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Sliding Mode Observer and Control System Design Chattering Reduction in Sliding Mode Observer Design and Its Application for Fault Detection Observers for Linear Systems Advances in Observer Design and Observation for Nonlinear Systems Observer Design for Nonlinear Dynamical Systems Sliding Mode Control Using MATLAB Automated Model Generation and Observer Design for Interconnected Systems : A Port-Hamiltonian Approach Sliding Mode Control and Observation Advances in Observer Design and Observation for Nonlinear Systems Analysis and Design of Hybrid Systems 2006 Road Map for Sliding Mode Control Design Disturbance Observer-Based Control Observer Design for Nonlinear Systems Observer-Based Fault Estimation Techniques High-Gain Observers in Nonlinear Feedback Control Stability Analysis and Nonlinear Observer Design using Takagi-Sugeno Fuzzy Models Sliding Mode Controllers and Observers Sliding Mode Control Methodology in the Applications of Industrial Power Systems Position Sensorless Control Techniques for Permanent Magnet Synchronous Machine Drives Sliding Mode Control Intelligent Control and Applications for Robotics Robust Observer-Based Fault Diagnosis for Nonlinear Systems Using MATLAB® Sliding Mode Control In Engineering Frequency-Shaped and Observer-Based Discrete-time Sliding Mode Control Fault Diagnosis and Fault Tolerance for Mechatronic Systems: Recent Advances 15th European Workshop on Advanced Control and Diagnosis (ACD

2019) *Applied Interval Analysis* *Advanced Control of Piezoelectric Micro-/Nano-Positioning Systems* *Systems, Automation, and Control* *Novel Nonlinear Sliding Mode Observers for State and Parameter Estimation* *Proceedings of the 2011 International Conference on Informatics, Cybernetics, and Computer Engineering (ICCE2011) November 19-20, 2011, Melbourne, Australia* *Advances in Guidance, Navigation and Control* *Proceedings of 2016 Chinese Intelligent Systems Conference* *Proceedings of the 28th Conference of Spacecraft TT&C Technology in China* *Control in Bioprocessing* *Sliding Mode Based Analysis and Identification of Vehicle Dynamics* *Mathematical Methods for Robust and Nonlinear Control* *Marine Tidal and Wave Energy Converters* *Application of Sliding Mode Methods to the Design of Reconfigurable Flight Control Systems* *Sliding Mode Observer Design for Permanent Magnetic Synchronous Generator Based Wind Energy Conversion Systems*

This book, published in two volumes, embodies the proceedings of the 15th European Workshop on Advanced Control and Diagnosis (ACD 2019) held in Bologna, Italy, in November 2019. It features contributed and invited papers from academics and professionals specializing in an important aspect of control and automation. The book discusses current theoretical research developments and open problems and illustrates practical applications and industrial priorities. With a focus on both theory and applications, it spans a wide variety of up-to-date topics in the field of systems and control, including robust control, adaptive control, fault-tolerant control, control reconfiguration, and model-based diagnosis of linear, nonlinear and hybrid systems. As the subject coverage has expanded to include cyber-physical production systems, industrial internet of *things and sustainability issues, some contributions are of an interdisciplinary nature, involving ICT disciplines and environmental sciences. This book is a valuable reference for both academics and professionals in the area of systems and control, with a focus on advanced control, automation, fault diagnosis and condition monitoring. My aim, in writing this monograph, has been to remedy this omission by presenting a comprehensive and unified theory of observers for continuous-time and discrete -time linear systems. The book is intended for post-graduate students and researchers specializing in control systems, now a core subject in a number of disciplines. Forming, as it does, a self-contained volume it should also be of service to control engineers primarily interested in applications, and to mathematicians with some exposure to control problems. Observer-based sliding mode control is investigated for application to aircraft reconfigurable flight control. An overview of reconfigurable flight control is given, including a review of the current state-of-the-art within the subdisciplines of fault detection parameter identification, adaptive control schemes, and dynamic control allocation. Of the adaptive control methods reviewed, sliding mode control (SMC) appears promising due its property of invariance to matched uncertainty. An overview of SMC is given and its properties are demonstrated. Sliding mode methods, however, are difficult to implement because unmodeled parasitic dynamics cause immediate and severe instability. This presents a challenge for all practical applications with limited bandwidth actuators. One method to deal with parasitic dynamics is the use of an asymptotic observer. Observer-based SMC is investigated, and a method for selecting observer gains is offered. An additional method for shaping the feedback loop using a filter is also developed. It is* *shown that this SMC prefilter is equivalent to a form of model reference hedging. A