

# Intelligent Control Systems An Introduction With Examples

Induction motors are the most important workhorses in industry. They are mostly used as constant-speed drives when fed from a voltage source of fixed frequency. Advent of advanced power electronic converters and powerful digital signal processors, however, has made possible the development of high performance, adjustable speed AC motor drives. This book aims to explore new areas of induction motor control based on artificial intelligence (AI) techniques in order to make the controller less sensitive to parameter changes. Selected AI techniques are applied for different induction motor control strategies. The book presents a practical computer simulation model of the induction motor that could be used for studying various induction motor drive operations. The control strategies explored include expert-system-based acceleration control, hybrid-fuzzy/PI two-stage control, neural-network-based direct self control, and genetic algorithm based extended Kalman filter for rotor speed estimation. There are also chapters on neural-network-based parameter estimation, genetic-algorithm-based optimized random PWM strategy, and experimental investigations. A chapter is provided as a primer for readers to get started with

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simulation studies on various AI techniques.

Presents major artificial intelligence techniques to induction motor drives Uses a practical simulation approach to get interested readers started on drive development Authored by experienced scientists with over 20 years of experience in the field Provides numerous examples and the latest research results Simulation programs available from the book's Companion Website This book will be invaluable to graduate students and research engineers who specialize in electric motor drives, electric vehicles, and electric ship propulsion. Graduate students in intelligent control, applied electric motion, and energy, as well as engineers in industrial electronics, automation, and electrical transportation, will also find this book helpful. Simulation materials available for download at [www.wiley.com/go/chanmotor](http://www.wiley.com/go/chanmotor)

With a strong emphasis on applications of intelligent control, this extremely accessible book covers the fundamentals, methodologies, architectures and algorithms of automatic control systems. The author summarizes several current concepts to improve industrial control systems, combining classical control techniques of dynamic modeling and control with new approaches discussed in the text.

Addresses such intelligent systems as neural networks, fuzzy logic, ruled based, and genetic algorithms. Demonstrates how to develop, design and use intelligent systems to solve sophisticated

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industrial control problems. Includes numerous worked application examples.

Control problems offer an industrially important application and a guide to understanding control systems for those working in Neural Networks.

Neural Systems for Control represents the most up-to-date developments in the rapidly growing application area of neural networks and focuses on research in natural and artificial neural systems directly applicable to control or making use of modern control theory. The book covers such important new developments in control systems such as intelligent sensors in semiconductor wafer manufacturing; the relation between muscles and cerebral neurons in speech recognition; online compensation of reconfigurable control for spacecraft aircraft and other systems; applications to rolling mills, robotics and process control; the usage of past output data to identify nonlinear systems by neural networks; neural approximate optimal control; model-free nonlinear control; and neural control based on a regulation of physiological investigation/blood pressure control. All researchers and students dealing with control systems will find the fascinating Neural Systems for Control of immense interest and assistance. Focuses on research in natural and artificial neural systems directly applicable to control or making use of modern control theory Represents the most up-to-date

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developments in this rapidly growing application area of neural networks Takes a new and novel approach to system identification and synthesis

In recent years, intelligent control has emerged as one of the most active and fruitful areas of research and development. Until now, however, there has been no comprehensive text that explores the subject with focus on the design and analysis of biological and industrial applications. Intelligent Control Systems Using Soft Computing

Methodologies does all that and more. Beginning with an overview of intelligent control methodologies, the contributors present the fundamentals of neural networks, supervised and unsupervised learning, and recurrent networks. They address various implementation issues, then explore design and verification of neural networks for a variety of applications, including medicine, biology, digital signal processing, object recognition, computer networking, desalination technology, and oil refinery and chemical processes. The focus then shifts to fuzzy logic, with a review of the fundamental and theoretical aspects, discussion of implementation issues, and examples of applications, including control of autonomous underwater vehicles, navigation of space vehicles, image processing, robotics, and energy management systems. The book concludes with the integration of genetic algorithms into the paradigm of soft computing

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methodologies, including several more industrial examples, implementation issues, and open problems and open problems related to intelligent control technology. Suitable as a textbook or a reference, Intelligent Control Systems explores recent advances in the field from both the theoretical and the practical viewpoints. It also integrates intelligent control design methodologies to give designers a set of flexible, robust controllers and provide students with a tool for solving the examples and exercises within the book.

