

Intelligent Control Aspects Of Fuzzy Logic And Neural Nets World Scientific Series In Robotics And Automated Systems

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Methods and Applications of Intelligent Control S.G. Tzafestas 2012-12-06 This book is concerned with Intelligent Control methods and applications. The field of intelligent control has been expanded very much during the 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 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.

Fuzzy Logic Augmentation of Neural and Optimization Algorithms: Theoretical Aspects and Real Applications Oscar Castillo 2018-01-10 This book comprises papers on diverse aspects of fuzzy logic, neural networks, and nature-inspired optimization meta-heuristics and their application in various areas such as intelligent control and robotics, pattern recognition, medical diagnosis, time series prediction and optimization of complex problems. The book is organized into seven main parts, each with a collection of papers on a similar subject. The first part presents new concepts and algorithms based on type-2 fuzzy logic for dynamic parameter adaptation in meta-heuristics. The second part discusses network theory and applications, and includes papers describing applications of neural networks in diverse areas, such as time series prediction and pattern recognition. The third part addresses the theory and practice of meta-heuristics in different areas of application, while the fourth part describes diverse fuzzy logic applications in the control area, which can be considered as intelligent controllers. The next two parts explore applications in areas, such as time series prediction, and pattern recognition and new optimization and evolutionary algorithms and their applications respectively. Lastly, the seventh part addresses the design and application of different hybrid intelligent systems.

Fuzzy Logic John Yen 1999 Providing equal emphasis on theoretical foundations and practical issues, this book features fuzzy logic concepts and techniques in intelligent systems, control, and information technology. Uses Fuzzy Logic Toolbox MATLAB to demonstrate exemplar applications and to develop hands-on exercises.

Type-2 Fuzzy Logic in Intelligent Control Applications Oscar Castillo 2011-11-08 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, 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.

Fuzzy Logic and Intelligent Systems Hua Harry Li 2007-07-07 One of the attractions of fuzzy logic is its utility in solving many real engineering problems. As many have realised, the major obstacles in building a real intelligent machine involve dealing with random disturbances, processing large amounts of imprecise data, interacting with a dynamically changing environment, and coping with uncertainty. Neural-fuzzy techniques help one to solve many of these problems. Fuzzy Logic and Intelligent Systems reflects the most recent developments in neural networks and fuzzy logic, and their application in intelligent systems. In addition, the balance between theoretical work and applications makes the book suitable for both researchers and engineers, as well as for graduate students.

Aspects of Soft Computing, Intelligent Robotics and Control János Fodor 2009-10-13 Soft computing, as a collection of techniques exploiting approximation and tolerance for imprecision and uncertainty in traditionally intractable problems, has become very effective and popular especially because of the synergy derived from its components. The integration of constituent technologies provides complementary methods that allow developing flexible computing tools and solving complex problems. A wide area of natural applications of soft computing techniques consists of the control of dynamic systems, including robots. Loosely speaking, control can be understood as driving a process to attain a desired goal. Intelligent control can be seen as an extension of this concept, to include autonomous human-like interactions of a machine with the environment. Intelligent robots can be characterized by the ability to operate in an uncertain, changing environment with the help of appropriate sensing. They have the power to autonomously plan and execute motion sequences to achieve a goal specified by a human user without detailed instructions. In this volume leading specialists address various theoretical and practical aspects in soft computing, intelligent robotics and control. The problems discussed are taken from fuzzy systems, neural networks, interactive evolutionary computation, intelligent mobile robotics, and intelligent control of linear and nonlinear dynamic systems.

Intelligent Control Based on Fuzzy Logic and Neural Network Theory Chuen-Chien Lee 1990 **Advances In Intelligent Control** C J Harris 1994-03-11 "Advances in intelligent control" is a collection of essays covering the latest research in the field. Based on a special issue of "The International Journal of Control", the book is arranged in two parts. Part one contains recent contributions of artificial neural networks to modelling and control. Part two concerns itself primarily with aspects of fuzzy logic in intelligent control, guidance and estimation, although some of the contributions either make direct equivalence relationships to neural networks or use hybrid methods where a neural network is used to develop the fuzzy rule base.

