

Intelligent Control Based on Flexible Neural Networks

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AND KEIGO WATANABE**

**MICROPROCESSOR-BASED AND
INTELLIGENT SYSTEMS ENGINEERING**

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Intelligent Control Based On Flexible Neural Networks

**Vladimir G. Ivancevic, Tijana T.
Ivancevic**



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Dynamic Modeling and Neural Network-Based Intelligent Control of Flexible Systems Hejia Gao, Wei He, Changyin Sun, 2025-01-03 Comprehensive treatment of several representative flexible systems ranging from dynamic modeling and intelligent control design through to stability analysis Fully illustrated throughout Dynamic Modeling and Neural Network Based Intelligent Control of Flexible Systems proposes high efficiency modeling methods and novel intelligent control strategies for several representative flexible systems developed by means of neural networks It discusses tracking control of multi link flexible manipulators vibration control of flexible buildings under natural disasters and fault tolerant control of bionic flexible flapping wing aircraft and addresses common challenges like external disturbances dynamic uncertainties output constraints and actuator faults Expanding on its theoretical deliberations the book includes many case studies demonstrating how the proposed approaches work in practice Experimental investigations are carried out on Quanser Rotary Flexible Link Quanser 2 DOF Serial Flexible Link Quanser Active Mass Damper and Quanser Smart Structure platforms The book starts by providing an overview of dynamic modeling and intelligent control of flexible systems introducing several important issues along with modeling and control methods of three typical flexible systems Other topics include Foundational mathematical preliminaries including the Hamilton principle model discretization methods Lagrange s equation method and Lyapunov s stability theorem Dynamic modeling of a single link flexible robotic manipulator and vibration control design for a string with the boundary time varying output constraint Unknown time varying disturbances such as earthquakes and strong winds and how to suppress them and use MATLAB and Quanser to verify effectiveness of a

proposed control Adaptive vibration control methods for a single floor building like structure equipped with an active mass damper AMD Dynamic Modeling and Neural Network Based Intelligent Control of Flexible Systems is an invaluable resource for researchers and engineers seeking high efficiency modeling methods and neural network based control solutions for flexible systems along with industry engineers and researchers who are interested in control theory and applications and students in related programs of study

Multi-Arm Cooperating Robots M.D. Zivanovic, M. Vukobratovic, 2006-07-09

Several consistent solutions for cooperative system control have recently been identified by the authors of the current monograph This was achieved by solving three separate tasks that are essential for solving the problem of cooperative manipulation as a whole The first task is related to the understanding of the physical nature of cooperative manipulation and finding a way for a sufficiently exact characterization of cooperative system statics kinematics and dynamics After successfully completing this task in the frame of the second task the problem of coordinated motion of the cooperative system is solved Finally as a solution to the third task the control laws of cooperative manipulation are synthesized The starting point in dealing with the above three tasks of cooperative manipulation was the assumption that the problem of force uncertainty in cooperative manipulation can be resolved by introducing elastic properties into the cooperative system at least in the part where force uncertainty appears In static and dynamic analysis of the elastic structure of cooperative systems the finite element method is applied In contrast to the procedure used in the major part of the available literature where deformation work is expressed by deviations from the unloaded state of fixed elastic structure in this monograph the deformation work is expressed by internal forces as a function of the absolute coordinates of contacts of mobile elastic structure Coordinated motion and control in cooperative manipulation are solved as the problem of coordinated motion and control of a mobile elastic structure taking into account the specific features of cooperative manipulation Coordinated motion and control laws in cooperative manipulation are synthesized on the basis of a non linear model where the problem of uncertainty is solved which is not the case in the available literature Simple examples demonstrate the consistent procedure of mathematical modeling and synthesis of nominal coordinated motion as well as control of the cooperative system This book will be useful to a wide audience of engineers ranging from undergraduate and graduate students new and advanced academic researchers to practitioners mechanical and electrical engineers computer and system scientists It is intended for readers whose work involves manufacturing industrial robotics automation computer and control engineering and who wish to find out about this important new technology and its potential advantages for control engineering applications

