Modeling And Control Of Complex Physical Systems The Port Hamiltonian Approach

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Decentralized Control of Complex Systems Modeling and Control of Complex Systems
A predictive control algorithm uses a model of the controlled system to predict the system behavior for various input scenarios and determines the most appropriate inputs accordingly. Predictive controllers are suitable for a wide range of systems; therefore, their advantages are especially evident when dealing with relatively complex systems, such as nonlinear, constrained, hybrid,

multivariate systems etc. However, designing a predictive control strategy for a complex system is generally a difficult task, because all relevant dynamical phenomena have to be considered. Establishing a suitable model of the system is an essential part of predictive control design. Classic modeling and identification approaches based on linear-systems theory are generally inappropriate for complex systems; hence, models that are able to appropriately consider complex dynamical properties have to be employed in a predictive control algorithm. This book first introduces some modeling frameworks, which can encompass the most frequently encountered complex dynamical phenomena and are practically applicable in the proposed predictive control approaches. Furthermore, unsupervised learning methods that can be used for complex-system identification are treated. Finally, several useful predictive control algorithms for complex systems are proposed and their particular advantages and drawbacks are discussed. The presented modeling, identification and control approaches are complemented by illustrative examples. The book is aimed towards researches and postgraduate students interested in modeling, identification and control, as well as towards control engineers needing practically usable advanced control methods for complex systems.

Port-Hamiltonian Systems Theory

Springer

The Final Proceedings for Complex

Systems: Control and Modeling Problems, 14 June 2004 - 19 June 2004 This is a computer science conference broadly covering topics related to modeling and control of complex systems and 'systems of systems'. Specific topics to be presented include: Open systems: Control and Modeling; Complex Systems: Information Interaction Models; Information Assurance in Complex Systems; System Analysis and Control Theory; Ontology analysis and synthesis; Multi-Agent Systems; Complex Engineering Systems and Enterprises management; Emergency Control; Control and Measurement in Complex Technical Systems; New Information Technologies. *Modeling and Control of a Large Nuclear Reactor* Springer Science & Business Media

Work with data like a pro using this guide that breaks down how to organize, apply, and most importantly, understand what you are analyzing in order to become a true data ninja. From the stock market to genomics laboratories, census figures to marketing email blasts, we are awash with data. But as anyone who has ever opened up a spreadsheet packed with seemingly infinite lines of data knows, numbers aren't enough: we need to know how to make those numbers talk. In The Model Thinker, social scientist Scott E. Page shows us the mathematical, statistical, and computational models—from linear regression to random walks and far beyond—that can turn anyone into a genius. At the core of the book is Page's

"many-model paradigm," which shows the reader how to apply multiple models to organize the data, leading to wiser choices, more accurate predictions, and more robust designs. The Model Thinker provides a toolkit for business people, students, scientists, pollsters, and bloggers to make them better, clearer thinkers, able to leverage data and information to their advantage.

Power System Modeling, Computation, and Control Springer

This book introduces electrical machine modeling and control for electrical engineering and science to graduate, undergraduate students as well as researchers, who are working on modeling and control of electrical machines. It targets electrical engineering students who have no time to derive mathematical equations for electrical machines in particular induction machine (IM) and doubly fed induction machines (DFIM). The main focus is on the application of field oriented control technique to induction motor (IM) and doubly fed induction motor (DFIM) in details, and since the induction motors have many drawback using this technique, therefore the application of a nonlinear control technique (feedback linearization) is applied to a reduced order model of DFIM to enhance the performance of doubly fed induction motor. Features Serves as text book for electrical motor modeling, simulation and control; especially modeling of induction motor and doubly fed induction motor using different frame of references. Vector

control (field oriented control) is given in more detailed, and is applied to induction motor. A nonlinear controller is applied to a reduced model of an doubly induction motor associated with a linear observer to estimate the unmeasured load torque, which is used to enhance the performance of the vector control to doubly fed induction motor. Access to the full MATLAB/SIMULINK blocks for simulation and control.

Decision Control, Management, and Support in Adaptive and Complex Systems: Quantitative Models Springer Science & Business Media

Fuzzy logic methodology has proven effective in dealing with complex nonlinear systems containing uncertainties that are otherwise difficult to model. Technology based on this methodology is applicable to many real-world problems, especially in the area of consumer products. This book presents the first comprehensive, unified treatment of fuzzy modeling and fuzzy control, providing tools for the control of complex nonlinear systems. Coverage includes model complexity, model precision, and computing time. This is an excellent reference for electrical, computer, chemical, industrial, civil, manufacturing, mechanical and aeronautical engineers, and also useful for graduate courses in electrical engineering, computer engineering, and computer science.