Industrial Intelligent Control Yong-Zai Lu 1996-05-01 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 industrial control problems. Includes numerous worked application examples.

An Introduction to Fuzzy Logic Applications in Intelligent Systems Ronald R. Yager 2012-12-06 An Introduction to Fuzzy Logic Applications in Intelligent Systems consists of a collection of chapters written by leading experts in the field of fuzzy sets. Each chapter addresses an area where fuzzy sets have been applied to situations broadly related to intelligent systems. The volume provides an introduction to and an overview of recent applications of fuzzy sets to various areas of intelligent systems. Its purpose is to provide

information and easy access for people new to the field. The book also serves as an excellent reference for researchers in the field and those working in the specifics of systems development. People in computer science, especially those in artificial intelligence, knowledge-based systems, and intelligent systems will find this to be a valuable sourcebook. Engineers, particularly control engineers, will also have a strong interest in this book. Finally, the book will be of interest to researchers working in decision support systems, operations research, decision theory, management science and applied mathematics. An Introduction to Fuzzy Logic Applications in Intelligent Systems may also be used as an introductory text and, as such, it is tutorial in nature.

Computational Intelligence for Modelling, Control & Automation Masoud Mohammadian 1999 This edited Book is dedicated to the theory and applications of Evolutionary Computation and Fuzzy Logic for Intelligent Control, Knowledge Acquisition and Information Retrieval. The book consists of 86 selected research papers from the 1999 International Conference on Computational Intelligence for Modelling, Control and Automation - CIMCA'99 The research papers presented in this book cover new techniques and applications in the following research areas: Evolutionary Computation, Fuzzy Logic and Expert Systems with their applications for Optimisation, Learning, Control, Scheduling and Multi-Criteria Analysis as well as Reliability Assessment, Information Retrieval and Knowledge Acquisition.

Modern Control Engineering P.N. Paraskevopoulos 2017-12-19 "Illustrates the analysis, behavior, and design of linear control systems using classical, modern, and advanced control techniques. Covers recent methods in system identification and optimal, digital, adaptive, robust, and fuzzy control, as well as stability, controllability, observability, pole placement, state observers, input-output decoupling, and model matching."

Lectures on Soft Computing and Fuzzy Logic Antonio Di Nola 2013-06-05 The present volume collects selected papers arising from lectures delivered by the authors at the School on Fuzzy Logic and Soft Computing held during the years 1996/97/98/99 and sponsored by the Salerno University. The authors contributing to this volume agreed with editors to write down, to enlarge and, in many cases, to rethink their original lectures, in order to offer to readership, a more compact presentation of the proposed topics. The aim of the volume is to offer a picture, as a job in progress, of the effort that is coming in founding and developing soft computing's techniques. The volume contains papers aimed to report on recent results containing genuinely logical aspects of fuzzy logic. The topics treated in this area cover algebraic aspects of Lukasiewicz Logic, Fuzzy Logic as the logic of continuous t-norms, Intuitionistic Fuzzy Logic. Aspects of fuzzy logic based on similar ity relation are presented in connection with the problem of flexible querying in deductive database. Departing from fuzzy logic, some papers present re sults in Probability Logic treating computational aspects, results based on indishernability relation and a non commutative version of generalized effect algebras. Several strict applications of soft computing are presented in the book. Indeed we find applications ranging among pattern recognition, image and signal processing, evolutionary agents, fuzzy cellular networks, classification in fuzzy environments. The volume is then intended to serve as a reference work for foundational logico-algebraic aspect of Soft Computing and for concrete applications of soft computing technologies.

Intelligent Control Nazmul Siddique 2013-11-29 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 the intelligent and adaptive control.

