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Advanced Sliding Mode Control for Mechanical Systems

Design, Analysis and
MATLAB Simulation



Advanced Sliding Mode Control For Mechanical Systems Design Analysis And Matlab Simulation

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Mokhtar**



Advanced Sliding Mode Control For Mechanical Systems Design Analysis And Matlab Simulation:

Advanced Sliding Mode Control for Mechanical Systems Jinkun Liu, Xinhua Wang, 2012-09-07 Advanced Sliding Mode Control for Mechanical Systems Design Analysis and MATLAB Simulation takes readers through the basic concepts covering the most recent research in sliding mode control. The book is written from the perspective of practical engineering and examines numerous classical sliding mode controllers including continuous time sliding mode control, discrete time sliding mode control, fuzzy sliding mode control, neural sliding mode control, backstepping sliding mode control, dynamic sliding mode control, sliding mode control based on observer, terminal sliding mode control, sliding mode control for robot manipulators and sliding mode control for aircraft. This book is intended for engineers and researchers working in the field of control. Dr Jinkun Liu works at Beijing University of Aeronautics and Astronautics and Dr Xinhua Wang works at the National University of Singapore. *Applications of Sliding Mode Control in Science and Engineering* Sundarapandian Vaidyanathan, Chang-Hua Lien, 2017-04-06 Gathering 20 chapters contributed by respected experts, this book reports on the latest advances in and applications of sliding mode control in science and engineering. The respective chapters address applications of sliding mode control in the broad areas of chaos theory, robotics, electrical engineering, physics, chemical engineering, memristors, mechanical engineering, environmental engineering, finance, and biology. Special emphasis has been given to papers that offer practical solutions and which examine design and modeling involving new types of sliding mode control such as higher order sliding mode control, terminal sliding mode control, super twisting sliding mode control, and integral sliding mode control. This book serves as a unique reference guide to sliding mode control and its recent applications for graduate students and researchers with a basic knowledge of electrical and control systems engineering.

Advanced Robust Nonlinear Control Approaches for Quadrotor Unmanned Aerial Vehicle Moussa Labbadi, Yassine Boukal, Mohamed Cherkaoui, 2021-09-14

This book studies selected advanced flight control schemes for an uncertain quadrotor unmanned aerial vehicle (UAV) systems in the presence of constant external disturbances, parametric uncertainties, measurement noise, time-varying external disturbances, and random external disturbances. Furthermore, in all the control techniques proposed in this book, it includes the simulation results with comparison to other nonlinear control schemes recently developed for the tracking control of a quadrotor UAV. The main contributions of the present book for quadrotor UAV systems are as follows: i) the proposed control methods are based on the high order sliding mode controller (SMC) and hybrid control algorithm with an optimization method; ii) the finite time control schemes are developed by using fast terminal SMC, FTSMC, nonsingular FTSMC, NFTSMC, global time-varying SMC, and adaptive laws; iii) the fractional order flight control schemes are developed by using the fractional order calculus theory, super twisting algorithm, NFTSMC, and the SMC. This book covers the research history and importance of quadrotor system subject to system uncertainties, external wind disturbances, and noise measurements, as well as the research status of advanced flight control methods, adaptive flight control methods, and flight control based on fractional

order theory The book would be interesting to most academic undergraduate postgraduates researchers on flight control for drones and applications of advanced controllers in engineering field This book presents a must survey for advanced finite time control for quadrotor system Some parts of this book have the potential of becoming the courses for the modelling and control of autonomous flying machines Readers academic researcher undergraduate student postgraduate student MBA executive and education practitioner interested in nonlinear control methods find this book an investigation This book can be used as a good reference for the academic research on the control theory drones terminal sliding mode control and related to this or used in Ph D study of control theory and their application in field engineering

Methods and Applications for Modeling and Simulation of Complex Systems Gary Tan,Axel Lehmann,Yong Meng Teo,Wentong Cai,2019-10-21 This

volume constitutes the proceedings of the 19th Asia Simulation Conference AsiaSim 2019 held in Singapore Singapore in October 2019 The 19 revised full papers and 5 short papers presented in this volume were carefully reviewed and selected from 36 submissions The papers are organized in topical sections on simulation and modeling methodology numerical and Monte Carlo simulation simulation applications blockchain deep learning and cloud simulation and visualization simulation applications short papers

