Stable Adaptive Neural Network Control

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Neural Network Control Of Robot Manipulators And Non-Linear Systems

Modeling and Control of Complex Systems
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BECKER IBARRA

Adaptive Neural Control of Walking Robots Springer This book presents the results of the second workshop on Neural Adaptive Control Technology, NACT II, held on September 9-10, 1996, in Berlin. The workshop was organised in connection with a three-year European-Union-funded Basic Research Project in the ESPRIT framework, called NACT, a collaboration between Daimler-Benz (Germany) and the University of Glasgow (Scotland).The NACT project, which began on 1 April 1994, is a study of the fundamental properties of neural-network-based adaptive control systems. Where possible, links with traditional adaptive control systems are exploited. A major aim is to develop a systematic engineering procedure for designing neural controllers for nonlinear dynamic systems. The techniques developed are being evaluated on concrete industrial problems from within the Daimler-Benz group of companies.The aim of the workshop was to bring together selected invited specialists in the fields of adaptive control, nonlinear systems and neural networks. The first workshop (NACT I) took place in Glasgow in May 1995 and was mainly devoted to theoretical issues of neural adaptive control. Besides monitoring further development of theory, the NACT II workshop was focused on industrial applications and software tools. This context dictated the focus of the book and guided the editors in the choice of the papers and their subsequent reshaping into substantive book chapters. Thus, with the project having progressed into its applications stage, emphasis is put on the transfer of theory of neural adaptive engineering into industrial practice. The contributors are therefore both renowned academics and practitioners from major industrial users of neurocontrol.
Nature-Inspired Computing: Concepts, Methodologies, Tools, and Applications CRC Press The two-volume set LNCS 7951 and 7952 constitutes the refereed proceedings of the 10th International Symposium on Neural Networks, ISNN 2013, held in Dalian, China, in July 2013. The 157 revised full papers presented were carefully reviewed and selected from numerous submissions. The papers are organized in following topics: computational neuroscience, cognitive science, neural network models, learning algorithms, stability and convergence analysis, kernel methods, large margin methods and SVM, optimization algorithms, varational methods, control, robotics, bioinformatics and biomedical engineering, brain-like systems and brain-computer interfaces, data mining and knowledge discovery and other applications of neural networks.
CONTROL SYSTEMS, ROBOTICS AND AUTOMATION – Volume XIII IGI Global
Stable Adaptive Neural Network ControlSpringer Science & Business Media
Neural Information Processing World Scientific

The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering. The rapid development of control technology impacts all areas of the control discipline. New theory, new controllers, actuators, sensors, new industrial processes, computer methods, new applications, new philosophies, ... , new challenges. Much of this development work resides in industrial reports, feasibility study papers and the reports of advanced collaborative projects. The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination. Within the control community there has been much discussion of and interest in the new Emerging Technologies and Methods. Neural networks along with Fuzzy Logic and Expert Systems is an emerging methodology which has the potential to contribute to the development of intelligent control technologies. This volume of some thirteen chapters edited by Kenneth Hunt, George Irwin and Kevin Warwick makes a useful contribution to the literature of neural network methods and applications. The chapters are arranged systematically progressing from theoretical foundations, through the training aspects of neural nets and concluding with four chapters of applications. The applications include problems as diverse as oven tempera ture control, and energy/load forecasting routines. We hope this interesting but balanced mix of material appeals to a wide range of readers from the theoretician to the industrial applications engineer.

Radial Basis Function (RBF) Neural Network Control for Mechanical Systems World Scientific

Recently, there has been considerable research interest in neural network control of robots, and satisfactory results have been obtained in solving some of the special issues associated with the problems of robot control in an "on-and-off" fashion. This book is dedicated to issues on adaptive control of robots based on neural networks. The text has been carefully tailored to (i) give a comprehensive study of robot dynamics, (ii) present structured network models for robots, and (iii) provide systematic approaches for neural network based adaptive controller design for rigid robots, flexible joint robots, and robots in constraint motion. Rigorous proof of the stability properties of adaptive neural network controllers is provided. Simulation examples are also presented to verify the effectiveness of the controllers, and practical implementation issues associated with the controllers are also discussed.