Intelligent Control: Principles, Techniques and Applications

Introduction to Neuro-Fuzzy Systems Robert Fuller 2013-06-05 Fuzzy sets were introduced by Zadeh (1965) as a means of representing and manipulating data that was not precise, but rather fuzzy. Fuzzy logic provides an inference morphology that enables approximate human reasoning capabilities to be applied to knowledge-based systems. The theory of fuzzy logic provides a mathematical strength to capture the uncertainties associated with human cognitive processes, such as thinking and reasoning. The conventional approaches to knowledge representation lack the means for representing the meaning of fuzzy concepts. As a consequence, the approaches based on first order logic and classical probability theory do not provide an appropriate conceptual framework for dealing with the representation of commonsense knowledge, since such knowledge is by its nature both lexically imprecise and noncategorical. The development of fuzzy logic was motivated in large measure by the need for a conceptual framework which can address the issue of uncertainty and lexical imprecision. Some of the essential characteristics of fuzzy logic relate to the following [242]. • In fuzzy logic, exact reasoning is viewed as a limiting case of approximate reasoning. • In fuzzy logic, everything is a matter of degree. • In fuzzy logic, knowledge is interpreted a collection of elastic or, equivalently, fuzzy constraint on a collection of variables. • Inference is viewed as a process of propagation of elastic constraints. • Any logical system can be fuzzified. There are two main characteristics of fuzzy systems that give them better performance for specific applications.

Neural and Fuzzy Logic Control of Drives and Power Systems Marcián Cirstea 2002-10-08 *Introduces cutting-edge control systems to a wide readership of engineers and students *The first book on neuro-fuzzy control systems to take a practical, applications-based approach, backed up with worked examples and case studies *Learn to use VHDL in real-world applications Introducing cutting edge control systems through real-world applications Neural networks and fuzzy logic based systems offer a modern control solution to AC machines used in variable speed drives, enabling industry to save costs and increase efficiency by replacing expensive and high-maintenance DC motor systems. The use of fast micros has revolutionised the field with sensorless vector control and direct torque control. This book reflects recent research findings and acts as a useful guide to the new generation of control systems for a wide readership of advanced undergraduate and graduate students, as well as practising engineers. The authors guide readers quickly and concisely through the complex topics of neural networks, fuzzy logic, mathematical modelling of electrical machines, power systems control and VHDL design. Unlike the academic monographs that have previously been published on each of these subjects, this book combines them and is based round case studies of systems analysis, control strategies, design, simulation and implementation. The result is a guide to applied control systems design that will appeal equally to students and professional design engineers. The book can also be used as a unique VHDL design aid, based on real-world power engineering applications.

Safety, Reliability and Applications of Emerging Intelligent Control Technologies T.S. Ng 2014-06-28 Increasingly, over the last few years, intelligent controllers have been incorporated into control systems. Presently, the numbers and types of intelligent controllers that contain variations of fuzzy logic, neural network, genetic algorithms or some other forms of knowledge based reasoning technology are dramatically rising. However, considering the stability of the system, when such controllers are included it is difficult to analyse and predict system behaviour under unexpected conditions. Leading researchers and industrial

practitioners were able to discuss and evaluate current development and future research directions at the first IFAC International Workshop on safety, reliability and applications on emerging intelligent control technology. This publication contains the papers, covering a wide range of topics, presented at the workshop.

Intelligent Control of Robotic Systems D. Katic 2013-03-14 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 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.

Intelligent Adaptive Control Lakhmi C. Jain 1998-12-29 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.

Fuzzy Model Identification Hans Hellendoorn 2012-12-06 During the past few years two principally different approaches to the design of fuzzy controllers have emerged: heuristics-based design and model-based design. The main motivation for the heuristics-based design is given by the fact that many industrial processes are still controlled in one of the following two ways: - The process is controlled manually by an experienced operator. - The process is controlled by an automatic control system which needs manual, on-line 'trimming' of its parameters by an experienced operator. In both cases it is enough to translate in terms of a set of fuzzy if-then rules the operator's manual control algorithm or manual on-line 'trimming' strategy in order to obtain an equally good, or even better, wholly automatic fuzzy control system. This implies that the design of a fuzzy controller can only be done after a manual control algorithm or trimming strategy exists. It is admitted in the literature on fuzzy control that the heuristics-based approach to the design of fuzzy controllers is very difficult to apply to multiple-input/multiple-output control problems which represent the largest part of challenging industrial process control applications. Furthermore, the heuristics-based design lacks systematic and formally verifiable tuning techniques. Also, studies of the stability, performance, and robustness of a closed loop system incorporating a heuristics-based fuzzy controller can only be done via extensive simulations.

