Simulation Of Sensorless Position Control Of A Stepper

This book includes the original, peer-reviewed research papers from the 9th Frontier Academic Forum of Electrical Engineering (FAFEE 2020), held in Xi'an, China, in August 2020. It gathers the latest research, innovations, and applications in the fields of Electrical Engineering. The topics it covers including electrical materials and equipment, electrical energy storage and device, power electronics and drives, new energy electric power system equipment, IntelliSense and intelligent equipment, biological electromagnetism and its applications, and insulation and discharge computation for power equipment. Given its scope, the book benefits all researchers, engineers, and graduate students who want to learn about cutting-edge advances in Electrical Engineering.

Position Sensorless Control of a Magnetically Levitated (Maglev) System

Unmanned aerial vehicles (UAVs) are being increasingly used in different applications in both military and civilian domains. These applications include surveillance, reconnaissance, remote sensing, target acquisition, border patrol, infrastructure monitoring, aerial imaging, industrial inspection, and emergency medical aid. Vehicles that can be considered autonomous must be able to make decisions and react to events without direct intervention by humans. Although some UAVs are able to perform increasingly complex autonomous manoeuvres, most UAVs are not fully autonomous; instead, they are mostly operated remotely by humans. To make UAVs fully autonomous, many technological and algorithmic developments are still required. For instance, UAVs will need to improve their sensing of obstacles and subsequent avoidance. This becomes particularly important as autonomous UAVs start to operate in civilian airspaces

that are occupied by other aircraft. The aim of this volume is to bring together the work of leading researchers and practitioners in the field of unmanned aerial vehicles with a common interest in their autonomy. The contributions that are part of this volume present key challenges associated with the autonomous control of unmanned aerial vehicles, and propose solution methodologies to address such challenges, analyse the proposed methodologies, and evaluate their performance.

Despite two decades of massive strides in research and development on control strategies and their subsequent implementation, most books on permanent magnet motor drives still focus primarily on motor design, providing only elementary coverage of control and converters. Addressing that gap with information that has largely been disseminated only in journals and at conferences, Permanent Magnet Synchronous and Brushless DC Motor Drives is a long-awaited comprehensive overview of power electronic converters for permanent magnet synchronous machines and control strategies for variable-speed operation. It introduces machines, power devices, inverters, and control, and addresses modeling, implementation, control strategies, and flux weakening operations, as well as parameter sensitivity, and rotor position sensorless control. Suitable for both industrial and academic audiences, this book also covers the simulation, low cost inverter topologies, and commutation torque ripple of PM brushless DC motor drives. Simulation of the motor drives system is illustrated with MATLAB® codes in the text. This book is divided into three parts—fundamentals of PM synchronous and brushless dc machines, power devices, inverters; PM synchronous motor drives, and brushless dc motor drives. With regard to the power electronics associated with these drive systems, the author: Explores use of the standard three-phase bridge inverter for driving the

machine, power factor correction, and inverter control Introduces space vector modulation step by step and contrasts with PWM Details dead time effects in the inverter, and its compensation Discusses new power converter topologies being considered for low-cost drive systems in PM brushless DC motor drives This reference is dedicated exclusively to PM ac machines, with a timely emphasis on control and standard, and low-cost converter topologies. Widely used for teaching at the doctoral level and for industrial audiences both in the U.S. and abroad, it will be a welcome addition to any engineer's library.

Power electronics technology is still an emerging technology, and it has found its way into many applications, from renewable energy generation (i.e., wind power and solar power) to electrical vehicles (EVs), biomedical devices, and small appliances, such as laptop chargers. In the near future, electrical energy will be provided and handled by power electronics and consumed through power electronics; this not only will intensify the role of power electronics technology in power conversion processes, but also implies that power systems are undergoing a paradigm shift, from centralized distribution to distributed generation. Today, more than 1000 GW of renewable energy generation sources (photovoltaic (PV) and wind) have been installed, all of which are handled by power electronics technology. The main aim of this book is to highlight and address recent breakthroughs in the range of emerging applications in power electronics and in harmonic and electromagnetic interference (EMI) issues at device and system levels as discussed in ?robust and reliable power electronics technologies, including fault prognosis and diagnosis technique stability of grid-connected converters and ?smart control of power electronics in devices, microgrids, and at system levels.