Stable Adaptive Control and Estimation for Nonlinear Systems Springer Science & Business Media

Intelligent systems are a hallmark of modern feedback control systems. But as these systems mature, we have come to expect higher levels of performance in speed and accuracy in the face of severe nonlinearities, disturbances, unforeseen dynamics, and unstructured uncertainties. Artificial neural networks offer a combination of adaptability, parallel processing, and learning capabilities that outperform other intelligent control methods in more complex

systems. Borrowing from Biology Examining neurocontroller design in discrete-time for the first time, Neural Network Control of Nonlinear Discrete-Time Systems presents powerful modern control techniques based on the parallelism and adaptive capabilities of biological nervous systems. At every step, the author derives rigorous stability proofs and presents simulation examples to demonstrate the concepts. Progressive Development After an introduction to neural networks, dynamical systems, control of nonlinear systems, and feedback linearization, the book builds systematically from actuator nonlinearities and strict feedback in nonlinear systems to nonstrict feedback, system identification, model reference adaptive control, and novel optimal control using the Hamilton-Jacobi-Bellman formulation. The author concludes by developing a framework for implementing intelligent control in actual industrial systems using embedded hardware. Neural Network Control of Nonlinear Discrete-Time Systems fosters an understanding of neural network controllers and explains how to build them using detailed derivations, stability analysis, and computer simulations.

Advances in Neural Networks - ISNN 2006

World Scientific Series In Robotics And Intelligent Systems

Presenting current trends in the development and applications of intelligent systems in engineering, this monograph focuses on recent research results in system identification and control. The recurrent neurofuzzy and the fuzzy cognitive network (FCN) models are presented. Both models are suitable for partially-known or unknown complex time-varying systems. Neurofuzzy Adaptive Control contains rigorous proofs of its statements which result in concrete conclusions for the selection of the design parameters of the algorithms presented. The neurofuzzy model combines concepts from fuzzy systems and recurrent high-order neural networks to produce powerful system approximations that are used for adaptive control. The FCN model stems from fuzzy cognitive maps and uses the notion of “concepts” and their causal relationships to capture the behavior of complex systems. The book shows how, with the benefit of proper training algorithms, these models are potent system emulators suitable for use in engineering systems. All chapters are supported by illustrative simulation experiments, while separate chapters are devoted to the potential industrial applications of each model including projects in: • contemporary power generation; • process control and • conventional benchmarking problems. Researchers and graduate students working in adaptive estimation and intelligent control will find Neurofuzzy Adaptive Control of interest both for the currency of its models and because it demonstrates their relevance for real systems. The monograph also shows industrial engineers how to test intelligent adaptive control easily using proven theoretical results.

Stable Adaptive Identification and Control of Nonlinear Systems Using Neural Network Models John Wiley & Sons

The focus of this book is the application of artificial neural networks in uncertain dynamical

systems. It explains how to use neural networks in concert with adaptive techniques for system identification, state estimation, and control problems. The authors begin with a brief historical overview of adaptive control, followed by a review of mathematical preliminaries. In the subsequent chapters, they present several neural network-based control schemes. Each chapter starts with a concise introduction to the problem under study, and a neural network-based control strategy is designed for the simplest case scenario. After these designs are discussed, different practical limitations (i.e., saturation constraints and unavailability of all system states) are gradually added, and other control schemes are developed based on the primary scenario. Through these exercises, the authors present structures that not only provide mathematical tools for navigating control problems, but also supply solutions that are pertinent to real-life systems.