Fuzzy Logic Augmentation of Nature-Inspired Optimization Metaheuristics Oscar Castillo 2014-09-20 This book describes recent advances on fuzzy logic augmentation of nature-inspired optimization metaheuristics and their application in areas such as intelligent control and robotics, pattern recognition, time series prediction and optimization of complex problems. The book is organized in two main parts, which contain a group of papers around a similar subject. The first part consists of papers with the main theme of theoretical aspects of fuzzy logic augmentation of nature-inspired optimization metaheuristics, which basically consists of papers that propose new optimization algorithms enhanced using fuzzy systems. The second part contains papers with the main theme of application of optimization algorithms, which are basically papers using nature-inspired techniques to achieve optimization of complex optimization problems in diverse areas of application.

Design of Intelligent Systems Based on Fuzzy Logic, Neural Networks and Nature-Inspired Optimization Patricia Melin 2015-06-12 This book presents recent advances on the design of intelligent systems based on fuzzy logic, neural networks and nature-inspired optimization and their application in areas such as, intelligent control and robotics, pattern recognition, time series prediction and optimization of complex problems. The book is organized in eight main parts, which contain a group of papers around a similar subject. The first part consists of papers with the main theme of theoretical aspects of fuzzy logic, which basically consists of papers that propose new concepts and algorithms based on fuzzy systems. The second part contains papers with the main theme of neural networks theory, which are basically papers dealing with new concepts and algorithms in neural networks. The third part contains papers describing applications of neural networks in diverse areas, such as time series prediction and pattern recognition. The fourth part contains papers describing new nature-inspired optimization algorithms. The fifth part presents diverse applications of nature-inspired optimization algorithms. The sixth part contains papers describing new optimization algorithms. The seventh part contains papers describing applications of fuzzy logic in diverse areas, such as time series prediction and pattern recognition. Finally, the eighth part contains papers that present enhancements to meta-heuristics based on fuzzy logic techniques.

Computational Intelligence: Soft Computing and Fuzzy-Neuro Integration with Applications Okay Kaynak 2012-12-06 Soft computing is a consortium of computing methodologies that provide a foundation for the conception, design, and deployment of intelligent systems and aims to formalize the human ability to make rational decisions in an environment of uncertainty and imprecision. This book is based on a NATO Advanced Study Institute held in 1996 on soft computing and its applications. The distinguished contributors consider the principal constituents of soft computing, namely fuzzy logic, neurocomputing, genetic computing, and probabilistic reasoning, the relations between them, and their fusion in industrial applications. Two areas emphasized in the book are how to achieve a synergistic combination of the main constituents of soft computing and how the combination can be used to achieve a high Machine Intelligence Quotient.