As robotic systems make their way into standard practice, they have opened the door to a wide spectrum of complex applications. Such applications usually demand that the robots be highly intelligent. Future robots are likely to have greater sensory capabilities, more intelligence, higher levels of manual dexterity, and adequate mobility, compared to humans. In order to ensure high-quality control and performance in robotics, new intelligent control techniques must be developed, which are capable of coping with task complexity, multi-objective decision making, large volumes of perception data and substantial amounts of heuristic information. Hence, the pursuit of intelligent autonomous robotic systems has been a topic of much fascinating research in recent years. On the other hand, as emerging technologies, Soft Computing paradigms consisting of complementary elements of Fuzzy Logic, Neural

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Computing and Evolutionary Computation are viewed as the most promising methods towards intelligent robotic systems. Due to their strong learning and cognitive ability and good tolerance of uncertainty and imprecision, Soft Computing techniques have found wide application in the area of intelligent control of robotic systems.

This book describes important techniques, developments, and applications of computational intelligence in system control. Chapters present: an introduction to the fundamentals of neural networks, fuzzy logic, and evolutionary computing a rigorous treatment of intelligent control industrial applications of intelligent control and soft computing, including transportation, petroleum, motor drive, industrial automation, and fish processing other knowledge-based techniques, including vehicle driving aid and air traffic management Intelligent Adaptive Control provides a state-of-the-art treatment of practical applications of computational intelligence in system control. The book cohesively covers introductory and advanced theory, design, implementation, and industrial use - serving as a singular resource for the theory and application of intelligent control, particularly employing fuzzy logic, neural networks, and evolutionary computing.

This book is concerned with Intelligent Control methods and applications. The field of intelligent control has been expanded very much during the

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recent years and a solid body of theoretical and practical results are now available. These results have been obtained through the synergetic fusion of concepts and techniques from a variety of fields such as automatic control, systems science, computer science, neurophysiology and operational research. Intelligent control systems have to perform anthropomorphic tasks fully autonomously or interactively with the human under known or unknown and uncertain environmental conditions. Therefore the basic components of any intelligent control system include cognition, perception, learning, sensing, planning, numeric and symbolic processing, fault detection/repair, reaction, and control action. These components must be linked in a systematic, synergetic and efficient way.

Predecessors of intelligent control are adaptive control, self-organizing control, and learning control which are well documented in the literature. Typical application examples of intelligent controls are intelligent robotic systems, intelligent manufacturing systems, intelligent medical systems, and intelligent space teleoperators. Intelligent controllers must employ both quantitative and qualitative information and must be able to cope with severe temporal and spatial variations, in addition to the fundamental task of achieving the desired transient and steady-state performance. Of course the level of intelligence required in each particular application is a matter of

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discussion between the designers and users. The current literature on intelligent control is increasing, but the information is still available in a sparse and disorganized way.

Urban mobility is not only one of the pillars of modern economic systems, but also a key issue in the quest for equality of opportunity, once it can improve access to other services. Currently, however, there are a number of negative issues related to traffic, especially in megacities, such as economical issues (cost of opportunity caused by delays), environmental (externalities related to emissions of pollutants), and social (traffic accidents). Solutions to these issues are more and more closely tied to information and communication technology. Indeed, a search in the technical literature (using the keyword "urban traffic" to filter out articles on data network traffic) retrieved the following number of articles (as of December 3, 2013): 9,443 (ACM Digital Library), 26,054 (Scopus), and 1,730,000 (Google Scholar). Moreover, articles listed in the ACM query relate to conferences as diverse as MobiCom, CHI, PADS, and AAMAS. This means that there is a big and diverse community of computer scientists and computer engineers who tackle research that is connected to the development of intelligent traffic and transportation systems. It is also possible to see that this community is growing, and that research projects are getting more and more interdisciplinary. To foster the cooperation among the involved communities, this book aims at giving a broad introduction into the basic but relevant concepts related to transportation systems, targeting researchers and



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practitioners from computer science and information technology. In addition, the second part of the book gives a panorama of some of the most exciting and newest technologies, originating in computer science and computer engineering, that are now being employed in projects related to car-to-car communication, interconnected vehicles, car navigation, platooning, crowd sensing and sensor networks, among others. This material will also be of interest to engineers and researchers from the traffic and transportation community.