The first book of its kind, Power Converters and AC Electrical Drives with Linear Neural Networks systematically explores the application of neural networks in the field of power electronics, with particular emphasis on the sensorless control of AC drives. It presents the classical theory based on space-vectors in identification, discusses control of electrical drives and power converters, and examines improvements that can be attained when using linear neural networks. The book integrates power electronics and electrical drives with artificial neural networks (ANN). Organized into four parts, it first deals with voltage source inverters and their control. It then covers AC electrical drive control, focusing on induction and permanent magnet synchronous motor drives. The third part examines theoretical aspects of linear neural networks, particularly the neural EXIN family. The fourth part highlights original applications in electrical drives and power quality, ranging from neural-based parameter estimation and sensorless control to distributed generation systems from renewable sources and active power filters. Simulation and experimental results are provided to validate the theories. Written by experts in the field, this state-of-the-art book requires basic knowledge of electrical machines and power electronics, as well as some familiarity with control systems, signal processing, linear algebra, and numerical analysis. Offering multiple paths through the material, the text is suitable for undergraduate and postgraduate students, theoreticians, practicing engineers, and researchers involved in applications of ANNs.

This two volume set LNAI 8102 and LNAI 8103 constitutes the refereed proceedings of the 6th International Conference on Intelligent Robotics and Applications, ICIRA 2013, held in Busan, South Korea, in September 2013. The 147 revised full papers presented were carefully reviewed and selected from 184 submissions. The papers discuss various topics from

intelligent robotics, automation and mechatronics with particular emphasis on technical challenges associated with varied applications such as biomedical application, industrial automation, surveillance and sustainable mobility.

As future generation electrical, information engineering and mechatronics become specialized and fragmented, it is easy to lose sight of the fact that many topics in these areas have common threads and, because of this, advances in one discipline may be transmitted to others. The 2011 International Conference on Electrical, Information Engineering and Mechatronics (EIEM 2011) is the first conference that attempts to follow the above idea of hybridization in electrical, information engineering, mechatronics and applications. This Proceedings of the 2011 International Conference on Electrical, Information Engineering and Mechatronics provides a forum for engineers and scientists to address the most innovative research and development including technical challenges and social, legal, political, and economic issues, and to present and discuss their ideas, results, works in progress and experience on all aspects of electrical, information engineering, mechatronics and applications. Engineers and scientists in academia, industry, and government will find a insights into the solutions that combine ideas from multiple disciplines in order to achieve something more significant than the sum of the individual parts in all aspects of electrical, information engineering, mechatronics and applications.

This Special Issue deals with improvements in the energy efficiency of electric devices, machines, and drives, which are achieved through improvements in the design, modelling, control, and operation of the system. Properly sized and placed coils of a welding transformer can reduce the required iron core size and improve the efficiency of the welding system

operation. New structures of the single-phase field excited flux switching machine improve its performance in terms of torque, while having higher back-EMF and unbalanced electromagnetic forces. A properly designed rotor notch reduces the torque ripple and cogging torque of interior permanent magnet motors for the drive platform of electric vehicles, resulting in lower vibrations and noise. In the field of modelling, the torque estimation of a Halbach array surface permanent magnet motor with a non-overlapping winding layout was improved by introducing an analytical two-dimensional subdomain model. A general method for determining the magnetically nonlinear two-axis dynamic models of rotary and linear synchronous reluctance machines and synchronous permanent magnet machines is introduced that considers the effects of slotting, mutual interaction between the slots and permanent magnets, saturation, cross saturation, and end effects. Advanced modern control solutions, such as neural network-based model reference adaptive control, fuzzy control, senseless control, torque/speed tracking control derived from the 3D non-holonomic integrator, including drift terms, maximum torque per ampere, and maximum efficiency characteristics, are applied to improve drive performance and overall system operation.

A PM Brushless DC motor drive system is used to control the speed or the position of a Permanent Magnet Brushless DC motor. The position and speed sensors have some disadvantages such as increasing cost and reducing the drive robustness. By the reason, sensorless control has been studied for the last decades but the study has been still reminding problems. Therefore, a novel estimation technique for speed and position of PMBLDC motor is proposed. In the technique, the speed and position is calculated from estimated back-EMF which is estimated by only measurable voltages and currents of the PMBLDC motor. This book

indicated following that Analysis of PMBLDC motor, Review of estimation method in previous research in PMBLDC motor, Modeling and simulation and analysis in Matlab/Simulink, Implementing estimation method with LabVIEW.