Green IT Engineering: Concepts, Models, Complex Systems Architectures Springer Science & Business Media

Provides students with an understanding

of the modeling and practice in power system stability analysis and control design, as well as the computational tools used by commercial vendors Bringing together wind, FACTS, HVDC, and several other modern elements, this book gives readers everything they need to know about power systems. It makes learning complex power system concepts, models, and dynamics simpler and more efficient while providing modern viewpoints of power system analysis. Power System Modeling, Computation, and Control provides students with a new and detailed analysis of voltage stability; a simple example illustrating the BCU method of transient stability analysis; and one of only a few derivations of the transient synchronous machine model. It offers a discussion on reactive power consumption of induction motors during start-up to illustrate the low-voltage phenomenon observed in urban load centers. Damping controller designs using power system stabilizer, HVDC systems, static var compensator, and thyristor-controlled series compensation are also examined. In addition, there are chapters covering flexible AC transmission Systems (FACTS)—including both thyristor and voltage-sourced converter technology—and wind turbine generation and modeling. Simplifies the learning of complex power system concepts, models, and dynamics Provides chapters on power flow solution, voltage stability, simulation methods, transient stability, small signal

stability, synchronous machine models (steady-state and dynamic models), excitation systems, and power system stabilizer design Includes advanced analysis of voltage stability, voltage recovery during motor starts, FACTS and their operation, damping control design using various control equipment, wind turbine models, and control Contains numerous examples, tables, figures of block diagrams, MATLAB plots, and problems involving real systems Written by experienced educators whose previous books and papers are used extensively by the international scientific community Power System Modeling, Computation, and Control is an ideal textbook for graduate students of the subject, as well as for power system engineers and control design professionals.

Modeling, Control and Optimization of Water Systems Springer Science & Business Media

The world of artificial systems is reaching complexity levels that es cape human understanding. Surface traffic, electricity distribution, air planes, mobile communications, etc. , are examples that demonstrate that we are running into problems that are beyond classical scientific or engi neering knowledge. There is an ongoing world-wide effort to understand these systems and develop models that can capture its behavior. The reason for this work is clear, if our lack of understanding deepens, we will lose our capability to control these systems and make they behave as we want. Researchers from many different

fields are trying to understand and develop theories for complex man-made systems. This book presents re search from the perspective of control and systems theory. The book has grown out of activities in the research program Control of Complex Systems (COSY). The program has been sponsored by the Eu ropean Science Foundation (ESF) which for 25 years has been one of the leading players in stimulating scientific research. ESF is a European asso ciation of more than 60 leading national science agencies spanning more than 20 countries. ESF covers has standing committees in Medical Sci ences, Life and Environmental Sciences, Physical and Engineering Sci ences, Humanities and Social Sciences. The COSY program was ESF's first activity in the Engineering Sciences. The program run for a period of five years starting January 1995.

Model Reduction and Control of Complex Systems MIT Press

These notes are based on (i) a series of lectures that I gave at the 14th Biennial Seminar of the Canadian Mathematical Congress held at the University of Western Ontario August 12-24, 1973 and (li) some of my lectures in a modeling course that I have cotaught in the Division of Bio-Medical Sciences at Brown during the past several years. An earlier version of these notes appeared in the Center for Dynamical Systems Lectures Notes series (CDS LN 73-1, November 1973). I have in this revised and extended version of those earlier notes incorporated a number of changes based both on classroom experience and

on my research efforts with several colleagues during the intervening period. The narrow viewpoint of the present notes (use of optimization and control theory in biomedical problems) reflects more the scope of the CMC lectures given in August, 1973 than the scope of my own interests. Indeed, my real interests have included the modeling process itself as well as the contributions made by investiga tors who employ the techniques and ideas of control theory, systems analysis, dif ferential equations, and stochastic processes. Some of these contributions have quite naturally involved application of optimal control theory. But in my opinion many of the interesting efforts being made in modeling in the biomedical sciences encompass much more than the use of control theory.

Semiotic Aspects of Control and Modeling Relations in Complex Systems
Springer
Explains multi-level models of enterprise systems and coversmodeling methodology This book addresses the essential phenomena underlying theoverall behaviors of complex systems and enterprises. Understanding these phenomena can enable improving these systems.These phenomena range from physical, behavioral, andorganizational, to economic and social, all of which involvesignificant human components. Specific phenomena of interest andhow they are represented depend on the questions of interest andthe relevant domains or contexts. Modeling and Visualization ofComplex Systems and

Enterprises examines visualization of phenomenaand how understanding the relationships among phenomena can providethe basis for understanding where deeper exploration is warranted.The author also reviews mathematical and computational models,defined very broadly across disciplines, which can enable deeperunderstanding. Presents a 10 step methodology for addressingquestions associated with the design or operation of complexsystems and enterprises Examines six archetypal enterprise problemsincluding two from healthcare, two from urban systems, and one eachfrom financial systems and defense systems Provides an introduction to the nature of complexsystems, historical perspectives on complexity and complex adaptivesystems, and the evolution of systems practice Modeling and Visualization of Complex Systems andEnterprises is written for graduate students studying systemsscience and engineering and professionals involved in systemsscience and engineering, those involved in complex systems such ashealthcare delivery, urban systems, sustainable energy, financialsystems, and national security.