The emergence of fuzzy logic and its applications has dramatically changed the face of industrial control engineering. Over the last two decades, fuzzy logic has allowed control engineers to meet and overcome the challenges of developing effective controllers for increasingly complex systems with poorly defined dynamics. Today's engineers need a working knowledge of the principles and techniques of fuzzy logic-Intelligent Control provides it. The author first introduces the traditional control techniques and contrasts them with intelligent control. He then presents several methods of representing and processing knowledge and introduces fuzzy logic as one such method. He highlights the advantages of fuzzy logic over other techniques, indicates its limitations, and describes in detail a hierarchical control structure appropriate for use in intelligent control systems. He introduces a variety of applications, most in the areas of robotics and mechatronics but with others including air conditioning and process/production control. One appendix provides

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discussion of some advanced analytical concepts of fuzzy logic, another describes a commercially available software system for developing fuzzy logic application. Intelligent Control is filled with worked examples, exercises, problems, and references. No prior knowledge of the subject nor advanced mathematics are needed to comprehend much of the book, making it well-suited as a senior undergraduate or first-year graduate text and a convenient reference tool for practicing professionals.

"Recent Advances in Intelligent Control Systems"

gathers contributions from workers around the world and presents them in four categories according to the style of control employed: fuzzy control; neural control; fuzzy neural control; and intelligent control. The contributions illustrate the interdisciplinary antecedents of intelligent control and contrast its results with those of more traditional control methods. A variety of design examples, drawn primarily from robotics and mechatronics but also representing process and production engineering, large civil structures, network flows, and others, provide instances of the application of computational intelligence for control. Presenting state-of-the-art research, this collection will be of benefit to researchers in automatic control, automation, computer science (especially artificial intelligence) and mechatronics while graduate students and practicing control engineers working with intelligent systems will find it a good source of study material.

Despite the available general literature in intelligent control, there is a definite lack of knowledge and know-how in practical applications of intelligent control in

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drying. This book fills that gap. Intelligent Control in Drying serves as an innovative and practical guide for researchers and professionals in the field of drying technologies, providing an overview of control principles and systems used in drying operations, from classical to model-based to adaptive and optimal control. At the same time, it lays out approaches to synthesis of control systems, based on the objectives and control strategies, reflecting complexity of drying process and material under drying. This essential reference covers both fundamental and practical aspects of intelligent control, sensor fusion and dynamic optimization with respect to drying.

Power electronics and variable frequency drives are continuously developing multidisciplinary fields in electrical engineering and it is practically not possible to write a book covering the entire area by one individual specialist. Especially by taking account the recent fast development in the neighboring fields like control theory, computational intelligence and signal processing, which all strongly influence new solutions in control of power electronics and drives. Therefore, this book is written by individual key specialist working on the area of modern advanced control methods which penetrates current implementation of power converters and drives. Although some of the presented methods are still not adopted by industry, they create new solutions with high further research and application potential. The material of the book is presented in the following three parts: Part I: Advanced Power Electronic Control in Renewable Energy Sources (Chapters 1-4), Part II: Predictive

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Control of Power Converters and Drives (5-7), Part III: Neurocontrol and Nonlinear Control of Power Converters and Drives (8-11). The book is intended for engineers, researchers and students in the field of power electronics and drives who are interested in the use of advanced control methods and also for specialists from the control theory area who like to explore new area of applications. This book illustrates basic principles, along with the development of the advanced algorithms, to realize smart robotic systems. It speaks to strategies by which a robot (manipulators, mobile robot, quadrotor) can learn its own kinematics and dynamics from data. In this context, two major issues have been dealt with; namely, stability of the systems and experimental validations. Learning algorithms and techniques as covered in this book easily extend to other robotic systems as well. The book contains MATLAB- based examples and c-codes under robot operating systems (ROS) for experimental validation so that readers can replicate these algorithms in robotics platforms.

Advanced Control Engineering provides a complete course in control engineering for undergraduates of all technical disciplines. Included are real-life case studies, numerous problems, and accompanying MatLab programs.