complete design procedure is given which takes advantage of the sliding mode boundary layer to recast the SMC as a linear control law. Frequency domain loop shaping is then used to design the sliding manifold. Finally, three aircraft applications are demonstrated. An F-18/HARV is used to demonstrate SISO and MIMO designs. The third application is a linear six degree-of-freedom advanced tailless fighter model. The observer-based SMC is seen to provide excellent tracking with superior robustness to parameter changes and actuator failures. Observer Design for Nonlinear Systems deals with the design of observers for the large class of nonlinear continuous-time models. It contains a unified overview of a broad range of general designs, including the most recent results and their proofs, such as the homogeneous and nonlinear Luenberger design techniques. The book starts from the observation that most observer designs consist in looking for a reversible change of coordinates transforming the expression of the system dynamics into some specific structures, called normal forms, for which an observer is known. Therefore, the problem of observer design is broken down into three sub-problems: • What are the available normal forms and their associated observers?• Under which conditions can a system be transformed into one of these forms and through which transformation? • How can an inverse transformation that recovers an estimate in the given initial coordinates be achieved? This organisation allows the book to structure results within a united framework, highlighting the importance of the choice of the observer coordinates for nonlinear systems. In particular, the first part covers state-affine forms with their Luenberger or Kalman designs, and triangular forms with their* *homogeneous high-gain designs. The second part addresses the transformation into linear forms through linearization by output injection or in the context of a nonlinear Luenberger design, and into triangular forms under the well-known uniform and differential observability assumptions. Finally, the third part presents some recently developed methods for avoiding the numerically challenging inversion of the transformation. Observer Design for Nonlinear Systems addresses students and researchers looking for an introduction to or an overview of the state of the art in observer design for nonlinear continuous-time dynamical systems. The book gathers the most important results focusing on a large and diffuse literature on general observer designs with global convergence, and is a valuable source of information for academics and practitioners. The sliding mode control methodology has proven effective in dealing with complex dynamical systems affected by disturbances, uncertainties and unmodeled dynamics. Robust control technology based on this methodology has been applied to many real-world problems, especially in the areas of aerospace control, electric power systems, electromechanical systems, and robotics. Sliding Mode Control and Observation represents the first textbook that starts with classical sliding mode control techniques and progresses toward newly developed higher-order sliding mode control and observation algorithms and their applications. The present volume addresses a range of sliding mode control issues, including: *Conventional sliding mode controller and observer design *Second-order sliding mode controllers and differentiators *Frequency domain analysis of conventional and second-order sliding mode controllers *Higher-order sliding mode controllers and differentiators *Higher-order sliding mode observers *Sliding mode* *disturbance observer based control *Numerous applications, including reusable launch vehicle and satellite formation control, blood glucose regulation, and car steering control are used as case studies Sliding Mode Control and Observation is aimed at graduate students with a basic knowledge of classical control theory and some knowledge of state-space methods and nonlinear systems, while being of interest to a wider audience of graduate students in electrical/mechanical/aerospace engineering and applied mathematics, as well as researchers in electrical, computer, chemical, civil, mechanical, aeronautical, and industrial engineering, applied mathematicians, control engineers, and physicists. Sliding Mode Control and Observation provides the necessary tools for graduate students, researchers and engineers to robustly control complex and uncertain nonlinear dynamical systems. Exercises provided at the end of each chapter make this an ideal text for an advanced course taught in control theory. In the formation of any control problem there will be discrepancies between the actual plant and the mathematical model for controller design. Sliding mode control theory seeks to produce controllers to over some such mismatches. This text provides the reader with a grounding in sliding mode control and is appropriate for the graduate with a basic knowledge of classical control theory and some knowledge of state-space methods. From this basis, more advanced theoretical results are developed. Two industrial case studies, which present the results of sliding mode controller implementations, are used to illustrate the successful practical