Intelligent Control C J Harris 1993-03-31 With increasing demands for high precision autonomous control over wide operating envelopes, conventional control engineering approaches are unable to adequately deal with system complexity, nonlinearities, spatial and temporal parameter variations, and with uncertainty. Intelligent Control or self-organising/learning control is a new emerging discipline that is designed to deal with problems. Rather than being model based, it is experiential based. Intelligent Control is the amalgam of the disciplines of Artificial Intelligence, Systems Theory and Operations Research. It uses most recent experiences or evidence to improve its performance through a variety of learning schemas, that for practical implementation must demonstrate rapid learning convergence, be temporally stable, be robust to parameter changes and internal and external disturbances. It is shown in this book that a wide class of fuzzy logic and neural net based learning algorithms satisfy these conditions. It is demonstrated that this class of intelligent controllers is based upon a fixed nonlinear mapping of the input (sensor) vector, followed by an output layer linear mapping with coefficients that are updated by various first order learning laws. Under these conditions self-organising fuzzy logic controllers and neural net controllers have common learning attributes. A theme example of the navigation and control of an autonomous guided vehicle is included throughout, together with a series of bench examples to demonstrate this new theory and its applicability. Contents: An Introduction to Intelligent Control Introductory Fuzzy Logic Fuzzy Logic Controller Structure and Design The Static Fuzzy Logic Controller Self-Organising Fuzzy Logic Control Indirect Self-Organising Fuzzy Logic Controllers Case Studies of Direct Adaptive Fuzzy Control Neural Network Approximation Capability for Control and Modelling The B-Spline Neural Network and Fuzzy Logic The Appendix: Mathematical Prerequisites Readership: Computer scientists, engineers and nonlinear scientists. keywords:

Fuzzy Logic in Control 1995

Fuzzy Logic Control H. B. Verbruggen 1999 Fuzzy logic control has become an important methodology in control engineering. This volume deals with applications of fuzzy logic control in various domains. The contributions are divided into three parts. The first part consists of two state-of-the-art tutorials on fuzzy control and fuzzy modeling. Surveys of advanced methodologies are included in the second part. These surveys address fuzzy decision making and control, fault detection, isolation and diagnosis, complexity reduction in fuzzy systems and neuro-fuzzy methods. The third part contains application-oriented contributions from various fields, such as process industry, cement and ceramics, vehicle control and traffic management, electromechanical and production systems, avionics, biotechnology and medical applications. The book is intended for researchers both from the academic world and from industry.

Intelligent Control Systems with LabVIEW™ Pedro Ponce-Cruz 2009-11-20 Intelligent Control with LabVIEW™ is a fresh and pragmatic approach to the understanding of a subject often clouded by too much mathematical theory. It exploits the full suite of tools provided by LabVIEW™, showing the student how to

design, develop, analyze, and visualize intelligent control algorithms quickly and simply. Block diagrams are used to follow the progress of an algorithm through the design process and allow seamless integration with hardware systems for rapid deployment in laboratory experiments. This text delivers a thorough grounding in the main tools of intelligent control: fuzzy logic systems; artificial neural networks; neuro-fuzzy systems; evolutionary methods; and predictive methods. Learning and teaching are facilitated by: extensive use of worked examples; end of chapter problems with separate solutions; and provision of intelligent control tools for LabVIEW™.

Differential Evolution Algorithm with Type-2 Fuzzy Logic for Dynamic Parameter Adaptation with Application to Intelligent Control Oscar Castillo 2020-11-19 This book focuses on the fields of fuzzy logic,

bio-inspired algorithm, especially the differential evolution algorithm and also considering the fuzzy control area. The main idea is that these two areas together can help solve various control problems and to find better results. In this book, the authors test the proposed method using five benchmark control problems. First, the water tank, temperature, mobile robot, and inverted pendulum controllers are considered. For these 4 problems, experimentation was carried out using a Type-1 fuzzy system and an Interval Type-2 system. The last control problem was the D.C. motor, for which the experiments were performed with Type-1, Interval Type-2, and Generalized Type-2 fuzzy systems. When we use fuzzy systems combined with the differential evolution algorithm, we can notice that the results obtained in each of the controllers are better and with increasing uncertainty, the results are even better. For this reason, the authors consider in this book the proposed method using fuzzy systems and the differential evolution algorithm to improve the fuzzy controllers' behavior in complex control problems.

Intelligent Control Clarence W. de Silva 2018-05-02 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 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.

Intelligent Control; Aspects of Fuzzy Logic and Neural Nets C. J. Harris 1993

Intelligent Control Systems Using Soft Computing Methodologies Ali Zilouchian 2001-03-27 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 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.

