Adaptive Backstepping Control Of Uncertain Systems Nonsmooth Nonlinearities Interactions Or Time Variations Lecture Notes In Control And Information Sciences

The Industrial Electronics Handbook, Second Edition combines traditional and newer, more specialized knowledge that will help industrial electronics engineers develop practical solutions for the design and implementation of high-power applications. Embracing the broad technological scope of the field, this collection explores fundamental areas, including analog and digital circuits, electronics, electromagnetic machines, signal processing, and industrial control and communications systems. It also facilitates the use of intelligent systems—such as neural networks, fuzzy systems, and evolutionary methods—in terms of a hierarchical structure that makes factory control and supervision more efficient by addressing the needs of all production components. Enhancing its value, this fully updated collection presents research and global trends as published in the IEEE Transactions on Industrial Electronics Journal, one of the largest and most respected publications in the field. Control and Mechatronics presents concepts of control theory in a way that makes them easily understandable and practically useful for engineers or students working with control system applications. Focusing more on practical applications than on mathematics, this book avoids typical theorems and proofs and instead uses plain language and useful examples to: Concentrate on control system analysis and design, comparing various techniques Cover estimation, observation, and identification of the objects to be controlled—to ensure accurate system models before production Explore the various aspects of robotics and mechatronics Other volumes in the set: Fundamentals of Industrial Electronics Power Electronics and Motor Drives Industrial Communication Systems Intelligent Systems

This book is part of a three volume set that constitutes the refereed proceedings of the 4th International Symposium on Neural Networks, ISNN 2007, held in Nanjing, China in June 2007. Coverage includes neural networks for control applications, robotics, data mining and feature extraction, chaos and synchronization, support vector machines, fault diagnosis/detection, image/video processing, and applications of neural networks.

This book presents the proceedings of the 20th Polish Control Conference. A triennial event that was first held in 1958, the conference successfully combines its long tradition with a modern approach to shed light on problems in control engineering, automation, robotics and a wide range of applications in these disciplines. The book presents new theoretical results concerning the steering of dynamical systems, as well as industrial case studies and worked solutions to real-world problems in contemporary engineering. It particularly focuses on the modelling, identification, analysis and design of automation systems; however, it also addresses the evaluation of their performance, efficiency and reliability. Other topics include fault-tolerant control in robotics, automated manufacturing, mechatronics and industrial systems. Moreover, it discusses data processing and transfer issues, covering a variety of methodologies, including model predictive, robust and adaptive techniques, as well as algebraic and geometric methods, and fractional order calculus approaches. The book also examines essential application areas, such as transportation and autonomous intelligent vehicle systems, robotic arms, mobile manipulators, cyber-physical systems, electric drives and both surface and underwater marine vessels. Lastly, it explores biological and medical applications of the control-theory-inspired methods.

This book includes original, peer-reviewed research papers from the 11th International Conference on Modelling, Identification and Control (ICMIC2019), held in Tianjin, China on

July 13-15, 2019. The topics covered include but are not limited to: System Identification, Linear/Nonlinear Control Systems, Data-driven Modelling and Control, Process Modelling and Process Control, Fault Diagnosis and Reliable Control, Intelligent Systems, and Machine Learning and Artificial Intelligence.The papers showcased here share the latest findings on methodologies, algorithms and applications in modelling, identification, and control, integrated with Artificial Intelligence (AI), making the book a valuable asset for researchers, engineers, and university students alike.