application theory. Many problems in decision making, monitoring, fault detection, and control require the knowledge of state variables and time-varying parameters that are not directly measured by* *sensors. In such situations, observers, or estimators, can be employed that use the measured input and output signals along with a dynamic model of the system in order to estimate the unknown states or parameters. An essential requirement in designing an observer is to guarantee the convergence of the estimates to the true values or at least to a small neighborhood around the true values. However, for nonlinear, large-scale, or time-varying systems, the design and tuning of an observer is generally complicated and involves large computational costs. This book provides a range of methods and tools to design observers for nonlinear systems represented by a special type of a dynamic nonlinear model -- the Takagi--Sugeno (TS) fuzzy model. The TS model is a convex combination of affine linear models, which facilitates its stability analysis and observer design by using effective algorithms based on Lyapunov functions and linear matrix inequalities. Takagi--Sugeno models are known to be universal approximators and, in addition, a broad class of nonlinear systems can be exactly represented as a TS system. Three particular structures of large-scale TS models are considered: cascaded systems, distributed systems, and systems affected by unknown disturbances. The reader will find in-depth theoretic analysis accompanied by illustrative examples and simulations of real-world systems. Stability analysis of TS fuzzy systems is addressed in detail. The intended audience are graduate students and researchers both from academia and industry. For newcomers to the field, the book provides a concise introduction dynamic TS fuzzy models along with two methods to construct TS models for a given nonlinear system It is well established that the sliding mode control strategy provides an effective and robust method of controlling the deterministic system due to its well-known invariance* *property to a class of bounded disturbance and parameter variations. Advances in microcomputer technologies have made digital control increasingly popular among the researchers worldwide. And that led to the study of discrete-time sliding mode control design and its implementation. This brief presents, a method for multi-rate frequency shaped sliding mode controller design based on switching and non-switching type of reaching law. In this approach, the frequency dependent compensator dynamics are introduced through a frequency-shaped sliding surface by assigning frequency dependent weighing matrices in a linear quadratic regulator (LQR) design procedure. In this way, the undesired high frequency dynamics or certain frequency disturbance can be eliminated. The states are implicitly obtained by measuring the output at a faster rate than the control. It is also known that the vibration control of smart structure is a challenging problem as it has several vibratory modes. So, the frequency shaping approach is used to suppress the frequency dynamics excited during sliding mode in smart structure. The frequency content of the optimal sliding mode is shaped by using a frequency dependent compensator, such that a higher gain can be obtained at the resonance frequencies. The brief discusses the design methods of the controllers based on the proposed approach for the vibration suppression of the intelligent structure. The brief also presents a design of discrete-time reduced order observer using the duality to discrete-time sliding surface design. First, the duality between the coefficients of the discrete-time reduced order observer and the sliding surface design is established and then, the design method for the observer using Riccati equation is explained. Using the proposed method, the observer for the Power System Stabilizer (PSS) for Single Machine Infinite Bus (SMIB)* *system is designed and the simulation is carried out using the observed states. The discrete-time sliding mode controller based on the proposed reduced order observer design method is also obtained for a laboratory experimental servo system and verified with the experimental results. This book presents a differential geometric method for designing nonlinear observers for multiple types of nonlinear systems, including single and multiple outputs, fully and partially observable systems, and regular and singular dynamical systems. It is an exposition of achievements in nonlinear observer normal forms. The book begins by discussing linear systems, introducing the concept of observability and observer design, and then explains the difficulty of those problems for nonlinear systems. After providing foundational information on the differential geometric method, the text shows how to use the method to address observer design problems. It presents methods for a variety of systems. The authors employ worked examples to illustrate the ideas presented. Observer Design for Nonlinear Dynamical Systems will be of interest to researchers, graduate students, and industrial professionals working with control of mechanical and dynamical systems. This book presents recent advanced techniques in sliding mode control