Intelligent Computing Methodologies De-Shuang Huang,Zhi-Kai Huang,Abir Hussain,2019-07-30 This two volume set of LNCS 11643 and LNCS 11644 constitutes in conjunction with the volume LNAI 11645 the refereed proceedings of the 15th International Conference on Intelligent Computing ICIC 2019 held in Nanchang China in August 2019 The 217 full papers of the three proceedings volumes were carefully reviewed and selected from 609 submissions The ICIC theme unifies the picture of contemporary intelligent computing techniques as an integral concept that highlights the trends in advanced computational intelligence and bridges theoretical research with applications The theme for this conference is Advanced Intelligent Computing Methodologies and Applications Papers related to this theme are especially solicited including theories methodologies and applications in science and technology

Smart Energy Empowerment in Smart and Resilient Cities Mustapha Hatti,2019-12-24 International Conference on Artificial Intelligence in Renewable Energetic Systems IC AIRES2019 26 28 November 2019 Taghit Bechar Algeria The challenges of the energy transition in the medium term lead to numerous technological breakthroughs in the areas of production optimal distribution and the rational use of energy and renewable energy energy efficiency and optimization of consumption massive electrification monitoring and control energy systems cogeneration and energy recovery processes new and renewable energies etc The fall in the cost of renewable energies and the desire for a local control of energy production are today calling for a profound change in the electricity system Local authorities are at the center of energy developments by taking into account the local nature of certain energy systems heat networks geothermal energy waste heat recovery and electricity generation from household waste On the other side digital sciences are at the heart of connected objects and intelligent products that combine information processing and communication capabilities with their environment Digital technology is at

the center of new systems engineering approaches 3D modeling virtualization simulation digital prototyping etc for the design and development of intelligent systems The book deals with various topics ranging from the design development and maintenance of energy production systems transport distribution or storage of energy optimization of energy efficiency especially in the use of energy innovation in the fields of energy production from renewable energies management of energy networks electricity fluids gas district heating energy storage modes battery super capacitors overseeing energy supply through supervision control and diagnosis risk management as well as the design and management of smart grids microgrid smartgrid This imposes the model of energy empowerment in the advent of smart cities Empower the world's most vulnerable energy poor citizens and establish growing and vibrant socioeconomic communities by academics students in engineering and data computing from around the world who have chosen an academic path leading to an electric power and energy engineering and artificial intelligence to advancing technology for the advantage of humanity

Model-based calibration of automated transmissions Huang, Hua, 2016-11-18 With continuous restrictions on emission standards and demands for higher driving comfort the calibration of shift quality is linked deeply and widely to automated transmission control algorithms This calibration process is typically implemented with real vehicles on the road under poorly reproducible conditions where the calibration engineer has no other choice but to try different control parameters till the subjective assessment on the shift quality meets certain requirements such as shifting comfort or sportiness Compared with today's multiplying number of variants in vehicle engine transmission combinations and exponential growth of control parameters this traditional method is backward and costly An efficient way to rise to the challenge is the model based automatic calibration In contrast to the conventional shift quality calibration this novel method uses a closed loop approach based on a dynamic model instead of human know how A shift quality correlated position trajectory is proposed Compared to the traditional control parameter adjustment method the guided trajectory has a higher tolerance to the system's hardware components and a better compatibility with TCUs from diverse suppliers Since shift quality is not restricted to a general summarized grade e.g. comfort and sportiness are always two conflicting influence factors in the terms of shift quality calibrations a multi objective evolutionary algorithm is applied to search the set of Pareto optimal front which includes all the optimal compromised control parameters of the gear shifting trajectory for possible choice In this work a hydro mechanical AMT synchronization system is used as an example to explain the proposed optimization process A Modelica based non linear hydro mechanical AMT system is modeled which describes the transient behavior during gear shifting in detail An effective fuzzy sliding mode position controller is designed for the referenced position tracking during synchronization in contrast to the conventional trial and error tuning method a genetic algorithm is applied to automatically identify and optimize the sliding mode controller parameters A novel multi objective evolutionary algorithm MLIA is developed to find out the optimal control set for the synchronization trajectories Verification at a transmission test bench shows that this model based multi