"Uncertainty is inherent in control systems. Consider the following example: as an aircraft flies, it consumes fuel, which causes its mass to decrease. In order to maintain stability, the autopilot mechanism must adapt to this (a priori unknown) change in mass. Delays also pose a challenge in control systems. If you have tried to maintain a comfortable water temperature while showering in a building with outdated plumbing, you will understand the difficulties that arise when a control system has significant delays: the controller (you) is forced to make decisions based on "old" information. The intersection of these two problems (estimating unknown parameters when a system has delays) poses a significant mathematical challenge. Delay-Adaptive Linear Control presents new mathematical techniques to handle the intersection of the two distinct types of uncertainty described above: adaptive constraints, and uncertainties caused by delays. Traditionally, the problems of adaption and delays have been treated separately. This book considers the intersection of these two problems, developing new techniques for addressing different combinations of uncertainty-all within a single, unified framework. This work has applications in electrical and mechanical engineering (unmanned aerial vehicles, robotic manipulators), biomedical engineering (3D printing, neuromuscular electrical stimulation), and management and traffic science (supply chains, traffic flow), among others. Beyond its practical importance, this work is also of significant theoretical interest, as it addresses mathematical challenges involved in the analysis and design of these systems"--

In the recent years, fractional-order systems have been studied by many researchers in the engineering field. It was found that many systems can be described more accurately by fractional differential equations than by integer-order models. Advanced Synchronization Control and Bifurcation of Chaotic Fractional-Order Systems is a scholarly publication that explores new developments related to novel chaotic fractional-order systems, control schemes, and their applications. Featuring coverage on a wide range of topics including chaos synchronization, nonlinear control, and cryptography, this publication is geared toward engineers, IT professionals, researchers, and upper-level graduate students seeking current research on chaotic fractional-order systems and their applications in engineering and computer science.

Shedding light on new opportunities in predictor feedback, this book significantly broadens the set of techniques available to a mathematician or engineer working on delay systems. It is a collection of tools and techniques that make predictor feedback ideas applicable to nonlinear systems, systems modeled by PDEs, systems with highly uncertain or completely unknown input/output delays, and systems whose actuator or sensor dynamics are modeled by more general hyperbolic or parabolic PDEs, rather than by pure delay. Replete with examples, Delay Compensation for Nonlinear, Adaptive, and PDE Systems is an excellent reference guide for graduate students, researchers, and professionals in mathematics, systems control, as well as chemical, mechanical, electrical, computer, aerospace, and civil/structural engineering. Parts of the book may be used in graduate courses on general distributed parameter systems, linear delay systems, PDEs, nonlinear control, state estimator and observers, adaptive control, robust control, or linear time-varying systems.

Nonlinear dynamics is still a hot and challenging topic. In this edited book, we focus on fractional dynamics, infinite dimensional dynamics defined by the partial differential equation, network dynamics, fractal dynamics, and their numerical analysis and simulation.Fractional

dynamics is a new topic in the research field of nonlinear dynamics which has attracted increasing interest due to its potential applications in the real world, such as modeling memory processes and materials. In this part, basic theory for fractional differential equations and numerical simulations for these equations will be introduced and discussed.In the infinite dimensional dynamics part, we emphasize on numerical calculation and theoretical analysis, including constructing various numerical methods and computing the corresponding limit sets, etc.In the last part, we show interest in network dynamics and fractal dynamics together with numerical simulations as well as their applications.

The editors of this Special Issue titled “Intelligent Control in Energy Systems” have attempted to create a book containing original technical articles addressing various elements of intelligent control in energy systems. In response to our call for papers, we received 60 submissions. Of those submissions, 27 were published and 33 were rejected. In this book, we offer the 27 accepted technical articles as well as one editorial. Authors from 15 countries (China, Netherlands, Spain, Tunisia, United Sates of America, Korea, Brazil, Egypt, Denmark, Indonesia, Oman, Canada, Algeria, Mexico, and the Czech Republic) elaborate on several aspects of intelligent control in energy systems. The book covers a broad range of topics including fuzzy PID in automotive fuel cell and MPPT tracking, neural networks for fuel cell control and dynamic optimization of energy management, adaptive control on power systems, hierarchical Petri Nets in microgrid management, model predictive control for electric vehicle battery and frequency regulation in HVAC systems, deep learning for power consumption forecasting, decision trees for wind systems, risk analysis for demand side management, finite state automata for HVAC control, robust ?-synthesis for microgrids, and neuro-fuzzy systems in energy storage.