This two-volume set (CCIS 134 and CCIS 135) constitutes the refereed proceedings of the International Conference on Intelligent Computing and Information Science, ICICIS2011, held in Chongqing, China, in January 2011. The 226 revised full papers presented in both volumes, CCIS 134 and CCIS 135, were carefully reviewed and selected from over 600 initial submissions. The papers provide the reader with a broad overview of the latest advances in the field of intelligent computing and information science.

This book has a complete set of applications of artificial neural networks that allow the reader to gain experience about the new systems for implementing and developing artificial intelligence (AI) methods, which can run in several digital systems. On the other hand, the book shows the newest algorithms of artificial intelligence that provide a wide spectrum of research areas in which AI can be deployed. There are a lot of books that address AI applications. However, this book shows the newest applications reached according with the technological changes that are presented nowadays. Those changes drastically appear in digital systems or other parallel areas that allow to improve the performance of AI algorithms. Hence, sometimes, the AI algorithms have to be redesigned in order to run in microcontrollers or FPGAs. The topics covered generate a structured book, so it could be used as a textbook, but it is designed to be accessible to a wide audience interested in AI.

Direct current machines are a quickly evolving domain whose applications affect many aspects of modern life from computers and printers to toys, electric vehicles, and traction applications.

As their many uses continue to grow, it has become apparent that understanding these machines is the key to understanding our future. Operation, Construction, and Functionality of Direct Current Machines brings together many concepts, from the most basic working principles and construction of DC machines to more advanced topics such as electro-magnetism, armature reaction, parallel operations, and many more. Highlighting theoretical concepts and numerical problems, this book is an essential reference source for students, educators, and anyone interested in the field of electric machines.

The volume LNCS 8866 constitutes the refereed proceedings of the 11th International Symposium on Neural Networks, ISNN 2014, held in Hong Kong and Macao, China on November/ December 2014. The 71 revised full papers presented were carefully reviewed and selected from 119 submissions. These papers cover all major topics of the theoretical research, empirical study and applications of neural networks research as follows. The focus is on following topics such as analysis, modeling, and applications.

An advanced introduction to the simulation and hardwareimplementation of BLDC motor drives A thorough reference on the simulation and hardwareimplementation of BLDC motor drives, this book covers recentadvances in the control of BLDC motor drives, including intelligentcontrol, sensorless control, torque ripple reduction and hardwareimplementation. With the guidance of the expert author team,readers will understand the principle, modelling, design andcontrol of BLDC motor drives. The advanced control methods and newachievements of BLDC motor drives, of interest to more advancedreaders, are also presented. Focuses on the control of PM brushlessDC motors, giving readers the foundations to the topic that theycan build on through more advanced reading Systematically guides

readers through the subject, introducingbasic operational principles before moving on to advanced controlalgorithms and implementations Covers special issues, such as sensorless control, intelligentcontrol, torque ripple reduction and hardware implementation, whichalso have applications to other types of motors Includes presentation files with lecture notes and Matlab 7coding on a companion website for the book

This is a textbook for graduate and final-year-undergraduate computer-science and electrical-engineering students interested in the hardware and software aspects of embedded and cyberphysical systems design. It is comprehensive and self-contained, covering everything from the basics to case-study implementation. Emphasis is placed on the physical nature of the problem domain and of the devices used. The reader is assumed to be familiar on a theoretical level with mathematical tools like ordinary differential equation and Fourier transforms. In this book these tools will be put to practical use. Engineering Embedded Systems begins by addressing basic material on signals and systems, before introducing to electronics. Treatment of digital electronics accentuating synchronous circuits and including high-speed effects proceeds to micro-controllers, digital signal processors and programmable logic. Peripheral units and decentralized networks are given due weight. The properties of analog circuits and devices like filters and data converters are covered to the extent desirable by a systems architect. The handling of individual elements concludes with power supplies including regulators and converters. The final section of the text is composed of four case studies: • electric-drive control, permanent magnet synchronous motors in particular; • lock-in amplification with measurement circuits for weight and torque, and moisture; • design of a simple continuous wave radar that can be operated to measure speed and distance; and •

design of a Fourier transform infrared spectrometer for process applications. End-of-chapter exercises will assist the student to assimilate the tutorial material and these are supplemented by a downloadable solutions manual for instructors. The “pen-and-paper” problems are further augmented with laboratory activities. In addition to its student market, Engineering Embedded Systems will assist industrial practitioners working in systems architecture and the design of electronic measurement systems to keep up to date with developments in embedded systems through self study.