objective optimization method has a guiding capability in automated transmission calibration Mit deutlich strengeren gesetzlichen Anforderungen hinsichtlich der Abgasemissionen und einer zunehmend anspruchsvolleren Nachfrage bezuglich des Fahrkomforts rückt die Frage nach der Schaltqualität stärker in den Fokus der Getriebeentwicklung Die Kalibrierung umgangssprachlich die Applikation ist deshalb ein Schwerpunkt bei der Entwicklung von Algorithmen für die Schaltqualität von automatisierten Getriebesteuerungen Der Kalibrierungsprozess wird in der Regel im Fahrzeugversuch auf der Straße durchgeführt Der Applikationsingenieur versucht unter diesen nicht reproduzierbaren Bedingungen verschiedene Steuerparameter zu adaptieren Dies wird für eine Schaltung solange durchgeführt bis die subjektive Beurteilung der Schaltqualität und die zugehörigen Eigenschaften wie zum Beispiel Schaltkomfort und Sportlichkeit erfüllt ist Dieser beschriebene Prozess ist zeit und personalaufwendig was mit dem aktuellen Angebot an Motor Getriebe Fahrzeugvarianten kaum bewältigt werden kann Als weitere Herausforderung steigt die Anzahl der kalibrierbaren Parameter der Regler und Steuerungsmethoden stetig um die Kundenbedürfnisse zu befriedigen weshalb auch aus Kostensicht ein besserer Prozess gefunden werden muss Eine effiziente Möglichkeit zur Lösung der skizzierten Problemstellungen ist die modellbasierte automatische Kalibrierung Im Gegensatz zu der herkömmlich auf Fahrversuche basierende Kalibrierung der Schaltqualität verwendet dieses neue Verfahren ein dynamisches Modell in einer geschlossenen Schleife Anstelle des Applikationsingenieurs für die Fahrvorgaben wird in der Schleife ein Fahrerregler und ein Optimierungsalgorithmus verwendet um so eine hohe Reproduzierbarkeit des Schaltereignisses sicherzustellen Es wird vorgeschlagen die Bewegung der Schaltstellung zu optimieren da diese mit der Schaltqualität korreliert Diametral steht dem die allgemeine Regleranpassung verschiedener Parameter für die Synchronisation gegenüber Die vorgeschlagene Methode der geführten Schaltbewegung weist eine deutlich höhere Toleranz gegenüber der Varianz an Hardwarekomponenten und damit eine bessere Kompatibilität zu den Getriebesteuerungen TCU's verschiedener Lieferanten auf Die Schaltqualität lässt sich nicht auf ein subjektives Kriterium zusammenfassen es werden immer unterschiedliche Faktoren wie z.B. Komfort und Sportlichkeit den Schaltvorgang bestimmen Deshalb wird für die Optimierung des Schaltvorgangs eine mehrkriterielle evolutionäre Algorithmus angewandt um die Paretofront zu identifizieren was alle Kompromisse der Schaltbewegungsregelung einschließt Es wird ein Modell eines hydromechanischen Synchronisationssystems für ein automatisiertes Getriebe als Beispielanwendung benutzt um den vorgeschlagenen Optimierungsprozess zu demonstrieren Das nichtlineare hydromechanische Synchronisationssystem wird mit der objektorientierten Sprache Modelica modelliert Mit dem Modell werden Schaltvorgänge detailliert beschrieben Ein Fuzzy Sliding Mode Regler wird für die jeweilige Bewegung der Schaltung während der Synchronisation benutzt Im Gegensatz zur herkömmlichen empirischen Anpassung der Reglerparameter wird ein genetischer Algorithmus angewendet um die automatische Erkennung und Bewertung der Parameter vom Fuzzy Sliding Mode Regler zu optimieren Ein neuartiger evolutionärer mehrkriterieller Algorithmus MLIA wurde angewandt um eine

optimale Bewegung der Schaltstellung während der Synchronisierung zu finden Die Validierung am Getriebeprüfstand zeigt dass diese modellbasierte Methode der mehrkriteriellen Optimierung in der automatisierten Getriebekalibrierung eine deutliche Verbesserung darstellt

Proceedings of International Conference on Industrial Instrumentation and Control Subhasis Bhaumik, Subrata Chattopadhyay, Tanushyam Chattopadhyay, Srijan Bhattacharya, 2022-02-15 This book is a collection of selected high quality research papers presented at the International Conference on Industrial Instrumentation and Control ICI2C 2021 organized by the Department of Applied Electronics Instrumentation Engineering RCC Institute of Information Technology Kolkata India during 20 August 22 2021 It includes novel and innovative work from experts practitioners scientists and decision makers from academia and industry It covers topics such as instrumentation application in industry instrumentation in electrical applications and instrumentation in recent trends with computation approach

Unmanned Aerial Vehicles: Breakthroughs in Research and Practice Management Association, Information Resources, 2019-05-03 First used in military applications unmanned aerial vehicles are becoming an integral aspect of modern society and are expanding into the commercial scientific recreational agricultural and surveillance sectors With the increasing use of these drones by government officials business professionals and civilians more research is needed to understand their complexity both in design and function Unmanned Aerial Vehicles Breakthroughs in Research and Practice is a critical source of academic knowledge on the design construction and maintenance of drones as well as their applications across all aspects of society Highlighting a range of pertinent topics such as intelligent systems artificial intelligence and situation awareness this publication is an ideal reference source for military consultants military personnel business professionals operation managers surveillance companies agriculturalists policymakers government officials law enforcement IT professionals academicians researchers and graduate level students

