state-space systems and the characteristics of singular systems. LMI-based sufficient conditions for ISS of Lur'e singular systems were proposed. Furthermore, observer design for nonlinear singular systems was studied and some observer

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design methods were proposed by the obtained stability results and convex optimization algorithms. Finally, absolute stability and multi-objective control of nonlinear singularly perturbed systems were considered. By Lyapunov functions, absolute stability criteria of Lur'e singularly perturbed systems were

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proposed and multi-objective control of T-S fuzzy singularly perturbed systems was achieved. Compared with the existing results, the obtained methods do not depend on the decomposition of the original system and can produce a determinate upper bound for the singular perturbation parameter.



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Handbook of Research on Advanced  
Intelligent Control Engineering and  
Automation