This book presents papers covering a wide spectrum of theory and practice, deeply rooted in engineering problems at a high practical and theoretical level. The contents explore theory, control systems and applications, the heart of the matter in electrical drives.

Axial Flux Permanent Magnet (AFPM) brushless machines are modern electrical machines with a lot of advantages over their conventional counterparts. This timeless and revised second edition deals with the analysis, construction, design, control and applications of AFPM machines. The authors present their own research results, as well as significant research contributions made by others.

Abstract: Electro-mechanical brake (EMB) systems have been proposed to replace the conventional hydraulic brake systems. Due to the advantages such as fault tolerant operation, robust performance, high efficiency, and reliable position sensorless control, switched reluctance machine (SRM) has been chosen as the servomotor of the EMB systems. This research is focused on the modeling and control of switched reluctance

machines for EMB systems. The overall goal is to design a robust clamping force controller without position sensors for the SRM. An accurate model and precisely estimated parameters are critical to the successful implementation of the control system. An inductance based model for switched reluctance machine is proposed for this research. Maximum likelihood estimation techniques are developed to identify the SRM parameters from standstill test and online operating data, which can overcome the effect of noise inherent in the data. Four-quadrant operation of the SRM is necessary for the EMB system. Based on the inductance model of SRM, algorithms for four-quadrant torque control and torque-ripple minimization are developed and implemented. The control objective of the EMB system is to provide desired clamping force response at the brake pads and disk. A robust clamping force controller is designed using backstepping. The backstepping design proceeds by considering lower-dimensional subsystems and designing virtual control inputs. The virtual control inputs in the first and second steps are rotor speed and torque, respectively. In the third step, the actual control inputs, phase voltages, appear and can be designed. Simulation results demonstrate the performance and robustness of the controller. Position sensorless control of SRM is desired to reduce system weight and cost, and increase reliability. A sliding mode observer based sensorless controller is developed. Algorithms for sensorless control at near zero speeds and sensorless startup are also proposed and simulated, with satisfactory results. Experimental testbed for the electro-

mechanical brake system has been setup in the laboratory. DSP based control system is used for SRM control. The algorithms developed in simulation have been implemented on the testbed, with corresponding results given. Future work is suggested to finalize the implementation of the electro-mechanical brake system.
This book provides an essential overview of the authors' work in the field of cable-suspended parallel robots, focusing on innovative design, mechanics, control, development and applications. It presents and analyzes several typical mechanical architectures of cable-suspended parallel robots in practical applications, including the feed cable-suspended structure for super antennae, hybrid-driven-based cable-suspended parallel robots, and cooperative cable parallel manipulators for multiple mobile cranes. It also addresses the fundamental mechanics of cable-suspended parallel robots on the basis of their typical applications, including the kinematics, dynamics and trajectory tracking control of the feed cable-suspended structure for super antennae. In addition it proposes a novel hybrid-driven-based cable-suspended parallel robot that uses integrated mechanism design methods to improve the performance of traditional cable-suspended parallel robots. A comparative study on error and performance indices of hybrid-driven based and traditional cable-suspended parallel robots rounds out the coverage. This book addresses the needs of researchers, engineers and post-graduates in the field of cable-suspended parallel robots and related areas.

This book focuses on pulsed alternators design and applications. Both principles and design methods have been addressed. This is achieved by providing in-depth study on a number of major topics such as electrical design, thermal management, mechanical analysis, and special application. The research results and practical experience accumulated in the preliminary research, the National Natural Science Foundation of China and other major cooperative projects. Taking the pulse alternator as the core component, the entire pulse alternator system is systematically introduced, including the electromagnetic design, thermal management analysis, mechanical performance analysis of the pulse alternator, the introduction of the electromagnetic weapon load, the control technology of the pulse alternator power system, and the elaboration of other key components of the power system. This motor has been researched at home and abroad, but this book is the first international monograph on the field of pulse alternators in this field, which has very important academic value and reference value. The book benefits researchers, engineers, and graduate students in fields of electrical engineering, pulsed power, etc.

This book examines the development and technical progress of self-driving vehicles in the context of the Vision Zero project from the European Union, which aims to eliminate highway system fatalities and serious accidents by 2050. It presents the concept of Autonomous Driving (AD) and discusses its applications in transportation, logistics, space, agriculture, and industrial and home automation.