and observer design for industrial power systems, focusing on their applications in polymer electrolyte membrane fuel cells and power converters. Readers will find not only valuable new fault detection and isolation techniques based on sliding mode control and observers, but also a number of robust control and estimation methodologies combined with fuzzy neural networks and extended state observer methods. The book also provides necessary experimental and simulation examples for proton exchange membrane fuel cell systems and power converter systems. Given its* *scope, it offers a valuable resource for undergraduate and graduate students, academics, scientists and engineers who are working in the field. Abstract: In this thesis, sliding mode controllers and observers are studied in terms of their robustness properties and implementation concerns. First, a twofold discrete time sliding mode control action is proposed defining a boundary layer which divides the original state space fictitiously into two regions. Outside the boundary layer, the velocity vector of the state trajectories is directed towards the boundary layer with a proper control action so as to achieve the outside stability. Inside the boundary layer, a modified equivalent control law is applied for disturbance rejection. The resulting controller eliminates the disturbance from the generalized control variable completely if its dynamics are known. If the disturbance dynamics are not available, a disturbance model is fitted using deviations from the sliding manifold and this model is incorporated into the control law. Second, a continuous time sliding mode observer design procedure is proposed for the reconstruction of the original state vector in finite time. Equivalent control concept is exploited for this purpose. A discrete time counterpart to the continuous time case is also provided using discrete time sliding mode control theory. The resulting observer shows a deadbeat response and is also robust to disturbances with known dynamics. The robustness properties of the discrete time sliding mode controllers and finite time converging characteristics of the sliding mode observers are verified on a truck-semitrailer system during typical highway maneuvers in simulations. Provides comprehensive coverage of the most recent developments in the theory of non-Archimedean pseudo-differential equations and its application to stochastics and mathematical physics--offering current methods of* *construction for stochastic processes in the field of p-adic numbers and related structures. Develops a new theory for parabolic equat 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 This book is devoted to control of finite and infinite dimensional processes with continuous-time and discrete time control, focusing on suppression problems and new methods of adaptation applicable for systems with sliding motions only. Special mathematical methods are needed for all the listed control tasks. These methods are addressed in the initial chapters, with coverage of the definition of the multidimensional sliding modes, the derivation of the differential equations of those motions, and the existence conditions. Subsequent* *chapters discusses various areas of further research. The book reflects the consensus view of the authors regarding the current status of SMC theory. It is addressed to a broad spectrum of engineers and theoreticians working in diverse areas of control theory and applications. It is well suited for use in graduate and postgraduate courses in such university programs as Electrical Engineering, Control of Nonlinear Systems, and Mechanical Engineering. The worldwide potential of electric power generation from marine tidal currents, waves, or offshore winds is enormous. The high load factor resulting from the fluid properties and the predictable resource characteristics make tidal and wave energy resources attractive and advantageous for power generation and advantageous when compared to other renewable energies. The technologies are just beginning to reach technical and economic viability to make them potential commercial power sources in the near future. While only a few small projects currently exist, the technology is advancing rapidly and has huge potential for generating bulk power. Moreover, international treaties related to climate control and dwindling fossil fuel resources have encouraged us to harness energy sustainably from such marine renewable sources. Several demonstrative projects have been scheduled to capture tidal and wave energies. A number of these projects have now reached a relatively mature stage and are close to completion. However, very little is known to the academic world about these technologies beyond the basics of their energy conversion principles. While research emphasis is more towards hydrodynamics and turbine design, very limited activities are witnessed in power conversion interface, control, and power quality aspects. Regarding this emerging and promising area of research, this book aims to* *present recent results, serving to promote successful marine renewable energies integration to the grid or to standalone microgrids. This book will play a central role in ensuring safe and reliable behaviour of intelligent and