Intelligent Manufacturing and Mechatronics Zambari Jamaludin, Mohd Najib Ali Mokhtar, 2019-07-03 This book presents the proceedings of SympoSIMM 2019 the 2nd edition of the Symposium on Intelligent Manufacturing and Mechatronics Focusing on Strengthening Innovations Towards Industry 4.0 the book presents studies on the details of Industry 4.0's current trends Divided into five parts covering various areas of manufacturing engineering and mechatronics stream namely artificial intelligence instrumentation and controls intelligent manufacturing modelling and simulation and robotics the book is a valuable resource for readers wishing to embrace the new era of Industry 4.0

Road Vehicles Surroundings Supervision On-Board Sensors and Communications Felipe Jimenez, 2019-01-29 This book is a printed edition of the Special Issue Road Vehicles Surroundings Supervision On Board Sensors and Communications that was published in Applied Sciences

Iterative Learning Control for Flexible Structures Tingting Meng, Wei He, 2020-03-23 This book presents iterative learning control ILC to address practical issues of flexible structures It is divided into four parts Part I provides a general introduction to ILC and flexible structures while Part II proposes various types of ILC for simple flexible structures to address issues such as vibration input

saturation input dead zone input backlash external disturbances and trajectory tracking It also includes simple partial differential equations to deal with the common problems of flexible structures Part III discusses the design of ILC for flexible micro aerial vehicles and two link manipulators and lastly Part IV offers a summary of the topics covered Unlike most of the literature on ILC which focuses on ordinary differential equation systems this book explores distributed parameter systems which are comparatively less stabilized through ILC Including a comprehensive introduction to ILC of flexible structures it also examines novel approaches used in ILC to address input constraints and disturbance rejection This book is intended for researchers graduate students and engineers in various fields such as flexible structures external disturbances nonlinear inputs and tracking control

Wireless Communications, Networking and Applications Qing-An Zeng, 2015-10-28 This book is based on a series of conferences on Wireless Communications Networking and Applications that have been held on December 27 28 2014 in Shenzhen China The meetings themselves were a response to technological developments in the areas of wireless communications networking and applications and facilitate researchers engineers and students to share the latest research results and the advanced research methods of the field The broad variety of disciplines involved in this research and the differences in approaching the basic problems are probably typical of a developing field of interdisciplinary research However some main areas of research and development in the emerging areas of wireless communication technology can now be identified The contributions to this book are mainly selected from the papers of the conference on wireless communications networking and applications and reflect the main areas of interest Section 1 Emerging Topics in Wireless and Mobile Computing and Communications Section 2 Internet of Things and Long Term Evolution Engineering Section 3 Resource Allocation and Interference Management Section 4 Communication Architecture Algorithms Modeling and Evaluation Section 5 Security Privacy and Trust and Section 6 Routing Position Management and Network Topologies

Handbook of Research on Advancements in Robotics and Mechatronics Habib, Maki K., 2014-12-31 The field of mechatronics integrates modern engineering science and technologies with new ways of thinking enhancing the design of products and manufacturing processes This synergy enables the creation and evolution of new intelligent human oriented machines The Handbook of Research on Advancements in Robotics and Mechatronics presents new findings practices technological innovations and theoretical perspectives on the the latest advancements in the field of mechanical engineering This book is of great use to engineers and scientists students researchers and practitioners looking to develop autonomous and smart products and systems for meeting today s challenges

Proceedings of the 2nd International Seminar on Aeronautics and Energy Nik Ahmad Ridhwan Nik Mohd., Shabudin Mat, 2023-11-18 This book consists of selected peer reviewed papers from the 2nd International Seminar on Aeronautics and Energy ISAE 2022 focusing on the theme to revive the aviation industry post COVID 19 pandemic The topics discussed in this book include aircraft design and optimization computational fluid dynamics CFD simulation and experimental aerodynamics aircraft structure and aeroelasticity guidance

control and navigation aircraft manufacturing and health monitoring avionics and system integration of UAV drones SITL AND HITL application on drones rockets and missile industrial wind engineering green fuel and aviation sustainability and aviation management This book is a valuable resource for academicians and industry players in the field of aviation and sustainability