Neural Network Control of Nonlinear Discrete-Time Systems Springer Nature

This book constitutes the proceedings of the 12th International Conference on Wireless Algorithms, Systems, and Applications, WASA 2017, held in Guilin, China, in June 2017.The 70 full papers and 9 short papers presented in this book werde carefully reviewed and selected from 238 submissions. The papers cover various topics such as cognitive radio networks; wireless sensor networks; cyber-physical systems; distributed and localized algorithm design and analysis; information and coding theory for wireless networks; localization; mobile cloud computing; topology control and coverage; security and privacy; underwater and underground networks; vehicular networks; internet of things; information processing and data management; programmable service interfaces; energy-efficient algorithms; system and protocol design; operating system and middle-ware support; and experimental test-beds, models and case studies.

Adaptive Neural Network Control of Robotic Manipulators Academic Press

Radial Basis Function (RBF) Neural Network Control for Mechanical Systems is motivated by the need for systematic design approaches to stable adaptive control system design using neural network approximation-based techniques. The main objectives of the book are to introduce the concrete design methods and MATLAB simulation of stable adaptive RBF neural control strategies. In this book, a broad range of implementable neural network control design methods for mechanical systems are presented, such as robot manipulators, inverted pendulums, single link flexible joint robots, motors, etc. Advanced neural network controller design methods and their stability analysis are explored. The book provides readers with the fundamentals of neural network control system design. This book is intended for the researchers in the fields of neural adaptive control, mechanical systems, Matlab simulation, engineering design, robotics and automation. Jinkun Liu is a professor at Beijing University of Aeronautics and Astronautics.

Adaptive Neural

Network Control of Robotic Manipulators Springer
This book investigates the ability of a neural network (NN) to learn how to control an unknown (nonlinear, in general) system, using data acquired on-line, that is during the process of attempting to exert control. Two algorithms are developed to train the neural network for real-time control applications. The first algorithm is known as Learning by Recursive Least Squares (LRLS) algorithm and the second algorithm is known as Integrated Gradient and Least Squares (IGLS) algorithm. The ability of these algorithms for training the NN controller for real-time control is demonstrated on practical applications and the local convergence and stability requirements of these algorithms are analysed. In addition, network topology, learning algorithms (particularly supervised learning) and neural network control strategies including a new classification system for them, are presented.
Adaptive Sliding Mode Neural Network Control for Nonlinear Systems Springer
This book presents theoretical explorations of several fundamental problems in the dynamics and control of flexible beam systems. By integrating fresh concepts and results to form a systematic approach to control, it establishes a basic theoretical framework. It includes typical control design examples verified using MATLAB simulation, which in turn illustrate the successful practical applications of active vibration control theory for flexible beam systems. The book is primarily intended for researchers and engineers in the control system and mechanical engineering community, offering them a unique resource.
Applications of Neural Networks in High Assurance Systems Stable Adaptive Neural Network Control
As technology continues to become more sophisticated, mimicking natural processes and phenomena also becomes more of a reality. Continued research in the field of natural computing enables an understanding of the world around us, in addition to opportunities for man-made computing to mirror the natural processes and systems that have existed for centuries. Nature-Inspired Computing: Concepts, Methodologies, Tools, and Applications takes an interdisciplinary approach to the topic of natural computing, including emerging technologies being developed for the purpose of simulating natural phenomena, applications across industries, and the future outlook of biologically and nature-inspired technologies. Emphasizing critical research in a comprehensive multi-volume set, this publication is designed for use by IT professionals, researchers, and graduate students studying intelligent computing.
Autonomous Mobile Robots Springer Science & Business Media
This book explains the basic concepts, theory and applications of fuzzy systems in control in a simple unified approach with clear ex-amples and simulations in the MATLAB programming language. Fuzzy systems, especially, type-2 neuro-fuzzy systems, are now used extensively in various engineering fields for different purposes. In plain language, this book aims to practically explain fuzzy sys-tems and different methods of

training and optimizing these systems. For this purpose, type-2 neuro-fuzzy systems are first analyzed along with various methods of training and optimizing these systems through implementation in MATLAB. These systems are then em-ployed to design adaptive fuzzy controllers. The authors aim at pre-senting all the well-known optimization methods clearly and code them in the MATLAB language.