We describe in this book, hybrid intelligent systems based mainly on type-2 fuzzy logic for intelligent control. Hybrid intelligent systems combine several intelligent computing paradigms, including fuzzy logic, and bio-inspired optimization algorithms, which can be used to produce powerful automatic control systems. The book is organized in three main parts,

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which contain a group of chapters around a similar subject. The first part consists of chapters with the main theme of theory and design algorithms, which are basically chapters that propose new models and concepts, which can be the basis for achieving intelligent control with interval type-2 fuzzy logic. The second part of the book is comprised of chapters with the main theme of evolutionary optimization of type-2 fuzzy systems in intelligent control with the aim of designing optimal type-2 fuzzy controllers for complex control problems in diverse areas of application, including mobile robotics, aircraft dynamics systems and hardware implementations. The third part of the book is formed with chapters dealing with the theme of bio-inspired optimization of type-2 fuzzy systems in intelligent control, which includes the application of particle swarm intelligence and ant colony optimization algorithms for obtaining optimal type-2 fuzzy controllers.

In the last decades robots are expected to be of increasing intelligence to deal with a large range of tasks. Especially, robots are supposed to be able to learn manipulation skills from humans. To this end, a number of learning algorithms and techniques have been developed and successfully implemented for various robotic tasks. Among these methods, learning from demonstrations (LfD) enables robots to effectively and efficiently acquire skills by learning from human demonstrators, such that a robot can be quickly programmed to perform a new task. This book introduces recent results on the development of advanced LfD-based learning and control approaches to improve the robot dexterous manipulation. First, there's an introduction to the simulation tools and robot platforms used in the authors' research. In order to enable a robot learning of human-like adaptive skills, the book explains how to transfer a human user's arm variable stiffness to the robot, based on the online estimation from the muscle electromyography (EMG). Next,

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the motion and impedance profiles can be both modelled by dynamical movement primitives such that both of them can be planned and generalized for new tasks. Furthermore, the book introduces how to learn the correlation between signals collected from demonstration, i.e., motion trajectory, stiffness profile estimated from EMG and interaction force, using statistical models such as hidden semi-Markov model and Gaussian Mixture Regression. Several widely used human-robot interaction interfaces (such as motion capture-based teleoperation) are presented, which allow a human user to interact with a robot and transfer movements to it in both simulation and real-world environments. Finally, improved performance of robot manipulation resulted from neural network enhanced control strategies is presented. A large number of examples of simulation and experiments of daily life tasks are included in this book to facilitate better understanding of the readers.

This textbook contains the essential knowledge in modeling, simulation, analysis, and applications in dealing with biological cellular control systems. In particular, the book shows how to use the law of mass balance and the law of mass action to derive an enzyme kinetic model - the Michaelis-Menten function or the Hill function, how to use a current-voltage relation, Nernst potential equilibrium equation, and Hodgkin and Huxley's models to model an ionic channel or pump, and how to use the law of mass balance to integrate these enzyme or channel models into a complete feedback control system. The book also illustrates how to use data to estimate parameters in a model, how to use MATLAB to solve a model numerically, how to do computer simulations, and how to provide model predictions. Furthermore, the book demonstrates how to conduct a stability and sensitivity analysis on a model.

Intelligent control is a rapidly developing, complex and

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challenging field with great practical importance and potential. Because of the rapidly developing and interdisciplinary nature of the subject, there are only a few edited volumes consisting of research papers on intelligent control systems but little is known and published about the fundamentals and the general know-how in designing, implementing and operating intelligent control systems. Intelligent control system emerged from artificial intelligence and computer controlled systems as an interdisciplinary field. Therefore the book summarizes the fundamentals of knowledge representation, reasoning, expert systems and real-time control systems and then discusses the design, implementation verification and operation of real-time expert systems using G2 as an example. Special tools and techniques applied in intelligent control are also described including qualitative modelling, Petri nets and fuzzy controllers. The material is illustrated with simple examples taken from the field of intelligent process control.

Intelligent Control Systems An Introduction with Examples Springer Science & Business Media

This book offers a comprehensive introduction to intelligent control system design, using MATLAB simulation to verify typical intelligent controller designs. It also uses real-world case studies that present the results of intelligent controller implementations to illustrate the successful application of the theory. Addressing the need for systematic design approaches to intelligent control system design using neural network and fuzzy-based techniques, the book introduces the concrete design method and MATLAB simulation of intelligent control strategies; offers a catalog of implementable intelligent control design methods for engineering applications; provides advanced intelligent controller design methods and their stability analysis methods; and presents a sample simulation and Matlab program for each intelligent control algorithm. The main topics addressed are expert control, fuzzy logic control,

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adaptive fuzzy control, neural network control, adaptive neural control and intelligent optimization algorithms, providing several engineering application examples for each method.