In practice, actuators often undergo failures and various factors influence its effectiveness. Also due to the increasing complexity of large-scale systems, subsystems are often interconnected, whereas the interactions between any two subsystems are difficult to deal with. This book details a series of new methodologies of designing and analyzing adaptive backstepping control systems involving treatment on actuator failures, subsystem interactions and nonsmooth nonlinearities. Moreover, it discusses some interesting open issues in adaptive failure accommodation, decentralized adaptive control and distributed adaptive coordinated control.

This is the first book on adaptive aeroservoelasticity and it presents the nonlinear and recursive techniques for adaptively controlling the uncertain aeroelastic dynamics Covers both linear and nonlinear control methods in a comprehensive manner Mathematical presentation of adaptive control concepts is rigorous Several novel applications of adaptive control presented here are not to be found in other literature on the topic Many realistic design examples are covered, ranging from adaptive flutter suppression of wings to the adaptive control of transonic limit-cycle oscillations

This book employs the powerful and popular adaptive backstepping control technology to design controllers for dynamic uncertain systems with non-smooth

nonlinearities. Various cases including systems with time-varying parameters, multi-inputs and multi-outputs, backlash, dead-zone, hysteresis and saturation are considered in design and analysis. For multi-inputs and multi-outputs systems, both centralized and decentralized controls are addressed. This book not only presents recent research results including theoretical success and practical development such as the proof of system stability and the improvement of system tracking and transient performance, but also gives self-contained coverage of fundamentals on the backstepping approach illustrated with simple examples. Detail description of methodologies for the construction of adaptive laws, feedback control laws and associated Lyapunov functions is systematically provided in each case. Approaches used for the analysis of system stability and tracking and transient performances are elaborated. Two case studies are presented to show how the presented theories are applied.

This book presents innovative technologies and research results on adaptive control of dynamic systems with quantization, uncertainty and nonlinearity including theoretical success and practical development such as approaches for stability analysis, treatment of subsystem interactions, improvement of system tracking and transient performance.

This book focuses on most recent theoretical findings on control issues for active suspension systems. The authors first introduce the theoretical background of active suspension control, then present constrained H? control approaches of active suspension systems in the entire frequency domain, focusing on the state feedback and dynamic output feedback controller in the finite frequency domain which people are most sensitive to. The book also contains nonlinear constrained tracking control via terminal sliding-mode control and adaptive robust theory, presenting controller design of active suspensions as well as the reliability control of active suspension systems. The target audience primarily comprises research experts in control theory, but the book may also be beneficial for graduate students alike.

Issues in Logic, Probability, Combinatorics, and Chaos Theory: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Logic, Probability, Combinatorics, and Chaos Theory. The editors have built Issues in Logic, Probability, Combinatorics, and Chaos Theory: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Logic, Probability, Combinatorics, and Chaos Theory in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Logic, Probability, Combinatorics, and Chaos Theory: 2011 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at

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This book presents a series of innovative technologies and research results on adaptive control of dynamic systems with quantization, uncertainty, and nonlinearity, including the theoretical success and practical development such as the approaches for stability analysis, the compensation of quantization, the treatment of subsystem interactions, and the improvement of system tracking and transient performance. Novel solutions by adopting backstepping design tools to a number of hotspots and challenging problems in the area of adaptive control are provided. In the first three chapters, the general design procedures and stability analysis of backstepping controllers and the basic descriptions and properties of quantizers are introduced as preliminary knowledge for this book. In the remainder of this book, adaptive control schemes are introduced to compensate for the effects of input quantization, state quantization, both input and state/output quantization for uncertain nonlinear systems and are applied to helicopter systems and DC Microgrid. Discussion remarks are provided in each chapter highlighting new approaches and contributions to emphasize the novelty of the presented design and analysis methods. Simulation results are also given in each chapter to show the effectiveness of these methods. This book is helpful to learn and understand the fundamental backstepping schemes for state feedback control and output feedback control. It can be used as a reference book or a textbook on adaptive quantized control for students with some background in feedback control systems. Researchers, graduate students, and engineers in the fields of control, information, and communication, electrical engineering, mechanical engineering, computer science, and others will benefit from this book.