Data-Driven Modeling of Complex Systems John Wiley & Sons

This book discusses the latest progresses and developments on complex systems research and intends to give an exposure to prospective readers about the theoretical and practical aspects of mathematical modelling, numerical simulation and

agent-based modelling frameworks. The main purpose of this book is to emphasize a unified approach to complex systems analysis, which goes beyond to examine complicated phenomena of numerous real-life systems; this is done by investigating a huge number of components that interact with each other at different (microscopic and macroscopic) scales; new insights and emergent collective behaviours can evolve from the interactions between individual components and also with their environments. These tools and concepts permit us to better understand the patterns of various real-life systems and help us to comprehend the mechanisms behind which distinct factors shaping some complex systems phenomena being influenced. This book is published in conjunction with the International Workshop on Complex Systems Modelling & Simulation 2019 (CoSMoS 2019): IoT & Big Data Integration. This international event was held at the Universiti Sains Malaysia Main Campus, Penang, Malaysia, from 8 to 11 April 2019. This book appeals to readers interested in complex systems research and other related areas such as mathematical modelling, numerical simulation and agent-based modelling frameworks. .

Modeling and Visualization of Complex Systems and Enterprises John Wiley & Sons

The current literature on dynamic systems is quite comprehensive, and system theory’s mathematical jargon

can remain quite complicated. Thus, there is a need for a compendium of accessible research that involves the broad range of fields that dynamic systems can cover, including engineering, life sciences, and the environment, and which can connect researchers in these fields. The Handbook of Research on Modeling, Analysis, and Control of Complex Systems is a comprehensive reference book that describes the recent developments in a wide range of areas including the modeling, analysis, and control of dynamic systems, as well as explores related applications. The book acts as a forum for researchers seeking to understand the latest theory findings and software problem experiments. Covering topics that include chaotic maps, predictive modeling, random bit generation, and software bug prediction, this book is ideal for professionals, academicians, researchers, and students in the fields of electrical engineering, computer science, control engineering, robotics, power systems, and biomedical engineering.

Modeling and Control of AC Machine using MATLAB®/SIMULINK Springer

Combining scientific computing methods and algorithms with modern data analysis techniques, including basic applications of compressive sensing and machine learning, this book develops techniques that allow for the integration of the dynamics of complex systems and big data. MATLAB is used throughout for mathematical solution strategies.

Modeling and Control of Complex

Physical Systems Springer Nature Modeling, Control And Optimization Of Complex Systems is a collection of contributions from leading international researchers in the fields of dynamic systems, control theory, and modeling. These papers were presented at the Symposium on Modeling and Optimization of Complex Systems in honor of Larry Yu-Chi Ho in June 2001. They include exciting research topics such as: -modeling of complex systems, -power control in ad hoc wireless networks, -adaptive control using multiple models, -constrained control, -linear quadratic control, -discrete events, -Markov decision processes and reinforcement learning, -optimal control for discrete event and hybrid systems, -optimal representation and visualization of multivariate data and functions in low-dimensional spaces.

Handbook of Research on Modeling, Analysis, and Control of Complex Systems Springer

Decentralized Control of Complex Systems

Cybernetics in the 21st Century Festschrift in Honor of Hidenori Kimura on the Occasion of his 60th Birthday John Wiley & Sons

This volume provides a comprehensive state of the art overview of a series of advanced trends and concepts that have recently been proposed in the area of green information technologies engineering as well as of design and development methodologies for models and complex systems architectures and their intelligent components. The

contributions included in the volume have their roots in the authors' presentations, and vivid discussions that have followed the presentations, at a series of workshop and seminars held within the international TEMPUS-project GreenCo project in United Kingdom, Italy, Portugal, Sweden and the Ukraine, during 2013-2015 and at the 1st - 5th Workshops on Green and Safe Computing (GreenSCom) held in Russia, Slovakia and the Ukraine. The book presents a systematic exposition of research on principles, models, components and complex systems and a description of industry- and society-oriented aspects of the green IT engineering. A chapter-oriented structure has been adopted for this book following a "vertical view" of the green IT, from hardware (CPU and FPGA) and software components to complex industrial systems. The 15 chapters of the book are grouped into five sections: (1) Methodology and Principles of Green IT Engineering for Complex Systems, (2) Green Components and Programmable Systems, (3) Green Internet Computing, Cloud and Communication Systems, (4) Modeling and Assessment of Green Computer Systems and Infrastructures, and (5) Green PLC-Based Systems for Industry Applications. The chapters provide an easy to follow, comprehensive introduction to the topics that are addressed, including the most relevant references, so that anyone interested in them can start the study by being able to easily find an introduction to the topic through these references. At