autonomous systems. It collects some of the most recent results in fault diagnosis and fault tolerant systems, with particular emphasis on mechatronic systems. This book introduces several observer-based methods, including: • the sliding-mode observer • the adaptive observer • the unknown-input observer and • the descriptor observer method for the problem of fault detection, isolation and estimation, allowing readers to compare and contrast the different approaches. The authors present basic material on Lyapunov stability theory, H¥ control theory, sliding-mode control theory and linear matrix inequality problems in a self-contained and step-by-step manner. Detailed and rigorous mathematical proofs are provided for all the results developed in the text so that readers can quickly gain a good understanding of the material. MATLAB® and Simulink® codes for all the examples, which can be downloaded from http://extras.springer.com, enable students to follow the methods and illustrative examples easily. The systems used in the examples make the book highly relevant to real-world problems in industrial control engineering and include a seventh-order aircraft model, a single-link flexible joint robot arm and a satellite controller. To help readers quickly find the information they need and to improve readability, the individual chapters are written so as to be semi-independent of each other. Robust Oberserver-Based Fault Diagnosis for Nonlinear Systems Using MATLAB® is of interest to process, aerospace, robotics and control engineers, engineering students and researchers with a control engineering background. The volume includes a set of* *selected papers extended and revised from the International Conference on Informatics, Cybernetics, and Computer Engineering. A computer network, often simply referred to as a network, is a collection of computers and devices interconnected by communications channels that facilitate communications and allows sharing of resources and information among interconnected devices. Put more simply, a computer network is a collection of two or more computers linked together for the purposes of sharing information, resources, among other things. Computer networking or Data Communications (Datacom) is the engineering discipline concerned with computer networks. Computer networking is sometimes considered a sub-discipline of electrical engineering, telecommunications, computer science, information technology and/or computer engineering since it relies heavily upon the theoretical and practical application of these scientific and engineering disciplines. Networks may be classified according to a wide variety of characteristics such as medium used to transport the data, communications protocol used, scale, topology, organizational scope, etc. Electronics engineering, also referred to as electronic engineering, is an engineering discipline where non-linear and active electrical components such as electron tubes, and semiconductor devices, especially transistors, diodes and integrated circuits, are utilized to design electronic circuits, devices and systems, typically also including passive electrical components and based on printed circuit boards. The term denotes a broad engineering field that covers important subfields such as analog electronics, digital electronics, consumer electronics, embedded systems and power electronics. Electronics engineering deals with implementation of applications, principles and algorithms developed within many* *related fields, for example solid-state physics, radio engineering, telecommunications, control systems, signal processing, systems engineering, computer engineering, instrumentation engineering, electric power control, robotics, and many others. ICCE 2011 Volume 3 is to provide a forum for researchers, educators, engineers, and government officials involved in the general areas of Computer Engineering and Electronic Engineering to disseminate their latest research results and exchange views on the future research directions of these fields. 99 high-quality papers are included in the volume. Each paper has been peer-reviewed by at least 2 program committee members and selected by the volume editor. Special thanks to editors, staff of association and every participants of the conference. It's you make the conference a success. We look forward to meeting you next year. This work addresses the automated generation of physical-based models and model-based observers. We develop port-Hamiltonian methods, which for the first time allow a complete and consistent automation of these two processes for a large class of interconnected systems. Abstract :Real-time rotor position and speed information is essential for effective power control of permanent magnet synchronous generator-based wind energy conversion systems. The presence of traditional encoders can increase the size, cost and complexity, but also reduce the overall system life-time and reliability. To provide a more reliable sensorless wind generation control scheme and eliminate the reliance on encoders, this paper presents a novel high order sliding mode observer for power control of permanent magnet synchronous generator-based wind energy conversion systems. Compared with the first order sliding mode observer, a