Fuzzy Logic Applications in Engineering Science J. Harris, 2006-01-17 Fuzzy logic is a relatively new concept in science applications Hitherto fuzzy logic has been a conceptual process applied in the field of risk management Its potential applicability is much wider than that however and its particular suitability for expanding our understanding of processes and information in science and engineering in our post modern world is only just beginning to be appreciated Written as a

companion text to the author's earlier volume *An Introduction to Fuzzy Logic Applications* the book is aimed at professional engineers and students and those with an interest in exploring the potential of fuzzy logic as an information processing kit with a wide variety of practical applications in the field of engineering science and develops themes and topics introduced in the author's earlier text

Fundamentals of Mechanics of Robotic Manipulation Marco Ceccarelli, 2013-03-09 This book has evolved from a course on Mechanics of Robots that the author has thought for over a dozen years at the University of Cassino at Cassino Italy It is addressed mainly to graduate students in mechanical engineering although the course has also attracted students in electrical engineering The purpose of the book consists of presenting robots and robotized systems in such a way that they can be used and designed for industrial and innovative non industrial applications with no great efforts The content of the book has been kept at a fairly practical level with the aim to teach how to model simulate and operate robotic mechanical systems The chapters have been written and organized in a way that they can be read even separately so that they can be used separately for different courses and readers However many advanced concepts are briefly explained and their use is emphasized with illustrative examples Therefore the book is directed not only to students but also to robot users both from practical and theoretical viewpoints In fact topics that are treated in the book have been selected as of current interest in the field of Robotics Some of the material presented is based upon the author's own research in the field since the late 1980's

Geometrical Dynamics of Complex Systems Vladimir G. Ivancevic, Tijana T. Ivancevic, 2006-09-10 *Geometrical Dynamics of Complex Systems* is a graduate level monographic textbook

It represents a comprehensive introduction into rigorous geometrical dynamics of complex systems of various natures By complex systems in this book are meant high dimensional nonlinear systems which can be but not necessarily are adaptive This monograph proposes a unified geometrical approach to dynamics of complex systems of various kinds engineering physical biophysical psychophysical sociophysical econophysical etc As their names suggest all these multi input multi output MIMO systems have something in common the underlying physics However instead of dealing with the popular soft complexity philosophy we rather propose a rigorous geometrical and topological approach We believe that our rigorous approach has much greater predictive power than the soft one We argue that science and technology is all about prediction and control Observation understanding and explanation are important in education at undergraduate level but after that it should be all prediction and control The main objective of this book is to show that high dimensional nonlinear systems and processes of real life can be modelled and analyzed using rigorous mathematics which enables their complete predictability and controllability as if they were linear systems It is well known that linear systems which are completely predictable and controllable by definition live only in Euclidean spaces of various dimensions They are as simple as possible mathematically elegant and fully elaborated from either scientific or engineering side However in nature nothing is linear In reality everything has a certain degree of nonlinearity which means unpredictability with subsequent uncontrollability

Human-Like

Biomechanics Vladimir G. Ivancevic, Tijana T. Ivancevic, 2008-01-11 Human Like Biomechanics is a comprehensive introduction into modern geometrical methods to be used as a unified research approach in two apparently separate and rapidly growing fields mathematical biomechanics and humanoid robotics The book contains six Chapters and an Appendix The first Chapter is an Introduction giving a brief review of mathematical techniques to be used in the text The second Chapter develops geometrical basis of human like biomechanics while the third Chapter develops its mechanical basis mainly from generalized Lagrangian and Hamiltonian perspective The fourth Chapter develops topology of human like biomechanics while the fifth Chapter reviews related nonlinear control techniques The sixth Chapter develops covariant biophysics of electro muscular stimulation The Appendix consists of two parts classical muscular mechanics and modern path integral methods which are both used frequently in the main text The whole book is based on the authors own research papers in human like biomechanics