Stable Adaptive Neural Network Control Engineering Research Series (R

This volume establishes a theoretical framework for the control structure for an autonomous walking robot capable of negotiating and exploring a rough-terrain environment with sparse footholds. In the early chapters, the late Mark Randall (electronic systems at the U. of the West of England) provides a hierarchical structure by examining the physiology, neuronal control, and co-ordination models postulated by observing insects, as well as a novel, computationally efficient, and principled foot trajectory generation scheme. Subsequent chapters focus on the main contribution of the research, which is the stable on-line neural control of complex structures. The research follows a biomimetic route and is illustrated with examples and practical experimental accounts. Distributed in the US by ASME. c. Book News Inc.

Nonlinear Neural Control with Power Systems Applications CRC Press

In recent years, Higher Order Neural Networks (HONNs) have been widely adopted by researchers for applications in control signal generating, pattern recognition, nonlinear recognition, classification, and predition of control and recognition scenarios. Due to the fact that HONNs have been proven to be faster, more accurate, and easier to explain than traditional neural networks, their applications are limitless. Applied Artificial Higher Order Neural Networks for Control and Recognition explores the ways in which higher order neural networks are being integrated specifically for intelligent technology applications. Emphasizing emerging research, practice, and real-world implementation, this timely reference publication is an essential reference source for researchers, IT professionals, and graduate-level computer science and engineering students.

Neural Network Engineering in Dynamic Control Systems Springer Science & Business Media

"Applications of Neural Networks in High Assurance Systems" is the first book directly addressing a key part of neural network technology: methods used to pass the tough verification and validation (V&V) standards required in many safety-critical applications. The book presents what kinds of evaluation methods have been developed across many sectors, and how to pass the tests. A new adaptive structure of V&V is developed in this book, different from the simple six sigma methods usually used for large-scale systems and different from the theorem-based approach used for simplified component subsystems.

Dynamic Recurrent Neural Networks for Stable Adaptive Control of Wing Rock Motion Springer Science & Business Media

Comprehension of complex systems comes from an understanding of not only the behavior of

constituent elements but how they act together to form the behavior of the whole. However, given the multidisciplinary nature of complex systems, the scattering of information across different areas creates a chaotic situation for those trying to understand pos

Neural Network-Based State Estimation of Nonlinear Systems John Wiley & Sons

"Neural Network-Based State Estimation of Nonlinear Systems" presents efficient, easy to implement neural network schemes for state estimation, system identification, and fault detection and Isolation with mathematical proof of stability, experimental evaluation, and Robustness against unmolded dynamics, external disturbances, and measurement noises.

Stable Adaptive Control of Unknown Nonlinear Dynamic Systems Using Neural Networks Springer Nature

It has long been the goal of engineers to develop tools that enhance our ability to do work, increase our quality of life, or perform tasks that are either beyond our ability, too hazardous, or too tedious to be left to human efforts. Autonomous mobile robots are the culmination of decades of research and development, and their potential is seemingly unlimited. Roadmap to the Future Serving as the first comprehensive reference on this interdisciplinary technology, Autonomous Mobile Robots: Sensing, Control, Decision Making, and Applications authoritatively addresses the theoretical, technical, and practical aspects of the field. The book examines in detail the key components that form an autonomous mobile robot, from sensors and sensor fusion to modeling and control, map building and path planning, and decision making and autonomy, and to the final integration of these components for diversified applications. Trusted Guidance A duo of accomplished experts leads a team of renowned international researchers and professionals who provide detailed technical reviews and the latest solutions to a variety of important problems. They share hard-won insight into the practical implementation and integration issues involved in developing autonomous and open robotic systems, along with in-depth examples, current and future applications, and extensive illustrations. For anyone involved in researching, designing, or deploying autonomous robotic systems, Autonomous Mobile Robots is the perfect resource.