Collection of selected, peer reviewed papers from the 2014 2nd Asian Pacific Conference on Mechatronics and Control Engineering (APCMCE 2014), August 8-9, 2014, Hong Kong. The 66 papers are grouped as follows: Chapter 1: Mechatronics, Robotics and Control Systems, Chapter 2: Communication and Information Technologies, Chapter 3: Measurements, Sensors, Data and Signal Processing, Chapter 4: Researches and Design in Mechanical Engineering, Chapter 5: Materials and Chemical Engineering, Chapter 6: Engineering Management in Industry

This book constitutes the proceedings of the First International Conference on Computational Intelligence and Information Technology, CIIT 2011, held in Pune, India, in November 2011. The 58 revised full papers, 67 revised short papers, and 32 poster papers presented were carefully reviewed and selected from 483 initial submissions. The papers are contributed by innovative academics and industrial experts in the field of computer science, information technology, computational engineering, mobile communication and security and offer a stage to a common forum, where a constructive dialog on theoretical concepts, practical ideas and results of the state of the art can be developed.

Abstract: Permanent-magnet-synchronous-machine (PMSM) drives have been increasingly applied in a variety of industrial applications which require fast dynamic response and accurate control over wide speed ranges. Two control techniques are proposed in this dissertation for PMSM drives, namely flux-weakening control incorporating speed regulation and sliding mode

observer with feedback of equivalent control. The research objectives are to extend the operating speed range of the PMSM drive system and improve its control robustness and adaptability to variations of operating conditions as well as dynamic performance. First, a robust flux-weakening control scheme is studied. With a novel current control strategy, the demagnetizing stator current required for the flux-weakening operation can be automatically generated based on the inherent cross-coupling effects in PMSM between its direct-axis and quadrature-axis current in the synchronous reference frame. The proposed control scheme is able to achieve both flux-weakening control and speed regulation simultaneously by using only one speed/flux-weakening controller without the knowledge of accurate machine parameters and dc bus voltage of power inverter. Moreover, no saturation of current regulators occurs under any load conditions, resulting in control robustness in the flux-weakening region. Secondly, a sliding mode observer is developed for estimating rotor position of PMSM without saliency in the implementation of position-sensorless vector control. A concept of feedback of equivalent control is applied to extend the operating range of sliding mode observer and improve its angle-estimation performance. Compared to conventional sliding mode observers, the proposed one features the flexibility to design parameters of sliding mode observer operating in a wide speed range. The estimation error of rotor position can be reduced by properly selecting the feedback gain of equivalent control. In addition, a flux-based sliding mode observer with adaptive feedback gain is investigated. The constant magnitude of equivalent control makes it easier to design the switching gain of discontinuous control in the sliding mode observer. As a result, the problematic chattering phenomenon normally prevailing at low speeds due to high switching gains can be mitigated or even eliminated. The feasibility

and effectiveness of the control techniques addressed in this dissertation are verified by both computer simulation and experimental results.

"This book analyzes the need for a holistic approach for the construction and engineering of cities and societies"--Provided by publisher.

The book covers different aspects of real-world applications of optimization algorithms. It provides insights from the Fourth International Conference on Harmony Search, Soft Computing and Applications held at BML Munjal University, Gurgaon, India on February 7–9, 2018. It consists of research articles on novel and newly proposed optimization algorithms; the theoretical study of nature-inspired optimization algorithms; numerically established results of nature-inspired optimization algorithms; and real-world applications of optimization algorithms and synthetic benchmarking of optimization algorithms.

The papers presented at CIEP aim at achieving lower costs through efficient use of power in industrial and business applications. Approaches to designing and building these techniques into operations are presented. Lower power demands through efficiencies in consumer products are described leading to portable product designs.

This helpful resource covers a large range of information regarding electrical actuators. In particular, robustness, a very problematic issue, is fully explored in a dedicated chapter. The text also deals with he estimate of non-measurable mechanical variables by examining the estimate of load moment, then observation of the positioning of a command without mechanical sensor. Finally, it examines the conditions needed to measure variables and real implementation of numerical algorithms. This is a key working resource for electrical engineers.

This book examines mechatronics and automatic control systems. The book covers important

emerging topics in signal processing, control theory, sensors, mechanic manufacturing systems and automation. The book presents papers from the 2013 International Conference on Mechatronics and Automatic Control Systems in Hangzhou, held in China during August 10-11, 2013.