Reverse Engineering the Mind Florian Neukart, 2016-10-24 Florian Neukart describes methods for interpreting signals in the human brain in combination with state of the art AI allowing for the creation of artificial conscious entities ACE Key methods are to establish a symbiotic relationship between a biological brain sensors AI and quantum hard and software resulting in solutions for the continuous consciousness problem as well as other state of the art problems The research conducted by the author attracts considerable attention as there is a deep urge for people to understand what advanced technology means in terms of the future of mankind This work marks the beginning of a journey the journey towards machines with conscious action and artificially accelerated human evolution

An Introduction to Fuzzy Logic Applications J. Harris, 2012-12-06 Fuzzy logic provides a unique method of approximate reasoning in an imperfect world This text is a bridge to the principles of fuzzy logic through an application focused approach to selected topics in Engineering and Management The many examples point to the richer solutions obtained through fuzzy logic and to the possibilities of much wider applications There are relatively few texts available at present in fuzzy logic applications The style and content of this text is complementary to those already available New areas of application are presented in a graded approach in which the underlying concepts are first described The text is broadly divided into two parts which treat Processes and Materials and also System Applications The level enables a selection of the text to be made for the substance of a senior undergraduate level course There is also sufficient volume and quality for the basis of a postgraduate course A more restricted and judicious selection can provide the material for a professional short course

Robust Control Algorithms for Flexible Manipulators Kshetrimayum Lochan, Binoy Krishna Roy, Bidyadhar Subudhi, Santhakumar Mohan, 2024-10-13 Various modelling and control of two link flexible manipulators are presented in this book The lumped parameter modelling method and the assumed modes method modelling are comprehensively reviewed The book also reviews the trajectory tracking problem and tip trajectory tracking problem along with the suppression of tip deflection of the links An exponential time varying signal and a chaotic signal are considered as the desired trajectories The identical non

identical slave manipulator is synchronised with the controlled master manipulator so that the slave manipulator indirectly follows the desired manipulator

Advances in Mechanism and Machine Science Tadeusz Uhl, 2019-06-13 This book gathers the proceedings of the 15th IFToMM World Congress which was held in Krakow Poland from June 30 to July 4 2019 Having been organized every four years since 1965 the Congress represents the world's largest scientific event on mechanism and machine science MMS The contributions cover an extremely diverse range of topics including biomechanical engineering computational kinematics design methodologies dynamics of machinery multibody dynamics gearing and transmissions history of MMS linkage and mechanical controls robotics and mechatronics micro mechanisms reliability of machines and mechanisms rotor dynamics standardization of terminology sustainable energy systems transportation machinery tribology and vibration Selected by means of a rigorous international peer review process they highlight numerous exciting advances and ideas that will spur novel research directions and foster new multidisciplinary collaborations

IEEE/PES Transmission and Distribution Conference and Exhibition 2002: Asia Pacific, 2002

Proceedings of the 2024 International Conference on Mechanics, Electronics Engineering and Automation (ICMEEA 2024) Yang Yue, 2024-09-24 This is an Open Access book 2024 International Conference on Mechanics Electronics Engineering and Automation ICMEEA 2024 will be held in Singapore during July 26 to 28 provides a forum for researchers and experts involved in different but related domains to confront research results The scope of ICMEEA 2024 includes the research and development of collaboration technologies to mechanical engineering electronic engineering control system and automation of systems The conference aims to provide a platform for researchers academicians and industry professionals to converge and explore the latest advancements breakthroughs and challenges in the fields of Mechanical Engineering Electronic Engineering and Automation Focusing on innovation and future prospects the event will foster knowledge exchange collaboration and the dissemination of cutting edge research that contributes to the evolution of these interconnected disciplines Join us as we delve into the transformative potential of technology discuss emerging trends and chart the course for a dynamic and interconnected future in mechanical engineering electronic engineering and automation