The first comprehensive, self–contained text on nonlinear analysis and robust control Increasingly, robust control plays a greater role in achieving high performance for systems that are too complex to be modeled accurately. Using Lyapunov?s direct method to develop design procedures, compare different controls, and give the reader a definite feel for stability analysis and robust control for nonlinear systems with significant uncertainty, this unique text: ? Presents the complete set of robust control design procedures for nonlinear uncertain systems ? Introduces the recursive interlacing design method that will generate robust control for uncertain systems with cascaded, feedback, and feedforward dynamics ? Covers a broad range of robust control designs, including state feedback and input–output, continuous–time and digital, and static and dynamic controls ? Gives advice on selecting design parameters according to their impact on stability and performance ? Features illustrations as well as end–of–chapter exercises and references

The six volume set LNCS 10634, LNCS 10635, LNCS 10636, LNCS 10637, LNCS 10638, and LNCS 10639 constitues the proceedings of the 24rd International Conference on Neural Information Processing, ICONIP 2017, held in Guangzhou, China, in November 2017. The 563 full papers presented were carefully reviewed and selected from 856 submissions. The 6 volumes are

organized in topical sections on Machine Learning, Reinforcement Learning, Big Data Analysis, Deep Learning, Brain-Computer Interface, Computational Finance, Computer Vision, Neurodynamics, Sensory Perception and Decision Making, Computational Intelligence, Neural Data Analysis, Biomedical Engineering, Emotion and Bayesian Networks, Data Mining, Time-Series Analysis, Social Networks, Bioinformatics, Information Security and Social Cognition, Robotics and Control, Pattern Recognition, Neuromorphic Hardware and Speech Processing.

This book focuses on the intelligent control design for both the induction motor (IM) and the permanent magnet synchronous motor (PMSM). Compared with traditional control schemes, such as the field-oriented control (FOC) and the direct torque control (DTC), the intelligent controllers designed in this book could overcome the influence of parameter uncertainty and load torque disturbance. This book is a research monograph, which provides valuable reference material for researchers who wish to explore the area of AC motor. In addition, the main contents of the book are also suitable for a one-semester graduate course. .

This book addresses a range of solutions and effective control techniques for Microbial Fuel Cells (MFCs), intended as a response to the increased energy consumption and wastewater production stemming from globalization. It describes the fundamentals of MFCs and control-oriented mathematical models, and provides detailed information on uncertain parameters. Various control techniques like robust control with LMI, adaptive backstepping control, and exact linearization control are developed for different mathematical models. In turn, the book elaborates on the basics of adaptive control, presenting several methods in detail. It also demonstrates how MFCs can be developed at the laboratory level, equipping readers to develop their own MFCs for experimental purposes. In closing, it develops a transfer function model for MFCs by combining a system identification technique and model reference adaptive control techniques. By addressing one of the most promising sources of clean and renewable energy, this book provides a viable solution for meeting the world’s increasing energy demands.

A critical part of ensuring that systems are advancing alongside technology without complications is problem solving. Practical applications of problem-solving theories can model conflict and cooperation and aid in creating solutions to real-world problems. Soft-Computing-Based Nonlinear Control Systems Design is a critical scholarly publication that examines the practical applications of control theory and its applications in problem solving to fields including economics, environmental management, and financial modelling. Featuring a wide range of topics, such as fuzzy logic, nature-inspired algorithms, and cloud computing, this book is geared toward academicians, researchers, and students seeking relevant research on control theory and its practical applications.