The main focus of this investigation is the development and implementation of a sensorless position estimation method and hysteresis position controller for a laboratory - based Maglev system. The proposed estimation method and controller are first validated through modeling and simulation. This sensorless scheme makes use of the maglev system's magnetic signature, namely, its inductance and requires only active phase current measurements. These measurements are then used along with the phase voltage equation to estimate position information that is in a one-to-one correspondence with the system's inductance. The theoretical aspects of the sensorless scheme are described. Finite element analysis (FEA) as well as experimental measurements have been carried out to obtain static and dynamics characteristics of the system. The proposed sensorless method has been implemented on a DSP microcontroller and the experimental results of this implementation are presented. In addition, simulation results will show the feasibility and effectiveness of this model-based position estimation scheme.

The switched reluctance machine (SRM) is the least expensive electrical machine to produce, yet one of the most reliable. As such, research has blossomed during the last decade, and the SRM and variable drive systems using SRMs are receiving considerable attention from industry. Because they require a power electronic converter and controller to function, however, successful realization of an SRM variable drive system demands an understanding of

the converter and controller subsystems and their integration with the machine. Switched Reluctance Motor Drives provides that understanding. It presents a unified view of the machine and its drive system from all of its system and subsystem aspects. With a careful balance of theory and implementation, the author develops the analysis and design of SRMs from first principles, introduces a wide variety of power converters available for driving the SRM, and systematically presents both low- and high-performance controllers. The book includes an in-depth study of acoustic noise and its minimization along with application examples that include comparisons between ac and dc drives and SRM drive. The result is the first book that provides a state-of-the-art knowledge of SRMs, power converters, and their use with both sensor-based and sensorless controllers. Switched Reluctance Motor Drives enables both students and engineers to learn all aspects of SRM drive systems and appreciate the interdependence of the various subsystems in performance optimization.

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.

This book presents theory and latest application work in Bond Graph methodology with a focus on: • Hybrid dynamical system models, • Model-based fault diagnosis, model-based fault tolerant control, fault prognosis • and also addresses • Open thermodynamic systems with compressible fluid flow, •

Distributed parameter models of mechanical subsystems. In addition, the book covers various applications of current interest ranging from motorised wheelchairs, in-vivo surgery robots, walking machines to wind-turbines.The up-to-date presentation has been made possible by experts who are active members of the worldwide bond graph modelling community. This book is the completely revised 2nd edition of the 2011 Springer compilation text titled Bond Graph Modelling of Engineering Systems – Theory, Applications and Software Support. It extends the presentation of theory and applications of graph methodology by new developments and latest research results. Like the first edition, this book addresses readers in academia as well as practitioners in industry and invites experts in related fields to consider the potential and the state-of-the-art of bond graph modelling.

Written by Ron Alterovitz and Ken Goldberg, this monograph combines ideas from robotics, physically-based modeling, and operations research to develop new motion planning and optimization algorithms for image-guided medical procedures.

Electric drives are everywhere, and with the looming promise of electric vehicles and renewable energy, they will become more complex and the demands on their capabilities will continue to increase. To keep up with these trends, students

require hands-on knowledge and a keen understanding of the subtleties involved in the operation of modern electr

“Compound Control Methodology for Flight Vehicles” focuses on new control methods for flight vehicles. In this monograph, the concept of compound control is introduced. It is demonstrated that both Sliding Mode Control (SMC) and Active Disturbance Rejection Control (ADRC) have their own advantages and limitations, i.e., chattering of SMC and the observability of extended state observer (ESO), respectively. It is shown that compound control combines their advantages and improves the performance of the closed-loop systems. The book is self-contained, providing sufficient mathematical foundations for understanding the contents of each chapter. It will be of significant interest to scientists and engineers engaged in the field of flight vehicle control.

Annotation The three volume set LNCS 4491/4492/4493 constitutes the refereed proceedings of the 4th International Symposium on Neural Networks, ISNN 2007, held in Nanjing, China in June 2007. The 262 revised long papers and 192 revised short papers presented were carefully reviewed and selected from a total of 1.975 submissions. The papers are organized in topical sections on neural fuzzy control, neural networks for control applications, adaptive dynamic programming and reinforcement learning, neural networks for nonlinear systems

modeling, robotics, stability analysis of neural networks, learning and approximation, data mining and feature extraction, chaos and synchronization, neural fuzzy systems, training and learning algorithms for neural networks, neural network structures, neural networks for pattern recognition, SOMs, ICA/PCA, biomedical applications, feedforward neural networks, recurrent neural networks, neural networks for optimization, support vector machines, fault diagnosis/detection, communications and signal processing, image/video processing, and applications of neural networks.