Computer & Control Abstracts, 1996

Electronics, Communications and Networks Antonio J. Tallón-Ballesteros, Estefanía Cortés-Ancos, Diego A. López-García, 2024-01-15 It is hard to imagine a world without electronic communication networks so dependent have we all become on the networks which now exist and have become part of the fabric of our daily lives This book presents papers from CECNet 2023 the 13th International Conference on Electronics Communications and Networks held as a hybrid event in person in Macau China and online via Microsoft Teams from 17-20 November 2023 This annual conference provides a comprehensive global forum for experts and participants from academia to exchange ideas and present the results of ongoing research in state of the art areas of electronics technology communications engineering and technology wireless communications engineering and technology and computer engineering and technology A total of 324 submissions were received for the conference and those

which qualified by virtue of falling under the scope of the conference topics were exhaustively reviewed by program committee members and peer reviewers taking into account the breadth and depth of the relevant research topics The 101 selected contributions included in this book present innovative original ideas or results of general significance supported by clear and rigorous reasoning and compelling new light in both evidence and method Subjects covered divide broadly into 3 categories electronics technology and VLSI internet technology and signal processing and information communication and communication networks Providing an overview of current research and developments in these rapidly evolving fields the book will be of interest to all those working with digital communications networks

Advanced Energy Technologies and Systems I Artur Zaporozhets, 2021-11-13 This book focuses on modern technologies and systems for solving problems in the energy sector It is shown that bioenergy is one of the promising areas of energy development The book collected the experience of scientists from many countries in the research of renewable energy The advantages of renewable energy are general availability renewability environmental friendliness The analysis carried out by the authors shows the current state of renewable energy in the world its trends and prospects New measuring systems are presented which can become the basis for measuring the thermal characteristics of various types of fuels including biofuels insulating materials enclosing structures etc System for monitoring of grainy biomass comminution with the use of genetic algorithms has been presented and described New technologies for the construction of power plants based on renewable energy sources have been proposed and investigated

Evolving Rule-Based Models Plamen P. Angelov, 2002-02-26 The idea about this book has evolved during the process of its preparation as some of the results have been achieved in parallel with its writing One reason for this is that in this area of research results are very quickly updated Another is possibly that a strong unchallenged theoretical basis in this field still does not fully exist From other hand the rate of innovation competition and demand from different branches of industry from biotech industry to civil and building engineering from market forecasting to civil aviation from robotics to emerging e commerce is increasingly pressing for more customised solutions based on learning consumers behaviour A highly interdisciplinary and rapidly innovating field is forming which focus is the design of intelligent self adapting systems and machines It is on the crossroads of control theory artificial and computational intelligence different engineering disciplines borrowing heavily from the biology and life sciences It is often called intelligent control soft computing or intelligent technology Some other branches have appeared recently like intelligent agents which migrated from robotics to different engineering fields data fusion knowledge extraction etc which are inherently related to this field The core is the attempts to enhance the abilities of the classical control theory in order to have more adequate flexible and adaptive models and control algorithms

Advances in Neural Networks--ISNN ..., 2005 **Modeling and Control of Dynamic Spatially Distributed Systems** Yizhi Wang, Zhong Yang, 2024-11-08 Modeling and Control of Dynamic Spatially Distributed Systems Pharmaceutical Processes provides a balanced approach to help readers to get started quickly in the field of

biochemical pharmaceuticals From a theoretical perspective dynamic spatially distributed systems are introduced to address their industrial applications After identifying problems the book provides readers with modeling and control system design techniques via a novel fuzzy set class of objects with a continuum of grades of membership to describe the grade of the object belonging to this fuzzy set and intelligent computation methods From an application perspective the book provides a thorough understanding of Good Manufacture Practices GMP and the importance of identification modelling and intelligent control of such systems reducing the test and error cost and the R D design time cycle of original drug development Provides an updated supplemental knowledge to the body of distributed parameter systems Covers control and analysis framework based on a state space approach for a non standard model from industrial complex systems Presents a novel proposed fuzzy set and applies it to case studies to illustrate its feasibility Includes a control system design solution from perspective of medicine production

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