the same time, all of them correspond to different aspects of the work in progress being carried out by various research groups throughout the world and, therefore, provide information on the state of the art of some of these topics, challenges and perspectives.

Explorations of Physical, Human, Economic, and Social Phenomena Butterworth-Heinemann

This book provides essential background knowledge on the development of model-based real-world solutions in the field of control and decision making for water systems. It presents system engineering methods for modelling surface water and groundwater resources as well as water transportation systems (rivers, channels and pipelines). The models in turn provide information on both the water quantity (flow rates, water levels) of surface water and groundwater and on water quality. In addition, methods for modelling and predicting water demand are described. Sample applications of the models are presented, such as a water allocation decision support system for semi-arid regions, a multiple-criteria control model for run-of-river hydropower plants, and a supply network simulation for public services.

System Dynamics IGI Global

From foundations to state-of-the-art; the tools and philosophy you need to build network models.

Modeling, Simulation, and Control of Mechatronic Systems CRC Press

Port-Hamiltonian Systems Theory: An Introductory Overview provides a

concise and easily accessible description of the foundations underpinning the subject and emphasizes novel developments in the field, which will be of interest to a broad range of researchers.

Big Data Modeling and Monitoring in Complex Systems Academic Press Hidenori Kimura, renowned system and control theorist, turned 60 years of age in November, 2001. To celebrate this memorable occasion, his friends, collaborators, and former students gathered from all over the world and held a symposium in his honor on November 1 and 2, 2001, at the Sanjo Conference Hall at the University of Tokyo. Reflecting his current research interests, the symposium was entitled "Cybernetics in the 21st Century: Information and Complexity in Control Theory," and it drew nearly 150 attendees. There were twenty-five lectures, on which the present volume is based. Hidenori Kimura was born on November 3, 1941, in Tokyo, just prior to the outbreak of the Second World War. It is not hard to imagine, then, that his early days, like those of so many of his contemporaries, must have been difficult. Fortunately, the war ended in 1945, and his generation found itself thoroughly occupied with the rebuilding effort and with Japan's uphill journey in the last half-century. He entered the University of Tokyo in 1963, received a B. S. in 1965, an M. S. in 1967, and, in 1970, a Ph. D. degree for his dissertation "A Study of Differential Games. " After obtaining his doctorate, he joined the

Department of Control En gineering at Osaka University as a research associate, and in 1973 he was promoted to an associate professor.

What You Need to Know to Make Data Work for You John Wiley & Sons In the era of cyber-physical systems, the area of control of complex systems has grown to be one of the hardest in terms of algorithmic design techniques and analytical tools. The 23 chapters, written by international specialists in the field, cover a variety of interests within the broader field of learning, adaptation, optimization and networked control. The editors have grouped these into the following 5 sections: “Introduction and Background on Control Theory”, “Adaptive Control and Neuroscience”, “Adaptive Learning Algorithms”, “Cyber-Physical Systems and Cooperative Control”, “Applications”. The diversity of the research presented gives the reader a unique opportunity to explore a comprehensive overview of a field of great interest to control and system theorists. This book is intended for researchers and control engineers in machine learning, adaptive control, optimization and automatic control systems, including Electrical Engineers, Computer Science Engineers, Mechanical Engineers, Aerospace/Automotive Engineers, and Industrial Engineers. It could be used as a text or reference for advanced courses in complex control systems. • Collection of chapters from several well-known professors and researchers that will showcase their recent work • Presents different state-of-

the-art control approaches and theory for complex systems • Gives algorithms that take into consideration the presence of modelling uncertainties, the unavailability of the model, the possibility of cooperative/non-cooperative goals and malicious attacks compromising the security of networked teams • Real system examples and figures throughout, make ideas concrete Includes chapters from several well-known professors and researchers that showcases their recent work Presents different state-of-the-art control approaches and theory for complex systems Explores the presence of modelling uncertainties, the unavailability of the model, the possibility of cooperative/non-cooperative goals, and malicious attacks compromising the security of networked teams Serves as a helpful reference for researchers and control engineers working with machine learning, adaptive control, and automatic control systems

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