high order sliding mode observer shows superior estimation accuracy with* *significantly reduced chattering effect. A three-level neutral-point-clamped space vector pulse width modulation (NPC-SVPWM) based power converter is used to reduce the voltage stress on power switching devices and produce less harmonics in the output waveforms compared with a traditional two-level inverter. Computer simulation results have shown the superior performance of the purposed high order sliding mode observer in wind turbine power control applications. Interest in the area of state and parameter estimation in nonlinear systems has grown significantly in recent years. The use of sliding mode observers promises superior robustness characteristics that make them very attractive for noisy uncertain systems. In this thesis, a novel Time-Averaged Lypunov functional (TAL) is proposed that examines the effect of Gaussian noise on the stability of a sliding mode observer. The TAL averages the Lyapunov analysis over a small finite time interval, allowing for intuitive analysis of noises and disturbances affecting the system. Initially, a sliding mode observer for a linear system is analysed using the proposed functional. Later, the results are extended to various classes of nonlinear systems. The necessary and sufficient conditions for the existence of the observer are presented in the form of Linear Matrix Inequality (LMI), which can be explicitly solved offline using commercial LMI solvers. The types of nonlinearity examined are fairly general and embodies Lipschitz, bounded Jacobian, Sector bounded and Dissipative nonlinearities. All the system models considered are highly nonlinear and consist of system disturbances and sensor noise. The proposed sliding mode observer provides less conservative conditions to verify the existence and stability of the observer. The observer can also be effectively used for unknown parameter estimation as outlined in the final chapter* *of this report. Various examples are provided throughout the premise to support the proposed observer design and demonstrate its effectiveness. Vehicles are complex mechanical systems with strong nonlinear characteristics and which can present some uncertainties due to their dynamic parameters such as masses, inertias, suspension springs, tires side slip coefficients, etc. A vehicle is composed of many parts, namely the unsprung mass, the sprung mass, the suspension which makes the link between these two masses and therefore ensures passenger comfort, and also the pneumatic which absorbs the energy coming from the road and ensures contact between the vehicle and the road. In addition to its complexity and the presence of many nonlinearities and uncertainties, the presence of some external perturbations, such as the wind and the road inputs with its own characteristics (radius of curvature, longitudinal and lateral slop, road profile and skid resistance) can cause risks not only to the vehicle but also to passengers and other road users. Many methods have been developed in order to understand the behavior of a vehicle (light and heavy vehicle), control it and assist the driver in order to avoid possible lane departures, rollover or jackknifing risks, to ensure a better passenger comfort by means of a suspension control and/or to estimate a safety speed and trajectory. Closes the gap between bioscience and mathematics-based process engineering This book presents the most commonly employed approaches in the control of bioprocesses. It discusses the role that control theory plays in understanding the mechanisms of cellular and metabolic processes, and presents key results in various fields such as dynamic modeling, dynamic properties of bioprocess models, software sensors designed for the online estimation of parameters and state variables, and control and supervision of* *bioprocesses Control in Bioengineering and Bioprocessing: Modeling, Estimation and the Use of Sensors is divided into three sections. Part I, Mathematical preliminaries and overview of the control and monitoring of bioprocess, provides a general overview of the control and monitoring of bioprocesses, and introduces the mathematical framework necessary for the analysis and characterization of bioprocess dynamics. Part II, Observability and control concepts, presents the observability concepts which form the basis of design online estimation algorithms (software sensor) for bioprocesses, and reviews controllability of these concepts, including automatic feedback control systems. Part III, Software sensors and observer-based control schemes for bioprocesses, features six application cases including dynamic behavior of 3-dimensional continuous bioreactors; observability analysis applied to 2D and 3D bioreactors with inhibitory and non-inhibitory models; and regulation of a continuously stirred bioreactor via modeling error compensation. Applicable across all areas of bioprocess engineering, including food and beverages, biofuels and renewable energy, pharmaceuticals and nutraceuticals, fermentation systems, product separation technologies, wastewater and solid-waste treatment technology, and bioremediation Provides a clear explanation of the mass-balance–based mathematical modelling of bioprocesses and