Advanced Control Systems: Theory and Applications provides an overview of advanced research lines in control systems as well as in design, development and implementation methodologies for perspective control systems and their components in different areas of industrial and special applications. It consists of extended versions of the selected papers presented at the XXV International Conference on Automatic Control "Automatics 2018" (September 18-19, 2018, Lviv, Ukraine) which is the main Ukrainian Control Conference organized by Ukrainian Association on Automatic Control (National member organization of IFAC) and Lviv National University "Lvivska Politechnica." More than 100 papers were presented at the conference with topics including: mathematical problems of control, optimization and game theory; control and identification under uncertainty; automated control of technical, technological and biotechnical objects; controlling the aerospace craft, marine vessels and other moving objects; intelligent control and information processing; mechatronics and robotics; information measuring technologies in automation; automation and IT training of personnel; the Internet of things and the latest technologies. The book is divided into two main parts, the first concerning theory (7 chapters) and the second concerning applications (7 chapters) of advanced control systems. The first part "Advances in Theoretical Research on Automatic Control" consists of theoretical research results which deal with descriptor control impulsive delay systems, motion control in condition of conflict, inverse dynamic models, invariant relations in optimal control, robust adaptive control, bio-inspired algorithms, optimization of fuzzy control systems,



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and extremal routing problem with constraints and complicated cost functions. The second part “Advances in Control Systems Applications” is based on the chapters which consider different aspects of practical implementation of advanced control systems, in particular, special cases in determining the spacecraft position and attitude using computer vision system, the spacecraft orientation by information from a system of stellar sensors, control synthesis of rotational and spatial spacecraft motion at approaching stage of docking, intelligent algorithms for the automation of complex biotechnical objects, an automatic control system for the slow pyrolysis of organic substances with variable composition, simulation complex of hierarchical systems based on the foresight and cognitive modelling, and advanced identification of impulse processes in cognitive maps. The chapters have been structured to provide an easy-to-follow introduction to the topics that are addressed, including the most relevant references, so that anyone interested in this field can get started in the area. This book may be useful for researchers and students who are interested in advanced control systems.

Readers of this book will be shown how, with the adoption of ubiquitous sensing, extensive data-gathering and forecasting, and building-embedded advanced actuation, intelligent building systems with the ability to respond to occupant preferences in a safe and energy-efficient manner are becoming a reality. The articles collected present a holistic perspective on the state of the art and current research directions in building automation, advanced sensing and control, including: model-based and model-free control design for temperature control; smart lighting systems; smart sensors and actuators (such as smart thermostats,

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lighting fixtures and HVAC equipment with embedded intelligence); and energy management, including consideration of grid connectivity and distributed intelligence. These articles are both educational for practitioners and graduate students interested in design and implementation, and foundational for researchers interested in understanding the state of the art and the challenges that must be overcome in realizing the potential benefits of smart building systems. This edited volume also includes case studies from implementation of these algorithms/sensing strategies in to-scale building systems. These demonstrate the benefits and pitfalls of using smart sensing and control for enhanced occupant comfort and energy efficiency.

Providing a thorough introduction to the field of soft computing techniques, *Intelligent Systems: Modeling, Optimization, and Control* covers every major technique in artificial intelligence in a clear and practical style. This book highlights current research and applications, addresses issues encountered in the development of applied systems, and describes a wide range of intelligent systems techniques, including neural networks, fuzzy logic, evolutionary strategy, and genetic algorithms. The book demonstrates concepts through simulation examples and practical experimental results. Case studies are also presented from each field to facilitate understanding.

This book attempts to couple control engineering with modern developments in science, through the concept of entropy. Such disciplines as intelligent machines, economics, manufacturing, environmental systems,

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waste etc. can be favorably affected and their performance can be improved or their catastrophic effects minimized. Entropy is used as the unifying measure of the various, seemingly disjoint, disciplines to represent the cost of producing work that improves the standard of living, both in engineering and in science. Modeling is done through probabilistic methods, thus establishing the irreversibility of the processes involved. This is in accordance with the modern view of science. In addition, the behavior of control for an arbitrary but fixed controller away from the optimal (equilibrium) has been obtained, the analytic expression of which should lead to chaotic solutions. The control activity is explained, based on the principle that control is making a system do what we want it to do. This helps to relate control theory with the sciences.