Industrial electronics systems govern so many different functions that vary in complexity-from the operation of relatively simple applications, such as electric

motors, to that of more complicated machines and systems, including robots and entire fabrication processes. The Industrial Electronics Handbook, Second Edition combines traditional and new

This book highlights relevant studies and applications in the area of robotics, which reflect the latest research, from interdisciplinary theoretical studies and computational algorithm development, to representative applications. It presents chapters on advanced control, such as fuzzy, neural, backstepping, sliding mode, adaptive, predictive, diagnosis and fault tolerant control etc. and addresses topics including cloud robotics, cable-driven robots, two-wheeled robots, mobile robots, swarm robots, hybrid vehicle, and drones. Each chapter employs a uniform structure: background, motivation, quantitative development (equations), case studies/illustration/tutorial (simulations, experiences, curves, tables, etc.), allowing readers to easily tailor the techniques to their own applications.

The two-volume set LNCS 7951 and 7952 constitutes the refereed proceedings of the 10th International Symposium on Neural Networks, ISNN 2013, held in Dalian, China, in July 2013. The 157 revised full papers presented were carefully reviewed and selected from numerous submissions. The papers are organized in following topics: computational neuroscience, cognitive science, neural network models, learning algorithms, stability and convergence analysis, kernel methods, large margin methods and SVM, optimization algorithms, varational methods, control, robotics, bioinformatics and biomedical engineering, brain-like systems and brain-computer interfaces, data mining and knowledge discovery and other applications of neural networks.

The objective of the EU Nonlinear Control Network Workshop was to bring together scientists who are already active in nonlinear control and young researchers working in this field. This book presents selectively invited contributions from the workshop, some describing state-of-the-art subjects that already have a status of maturity while others propose promising future directions in nonlinear control. Amongst others, following topics of nonlinear and adaptive control are included: adaptive and robust control, applications in physical systems, distributed parameter systems, disturbance attenuation, dynamic feedback, optimal control, sliding mode control, and tracking and motion planning.

This book presents theoretical explorations of several fundamental problems in the dynamics and control of flexible beam systems. By integrating fresh concepts and results to form a systematic approach to control, it establishes a basic theoretical framework. It includes typical control design examples verified using MATLAB simulation, which in turn illustrate the successful practical applications of active vibration control theory for flexible beam systems. The book is primarily intended for researchers and engineers in the control system and mechanical engineering community, offering them a unique resource.

Adaptive Control of Linear Hyperbolic PDEs provides a comprehensive treatment of adaptive control of linear hyperbolic systems, using the backstepping method. It develops adaptive control strategies for different combinations of measurements and actuators, as well as for a range of different combinations of parameter uncertainty. The book treats boundary control of systems of hyperbolic partial differential equations (PDEs) with uncertain parameters. The authors develop designs for single equations, as well as any number of coupled equations. The designs are accompanied by mathematical proofs, which allow the reader to gain insight into the technical challenges associated with adaptive control of hyperbolic PDEs, and to get

an overview of problems that are still open for further research. Although stabilization of unstable systems by boundary control and boundary sensing are the particular focus, state-feedback designs are also presented. The book also includes simulation examples with implementational details and graphical displays, to give readers an insight into the performance of the proposed control algorithms, as well as the computational details involved. A library of MATLAB® code supplies ready-to-use implementations of the control and estimation algorithms developed in the book, allowing readers to tailor controllers for cases of their particular interest with little effort. These implementations can be used for many different applications, including pipe flows, traffic flow, electrical power lines, and more. Adaptive Control of Linear Hyperbolic PDEs is of value to researchers and practitioners in applied mathematics, engineering and physics; it contains a rich set of adaptive control designs, including mathematical proofs and simulation demonstrations. The book is also of interest to students looking to expand their knowledge of hyperbolic PDEs.

Backstepping Control of Nonlinear Dynamical Systems addresses both the fundamentals of backstepping control and advances in the field. The latest techniques explored include ‘active backstepping control’, ‘adaptive backstepping control’, ‘fuzzy backstepping control’ and ‘adaptive fuzzy backstepping control’. The reference book provides numerous simulations using MATLAB and circuit design. These illustrate the main results of theory and applications of backstepping control of nonlinear control systems. Backstepping control encompasses varied aspects of mechanical engineering and has many different applications within the field. For example, the book covers aspects related to robot manipulators, aircraft flight control systems, power systems, mechanical systems, biological systems and chaotic systems. This multifaceted view of subject areas means that this useful reference resource will be ideal for a large cross section of the mechanical engineering community. Details the real-world applications of backstepping control Gives an up-to-date insight into the theory, uses and application of backstepping control Bridges the gaps for different fields of engineering, including mechanical engineering, aeronautical engineering, electrical engineering, communications engineering, robotics and biomedical instrumentation