Advanced Fuzzy Logic Technologies in Industrial Applications Ying Bai 2007-01-17 This book introduces a dynamic, on-line fuzzy inference system. In this system membership functions and control rules are not determined until the system is applied and each output of its lookup table is calculated based on current inputs. The book describes the real-world uses of new fuzzy techniques to simplify readers' tuning processes and enhance the performance of their control systems. It further contains application examples.

Intelligent Control Christopher John Harris 1993 With increasing demands for high precision autonomous control over wide operating envelopes, conventional control engineering approaches are unable to adequately deal with system complexity, nonlinearities, spatial and temporal parameter variations, and with uncertainty. Intelligent Control or self-organising/learning control is a new emerging discipline that is designed to deal with problems. Rather than being model based, it is experiential based. Intelligent Control is the amalgam of the disciplines of Artificial Intelligence, Systems Theory and Operations Research. It uses most recent experiences or evidence to improve its performance through a variety of learning schemas, that for practical implementation must demonstrate rapid learning convergence, be temporally stable, be robust to parameter changes and internal and external disturbances. It is shown in this book that a wide class of fuzzy logic and neural net based learning algorithms satisfy these conditions. It is demonstrated that this class of intelligent controllers is based upon a fixed nonlinear mapping of the input (sensor) vector, followed by an output layer linear mapping with coefficients that are updated by various first order learning laws. Under these conditions self-organising fuzzy logic controllers and neural net controllers have common learning attributes. A theme example of the navigation and control of an autonomous guided vehicle is included throughout, together with a series of bench examples to demonstrate this new theory and its applicability.

Fuzzy Control of Industrial Systems Ian S. Shaw 2013-12-20 Fuzzy Control of Industrial Systems: Theory and Applications presents the basic theoretical framework of crisp and fuzzy set theory, relating these concepts to control engineering based on the analogy between the Laplace transfer function of linear systems and the fuzzy relation of a nonlinear fuzzy system. Included are generic aspects of fuzzy systems with an emphasis on the many degrees of freedom and its practical design implications, modeling and systems identification techniques based on fuzzy rules, parametrized rules and relational equations, and the principles of adaptive fuzzy and neurofuzzy systems. Practical design aspects of fuzzy controllers are covered by the detailed treatment of fuzzy and neurofuzzy software design tools with an emphasis on iterative fuzzy tuning, while novel stability limit testing methods and the definition and practical examples of the new concept of collaborative control systems are also given. In addition, case studies of successful applications in industrial automation, process control, electric power technology, electric traction, traffic engineering, wastewater treatment, manufacturing, mineral processing and automotive engineering are also presented, in order to assist industrial control systems engineers in recognizing situations when fuzzy and neurofuzzy would offer certain advantages over traditional methods, particularly in controlling highly nonlinear and time-variant plants and processes.

Intelligent Control Kaushik Das Sharma 2018-08-28 This book discusses systematic designs of stable adaptive fuzzy logic controllers employing hybridizations of Lyapunov strategy-based approaches/ H^∞ theory-based approaches and contemporary stochastic optimization techniques. The text demonstrates how candidate stochastic optimization techniques like Particle swarm optimization (PSO), harmony search (HS) algorithms, covariance matrix adaptation (CMA) etc. can be utilized in conjunction with the Lyapunov theory/ H^∞ theory to develop such hybrid control strategies. The goal of developing a series of such hybridization processes is to combine the strengths of both Lyapunov theory/ H^∞ theory-based local search methods and stochastic optimization-based global search methods, so as to attain superior control algorithms that can simultaneously achieve desired asymptotic performance and provide improved transient responses. The book also demonstrates how these intelligent adaptive control algorithms can be effectively utilized in real-life applications such as in temperature control for air heater systems with transportation delay, vision-based navigation of mobile robots, intelligent control of robot manipulators etc. *Introduction To Type-2 Fuzzy Logic Control* Jerry Mendel 2014-06-16 An introductory book that provides theoretical, practical, and application coverage of the emerging field of type-2 fuzzy logic control Until recently, little was known about type-2 fuzzy controllers due to the lack of basic calculation methods available for type-2 fuzzy sets and logic—and many different aspects of type-2 fuzzy control still needed to be investigated in order to advance this new and powerful technology. This self-contained reference covers everything readers need to know about the growing field. Written with an educational focus in mind,