This application-oriented monograph focuses on a novel and complex type of control systems. Written on an engineering level, including fundamentals, advanced methods and applications, the book applies techniques originating from new methods such as artificial intelligence, fuzzy logic, neural networks etc.

Fractional order calculus is finding increasing interest in the control system community. Hardware realizations of fractional order controllers have sparked off a renewed zeal into the investigations of control system design in the light of fractional calculus. As such many notions of integer order LTI systems are being modified and extended to incorporate these new concepts.

Computational Intelligence (CI) techniques have been applied to engineering problems to find solutions to many

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hitherto intractable conundrums and is a useful tool for dealing with problems of higher computational complexity. This book borders on the interface between CI techniques and fractional calculus, and looks at ways in which fractional order control systems may be designed or enhanced using CI based paradigms. To the best of the author's knowledge this is the first book of its kind exclusively dedicated to the application of computational intelligence techniques in fractional order systems and control. The book tries to assimilate various existing concepts in this nascent field of fractional order intelligent control and is aimed at researchers and post graduate students working in this field.

**Intelligent Vibration Control in Civil Engineering Structures** provides readers with an all-encompassing view of the theoretical studies, design methods, real-world implementations, and applications relevant to the topic. The book focuses on design and property tests on different intelligent control devices, innovative control strategies, analysis examples for structures with intelligent control devices, and designs and tests for intelligent controllers. Focuses on the principles, methods, and applications of intelligent vibration control in civil engineering. Covers intelligent control, including active and semi-active control. Includes comprehensive contents, such as design and properties of different intelligent control devices, control strategies, and dynamic analysis, intelligent controller design, numerical examples, and experimental data.

From aeronautics and manufacturing to healthcare and disaster management, systems engineering (SE) now

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focuses on designing applications that ensure performance optimization, robustness, and reliability while combining an emerging group of heterogeneous systems to realize a common goal. Use SoS to Revolutionize Management of Large Organizations, Factories, and Systems Intelligent Control Systems with an Introduction to System of Systems Engineering integrates the fundamentals of artificial intelligence and systems control in a framework applicable to both simple dynamic systems and large-scale system of systems (SoS). For decades, NASA has used SoS methods, and major manufacturers—including Boeing, Lockheed-Martin, Northrop-Grumman, Raytheon, BAE Systems—now make large-scale systems integration and SoS a key part of their business strategies, dedicating entire business units to this remarkably efficient approach. Simulate Novel Robotic Systems and Applications Transcending theory, this book offers a complete and practical review of SoS and some of its fascinating applications, including: Manipulation of robots through neural-based network control Use of robotic swarms, based on ant colonies, to detect mines Other novel systems in which intelligent robots, trained animals, and humans cooperate to achieve humanitarian objectives Training engineers to integrate traditional systems control theory with soft computing techniques further nourishes emerging SoS technology. With this in mind, the authors address the fundamental precepts at the core of SoS, which uses human heuristics to model complex systems, providing a scientific rationale for integrating independent, complex systems into a single

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coordinated, stabilized, and optimized one. They provide readers with MATLAB® code, which can be downloaded from the publisher's website to simulate presented results and projects that offer practical, hands-on experience using concepts discussed throughout the book.

Intelligent Control considers non-traditional modelling and control approaches to nonlinear systems. Fuzzy logic, neural networks and evolutionary computing techniques are the main tools used. The book presents a modular switching fuzzy logic controller where a PD-type fuzzy controller is executed first followed by a PI-type fuzzy controller thus improving the performance of the controller compared with a PID-type fuzzy controller. The advantage of the switching-type fuzzy controller is that it uses one rule-base thus minimises the rule-base during execution. A single rule-base is developed by merging the membership functions for change of error of the PD-type controller and sum of error of the PI-type controller. Membership functions are then optimized using evolutionary algorithms. Since the two fuzzy controllers were executed in series, necessary further tuning of the differential and integral scaling factors of the controller is then performed. Neural-network-based tuning for the scaling parameters of the fuzzy controller is then described and finally an evolutionary algorithm is applied to the neurally-tuned-fuzzy controller in which the sigmoidal function shape of the neural network is determined. The important issue of stability is addressed and the text demonstrates empirically that the developed controller was stable within the operating range. The text concludes with ideas for future research to show the reader the potential for further study in this area. Intelligent Control will be of interest to researchers from engineering and computer science backgrounds working in

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the intelligent and adaptive control.