the main tools for its dynamic analysis Offers industry-based applications on: myco-diesel for implementing "quality" of observability; developing a virtual sensor based on the Just-In-Time Model to monitor biological control systems; and virtual sensor design for state estimation in a photocatalytic bioreactor for hydrogen production Control in Bioengineering and Bioprocessing is intended as a foundational text for graduate level students in* *bioengineering, as well as a reference text for researchers, engineers, and other practitioners interested in the field of estimation and control of bioprocesses. This book discusses various methods for designing different kinds of observers, such as the Luenberger observer, unknown input observers, discontinuous observers, sliding mode observers, observers for impulsive systems, observers for nonlinear Takagi-Sugeno fuzzy systems, and observers for electrical machines. A hydraulic process system and a renewable energy system are provided as examples of applications. For over a quarter of a century, high-gain observers have been used extensively in the design of output feedback control of nonlinear systems. This book presents a clear, unified treatment of the theory of high-gain observers and their use in feedback control. Also provided is a discussion of the separation principle for nonlinear systems; this differs from other separation results in the literature in that recovery of stability as well as performance of state feedback controllers is given. The author provides a detailed discussion of applications of high-gain observers to adaptive control and regulation problems and recent results on the extended high-gain observers. In addition, the author addresses two challenges that face the implementation of high-gain observers: high dimension and measurement noise. Low-power observers are presented for high-dimensional systems. The effect of measurement noise is characterized and techniques to reduce that effect are presented. The book ends with discussion of digital implementation of the observers. Readers will find comprehensive coverage of the main results on high-gain observers; rigorous, self-contained proofs of all results; and numerous examples that illustrate and provide motivation for the results. The book is intended for engineers and* *applied mathematicians who design or research feedback control systems. Due to its abilities to compensate disturbances and uncertainties, disturbance observer based control (DOBC) is regarded as one of the most promising approaches for disturbance-attenuation. One of the first books on DOBC, Disturbance Observer Based Control: Methods and Applications presents novel theory results as well as best practices for applica This book discusses various methods for designing different kinds of observers, such as the Luenberger observer, unknown input observers, discontinuous observers, sliding mode observers, observers for impulsive systems, observers for nonlinear Takagi-Sugeno fuzzy systems, and observers for electrical machines. A hydraulic process system and a renewable energy system are provided as examples of applications. The book presents selected, extended and peer reviewed papers from the International Multiconference on System, Automation and Control held Leipzig in 2018. These are complemented with solicited contributions by international experts. Main topics are automatic control, robotics, synthesis of automation systems. Application examples range from man-machine interaction, mechatronics, on to biological and economical models. This book collects selected papers from the 28th Conference of Spacecraft TT&C Technology in China held on November 8-10, 2016. The book features state-of-the-art studies on spacecraft TT&C in China with the theme of "Openness, Integration and Intelligent Interconnection". To meet requirements of new space endeavors, development of spacecraft instrumentation systems have to follow an open concept and approach in China. An open spacecraft instrumentation system encompasses integrated development of different types of services, integration of disciplines and specialties, intelligent links, and more* *scientific and intelligent information interface technology. Researchers and engineers in the field of aerospace engineering and communication engineering can benefit from the book. This volume contains the proceedings of Analysis and Design of Hybrid Systems 2006: the 2nd IFAC Conference on Analysis and Design of Hybrid Systems, organized in Alghero (Italy) on June 7-9, 2006. ADHS is a series of triennial meetings that aims to bring together researchers and practitioners with a background in control and computer science to provide a survey of the advances in the field of hybrid systems, and of their ability to take up the challenge of analysis, design and verification of efficient and reliable control systems. ADHS'06 is the second Conference of this series after ADHS'03 in Saint Malo. 65 papers selected through careful reviewing process Plenary lectures presented by three distinguished speakers Featuring interesting new research topics This book explores emerging methods and algorithms that enable precise control of micro-/nano-positioning systems. The text describes three control strategies: hysteresis-model-based feedforward control and hysteresis-model-free feedback control based on and free from state observation. Each paradigm receives dedicated attention within a particular part of the text. Readers are shown how to design, validate and apply a variety of new control approaches in micromanipulation: hysteresis modelling, discrete-time sliding-mode control and model-reference adaptive control. Experimental results are provided throughout and build up to a detailed treatment of practical applications in the fourth part of the book. The applications focus on control of piezoelectric grippers. Advanced Control of Piezoelectric Micro-/Nano-Positioning Systems will assist academic researchers and practising control and mechatronics engineers interested in* *suppressing sources of nonlinearity such as hysteresis and drift when combining position and force control of precision systems with piezoelectric actuation. The underlying theory on which much modern robust and nonlinear control is based can be difficult to grasp. This volume is a collection of lecture notes presented by experts in advanced control engineering. The book is designed to provide a better grounding in the theory underlying several important areas of control. It is hoped the book will help the reader to apply otherwise abstruse ideas of nonlinear control in a variety of real systems. This book features the latest theoretical results and techniques in the field of guidance, navigation, and control (GNC) of vehicles and aircraft. It covers a range of topics, including, but not limited to, intelligent computing communication and control; new methods of navigation, estimation, and tracking; control of multiple moving objects; manned and autonomous unmanned systems; guidance, navigation, and control of miniature aircraft; and sensor systems for guidance, navigation, and control. Presenting recent advances in the form of illustrations, tables, and text, it also provides detailed information of a number of the studies, to offer readers insights for their own research. In addition, the book addresses fundamental concepts and studies in the development of GNC, making it a valuable resource for both beginners and researchers wanting to further their understanding of guidance, navigation, and control. 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. This book investigates observer-fault estimation techniques in detail, while also highlighting recent research and findings regarding fault estimation. Many practical control systems are subject to possible malfunctions, which may cause significant performance loss or even system instability. To improve the reliability, performance and safety of dynamical systems, fault diagnosis techniques are now receiving considerable attention, both in research and applications, and have been the subject of intensive investigations. Fault detection – the essential first step in fault diagnosis – is a binary decision-making process used to determine whether or not a fault has occurred. In turn, fault isolation is used to identify the location of the faulty component, while fault estimation is used to identify the size of the fault online. Compared with the problems involved in fault detection and isolation, fault estimation is considerably more challenging. The book focuses on position sensorless control for PMSM drives, addressing both basic principles and experimental evaluation. It provides an in-depth study on a number of major topics, such as model-based sensorless control, saliency-based sensorless control, position estimation error ripple elimination and acoustic noise reduction. Offering a comprehensive and systematic overview of position sensorless control and practical issues it is particularly suitable for readers interested in the sensorless control techniques for PMSM drives. The book is also a valuable resource for researchers, engineers, and graduate students in fields of ac motor drives and sensorless control. At the core of many engineering* *problems is the solution of sets of equa tions and inequalities, and the optimization of cost functions. Unfortunately, except in special cases, such as when a set of equations is linear in its un knowns or when a convex cost function has to be minimized under convex constraints, the results obtained by conventional numerical methods are only local and cannot be guaranteed. This means, for example, that the actual global minimum of a cost function may not be reached, or that some global minimizers of this cost function may escape detection. By contrast, interval analysis makes it possible to obtain guaranteed approximations of the set of all the actual solutions of the problem being considered. This, together with the lack of books presenting interval techniques in such a way that they could become part of any engineering numerical tool kit, motivated the writing of this book. The adventure started in 1991 with the preparation by Luc Jaulin of his PhD thesis, under Eric Walter's supervision. It continued with their joint supervision of Olivier Didrit's and Michel Kieffer's PhD theses. More than two years ago, when we presented our book project to Springer, we naively thought that redaction would be a simple matter, given what had already been achieved . . .*