The biennial Congress of the Italian Society of Oral Pathology and Medicine (SIPMO) is an International meeting dedicated to the growing diagnostic challenges in the oral pathology and medicine field. The III International and XV National edition will be a chance to discuss clinical conditions which are unusual, rare, or difficult to define. Many consolidated national and international research groups will be involved in the debate and discussion through special guest lecturers, academic dissertations, single clinical case presentations, posters, and degree thesis discussions. The SIPMO Congress took place from the 17th to the 19th of October 2019 in Bari (Italy), and the enclosed copy of Proceedings is a non-exhaustive collection of abstracts from the SIPMO 2019 contributions.

Mathematics—Advances in Research and Application: 2012 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Mathematics. The editors have built Mathematics—Advances in Research and Application: 2012 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Mathematics in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Mathematics—Advances in Research and Application: 2012 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Adaptive Backstepping Control of Uncertain SystemsNonsmooth Nonlinearities, Interactions or

Time-VariationsSpringer Science & Business Media

This book studies selected discrete-time flight control schemes for fixed-wing unmanned aerial vehicle (UAV) systems in the presence of system uncertainties, external disturbances and input saturation. The main contributions of this book for UAV systems are as follows: (i) the proposed integer-order discrete-time control schemes are based on the designed discrete-time disturbance observers (DTDOs) and the neural network (NN); and (ii) the fractional-order discrete-time control schemes are developed by using the fractional-order calculus theory, the NN and the DTDOs. The book offers readers a good understanding of how to establish discrete-time tracking control schemes for fixed-wing UAV systems subject to system uncertainties, external wind disturbances and input saturation. It represents a valuable reference guide for academic research on uncertain UAV systems, and can also support advanced / Ph.D. studies on control theory and engineering.

This two-volume set LNCS 11554 and 11555 constitutes the refereed proceedings of the 16th International Symposium on Neural Networks, ISNN 2019, held in Moscow, Russia, in July 2019. The 111 papers presented in the two volumes were carefully reviewed and selected from numerous submissions. The papers were organized in topical sections named: Learning System, Graph Model, and Adversarial Learning; Time Series Analysis, Dynamic Prediction, and Uncertain Estimation; Model Optimization, Bayesian Learning, and Clustering; Game Theory, Stability Analysis, and Control Method; Signal Processing, Industrial Application, and Data Generation; Image Recognition, Scene Understanding, and Video Analysis; Bio-signal, Biomedical Engineering, and Hardware.

Chinese Control and Decision Conference is an annual international conference to create a forum for scientists, engineers and practitioners throughout the world to present the latest advancement in Control, Decision, Automation, Robotics and Emerging Technologies

This book gathers papers presented during the 4th International Conference on Electrical Engineering and Control Applications. It covers new control system models, troubleshooting tips and complex system requirements, such as increased speed, precision and remote capabilities. Additionally, the papers discuss not only the engineering aspects of signal processing and various practical issues in the broad field of information transmission, but also novel technologies for communication networks and modern antenna design. This book is intended for researchers, engineers and advanced postgraduate students in the fields of control and electrical engineering, computer science and signal processing, as well as mechanical and chemical engineering.

These proceedings present selected research papers from CISC’16, held in Xiamen, China. The topics include Multi-agent system, Evolutionary Computation, Artificial Intelligence, Complex systems, Computation intelligence and soft computing, Intelligent control, Advanced control technology, Robotics and applications, Intelligent information processing, Iterative learning control, Machine Learning, and etc. Engineers and researchers from academia, industry, and government can get an insight view of the solutions combining ideas from multiple disciplines in the field of intelligent systems.