A large international conference on Advances in Intelligent Control and Computer Engineering was held in Hong Kong, March 17-19, 2010, under the auspices of the International MultiConference of Engineers and Computer Scientists (IMECS 2010). The IMECS is organized by the International Association of Engineers (IAENG). Intelligent Control and Computer Engineering contains 25 revised and extended research articles written by prominent researchers participating in the conference. Topics covered include artificial intelligence, control engineering, decision supporting systems, automated planning, automation systems, systems identification, modelling and simulation, communication systems, signal processing, and industrial applications. Intelligent Control and Computer Engineering offers the state of the art of tremendous advances in intelligent control and computer engineering and also serves as an excellent reference text for researchers and graduate students, working on intelligent control and computer engineering.

Introduction; Fuzzy control: the basics; Case studies in design and implementation; nonlinear analysis; Fuzzy identification and estimation; Adaptive fuzzy control; Fuzzy supervisory control; Perspectives on fuzzy control.

This book describes intelligent control and its use in power electronic systems, specifically AC motor drives and uninterruptable power supply (UPS) systems. The book covers both the fundamentals of the subject and its practical applications. From the Foreword by Lofti A. Zadeh, Director of Berkeley Soft Computing Center, California: "What is unusual about [this book] is that it starts with a description of more or less classical control techniques; moves on to modern control and state space techniques; addresses in detail the complex issues arising in the analysis and design of robust control; takes up digital signal processing controllers; and finally,

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presents a very insightful exposition of soft computing techniques and their application to advanced control of AC drives and UPS systems."

Sleep medicine has been developing for more than 40 years. The current concepts in sleep technology are mainly centered on polysomnography (PSG) and issues related to sleep technicians. However, the editors believe that the true value of technology is revealed only when benefits to humanity are manifest. To this end, they endeavor to create a new era in sleep technology, one that will improve the quality of people's sleep and daily lives. This edited book, *Introduction to Modern Sleep Technology*, provides a comprehensive reference volume to the latest advancements in the area of Sleep Technology. It offers an excellent range of insights and opinions from leading researchers and experts in multiple disciplines spanning academia, clinical practice and industry. Up-to-date insights into the current research topics in this field are featured in addition to the latest technological advances with reference to appropriate working examples. The current book combines the five dimensions of knowledge, i.e., sleep medicine, clinical psychology engineering, industrial design and technology management to ensure the content is applicable to people's daily lives.

This intriguing and motivating book presents the basic ideas and understanding of control, signals and systems for readers interested in engineering and science. Through a series of examples, the book explores both the theory and the practice of control.

The essential introduction to the principles and applications of feedback systems—now fully revised and expanded This textbook covers the mathematics needed to model, analyze, and design feedback systems. Now more user-friendly than ever, this revised and expanded edition of *Feedback Systems* is a one-volume resource for students and researchers in



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mathematics and engineering. It has applications across a range of disciplines that utilize feedback in physical, biological, information, and economic systems. Karl Åström and Richard Murray use techniques from physics, computer science, and operations research to introduce control-oriented modeling. They begin with state space tools for analysis and design, including stability of solutions, Lyapunov functions, reachability, state feedback observability, and estimators. The matrix exponential plays a central role in the analysis of linear control systems, allowing a concise development of many of the key concepts for this class of models. Åström and Murray then develop and explain tools in the frequency domain, including transfer functions, Nyquist analysis, PID control, frequency domain design, and robustness. Features a new chapter on design principles and tools, illustrating the types of problems that can be solved using feedback Includes a new chapter on fundamental limits and new material on the Routh-Hurwitz criterion and root locus plots Provides exercises at the end of every chapter Comes with an electronic solutions manual An ideal textbook for undergraduate and graduate students Indispensable for researchers seeking a self-contained resource on control theory

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