Automation, Control and Energy Efficiency in Complex Systems Hamid Khayyam, 2020-12-22 This book is aimed at serving researchers engineers scientists and engineering graduate and PhD students of engineering and physical science together with individuals interested in engineering and science This book focuses on the application of engineering methods to complex systems including transportation building and manufacturing with approaches representing a wide variety of disciplines of engineering and science Throughout the book great emphases are placed on engineering applications of complex systems as well as the methodologies of automation including artificial intelligence automated and intelligent control energy analysis energy modelling energy management and optimised energy efficiency The significant impact of recent studies that have been selected for presentation are of high interest in engineering complex systems An attempt has been made to expose the reading audience of engineers and researchers to a broad range of theoretical and practical topics The topics contained in the present book are of specific interest to engineers who are seeking expertise in transportation building and manufacturing technologies as well as mathematical modelling of complex systems engineering approaches to engineering complex problems automation via artificial intelligence methods automated and intelligent control and energy systems The primary audience of this book are researchers graduate students and engineers in mechanical engineering control engineering computer engineering electrical engineering and science disciplines In particular the book can be used for training graduate and PhD students as well as senior undergraduate students to enhance their knowledge by taking a graduate or advanced undergraduate course in the areas of complex systems control systems energy systems and engineering applications The covered research topics are also of interest to engineers and academia who are seeking to expand their expertise in these areas

Advanced Control Systems for Electric Drives Adel Merabet, 2020-12-07 This book provides extensive information about advanced control techniques in electric drives Multiple control and estimation methods are studied for position and speed tracking in different drives Artificial intelligence tools such as fuzzy logic and neural networks are used for specific applications using electric drives

Sliding Mode Control Using MATLAB Jinkun Liu, 2017-05-25 Sliding Mode Control Using MATLAB provides many sliding mode controller design examples along with simulation examples and MATLAB programs Following the review of sliding mode control the book includes sliding mode control for continuous systems robust adaptive sliding mode control sliding mode control for underactuated systems backstepping and dynamic surface sliding mode control sliding mode control based on filter and observer sliding mode control for discrete systems fuzzy sliding mode control neural network sliding mode control and sliding mode control for robot manipulators The contents of each chapter are independent providing readers with information they can use for their

own needs It is suitable for the readers who work on mechanical and electronic engineering electrical automation engineering etc and can also be used as a teaching reference for universities Provides many sliding mode controller design examples to help readers solve their research and design problems Includes various implementable robust sliding mode control design solutions from engineering applications Provides the simulation examples and MATLAB programs for each sliding mode control algorithm

International Advanced Researches & Engineering Congress 2017 Proceeding Book Recep HALICIOGLU,Hediye KIRLI AKIN,Yusuf FEDAI,2017-12-29 INTERNATIONAL WORKSHOPS at IAREC 17 This book includes English main and Turkish languages International Workshop on Mechanical Engineering International Workshop on Mechatronics Engineering International Workshop on Energy Systems Engineering International Workshop on Automotive Engineering and Aerospace Engineering International Workshop on Material Engineering International Workshop on Manufacturing Engineering International Workshop on Physics Engineering International Workshop on Electrical and Electronics Engineering International Workshop on Computer Engineering and Software Engineering International Workshop on Chemical Engineering International Workshop on Textile Engineering International Workshop on Architecture International Workshop on Civil Engineering International Workshop on Geomatics Engineering International Workshop on Industrial Engineering International Workshop on Food Engineering International Workshop on Aquaculture Engineering International Workshop on Agriculture Engineering International Workshop on Mathematics Engineering International Workshop on Bioengineering Engineering International Workshop on Biomedical Engineering International Workshop on Genetic Engineering International Workshop on Environmental Engineering International Workshop on Other Engineering Science

Radial Basis Function (RBF) Neural Network Control for Mechanical Systems Jinkun Liu,2013-01-26 Radial Basis Function RBF Neural Network Control for Mechanical Systems is motivated by the need for systematic design approaches to stable adaptive control system design using neural network approximation based techniques The main objectives of the book are to introduce the concrete design methods and MATLAB simulation of stable adaptive RBF neural control strategies In this book a broad range of implementable neural network control design methods for mechanical systems are presented such as robot manipulators inverted pendulums single link flexible joint robots motors etc Advanced neural network controller design methods and their stability analysis are explored The book provides readers with the fundamentals of neural network control system design This book is intended for the researchers in the fields of neural adaptive control mechanical systems Matlab simulation engineering design robotics and automation Jinkun Liu is a professor at Beijing University of Aeronautics and Astronautics

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