Introduction to Type-2 Fuzzy Logic Control: Theory and Applications uses a coherent structure and uniform mathematical notations to link chapters that are closely related, reflecting the book's central themes: analysis and design of type-2 fuzzy control systems. The book includes worked examples, experiment and simulation results, and comprehensive reference materials. The book also offers downloadable computer programs from an associated website. Presented by world-class leaders in type-2 fuzzy logic control, Introduction to Type-2 Fuzzy Logic Control: Is useful for any technical person interested in learning type-2 fuzzy control theory and its applications. Offers experiment and simulation results via downloadable computer programs. Features type-2 fuzzy logic background chapters to make the book self-contained. Provides an extensive literature survey on both fuzzy logic and related type-2 fuzzy control. Introduction to Type-2 Fuzzy Logic Control is an easy-to-read reference book suitable for engineers, researchers, and graduate students who want to gain deep insight into type-2 fuzzy logic control.

Fuzzy Logic in Intelligent System Design Patricia Melin 2017-09-30 This book describes recent advances in the use of fuzzy logic for the design of hybrid intelligent systems based on nature-inspired optimization and their applications in areas such as intelligent control and robotics, pattern recognition, medical diagnosis, time series prediction and optimization of complex problems. Based on papers presented at the North American Fuzzy Information Processing Society Annual Conference (NAFIPS 2017), held in Cancun, Mexico from 16 to 18 October 2017, the book is divided into nine main parts, the first of which first addresses theoretical aspects, and proposes new concepts and algorithms based on type-1 fuzzy systems. The second part consists of papers on new concepts and algorithms for type-2 fuzzy systems, and on applications of type-2 fuzzy systems in diverse areas, such as time series prediction and pattern recognition. In turn, the third part contains papers that present enhancements to meta-heuristics based on fuzzy logic techniques describing new nature-inspired optimization algorithms that use fuzzy dynamic adaptation of parameters.

The fourth part presents emergent intelligent models, which range from quantum algorithms to cellular automata. The fifth part explores applications of fuzzy logic in diverse areas of medicine, such as the diagnosis of hypertension and heart diseases. The sixth part describes new computational intelligence algorithms and their applications in different areas of intelligent control, while the seventh examines the use of fuzzy logic in different mathematic models. The eighth part deals with a diverse range of applications of fuzzy logic, ranging from environmental to autonomous navigation, while the ninth covers theoretical concepts of fuzzy models.

Fuzzy Logic Marek J. Patyra 2012-12-06 This edited volume contains ten papers on the subject of fuzzy technology. Fuzzy technology emerged as a combination of fuzzy sets theory, fuzzy logic and fuzzy-based reasoning. As a technology it gained a very practical meaning through thousands of applications in different theoretical as well as practical disciplines, covering mathematics, physics, chemistry, biology, life science, social science, economy, computer science, and (foremost) electrical, electronic, mechanical, nuclear, chemical, textile, aeronautic, ocean, and many other engineering disciplines. The goal of this book is to create an interest in fuzzy technology among researchers, engineers, professionals and students involved in the research and development in the broad area of artificial intelligence. This book is also intended to bring the reader up-to-date in the area of implementations and applications of fuzzy technology, as well as to generate and stimulate new research ideas in this area. It may inspire and motivate the researcher in new directions, as well as creating a force for new efforts to make a fuzzy technology commonly known and used in science and engineering. This volume appears at a time of unprecedented research interest in the field of fuzzy technology. I intentionally wrote research due to the events that have occurred during the last couple of years. To be more specific, I should describe this interest geographically.

Intelligent Control Based on Fuzzy Logic and Constraint Processing Ching-Yu Tyan 1995