

Fundamentals Of Economic Model Predictive Control

The book shows how the operation of renewable-energy microgrids can be facilitated by the use of model predictive control (MPC). It gives readers a wide overview of control methods for microgrid operation at all levels, ranging from quality of service, to integration in the electricity market. MPC-based solutions are provided for the main control issues related to energy management and optimal operation of microgrids. The authors present MPC techniques for case studies that include different renewable sources – mainly photovoltaic and wind – as well as hybrid storage using batteries, hydrogen and supercapacitors. Experimental results for a pilot-scale microgrid are also presented, as well as simulations of scheduling in the electricity market and integration of electric and hybrid vehicles into the microgrid. In order to replicate the examples provided in the book and to develop and validate control algorithms on existing or projected microgrids. Model Predictive Control of Microgrids will interest researchers and practitioners, enabling them to keep abreast of a rapidly developing field. The text will also help to guide graduate students through processes from the conception and initial design of a microgrid through its implementation to the optimization of microgrid management. Advances in Industrial Control reports and encourages the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

This book explores the extent to which economic theory is able to provide the theoretical foundations of strategic management. To this end it draws on the philosophy of science; microeconomic theory; and different approaches to strategic management. The work shows that many of the propositions of strategic management are deducible from the economic theories considered. It argues that these propositions should be made open to empirical testing and that a unified theory of strategic management should be developed. Thus the book addresses a current major concern of theorists - that strategy remains 'atheoretical' and that this reduces the predictive power of the subject and hampers further theory development. The essential contribution made is that economic theory should be systematically explored in order to establish the foundations of business strategy.

The second edition of a comprehensive introduction to machine learning approaches used in predictive data analytics, covering both theory and practice. Machine learning is often used to build predictive models by extracting patterns from large datasets. These models are used in predictive data analytics applications including price prediction, risk assessment, predicting customer behavior, and document classification. This introductory textbook offers a detailed and focused treatment of the most important machine learning approaches used in predictive data analytics, covering both theoretical concepts and practical applications. Technical and mathematical material is augmented with explanatory worked examples, and case studies illustrate the application of these models in the broader business context. This second edition covers recent developments in machine learning, especially in a new chapter on deep learning, and two new chapters that go beyond predictive analytics to cover unsupervised learning and reinforcement learning.

Process Systems Engineering brings together the international community of researchers and engineers interested in computing-based methods in process engineering. This conference highlights the contributions of the PSE community towards the sustainability of modern society and is based on the 13th International Symposium on Process Systems Engineering PSE 2018 event held San Diego, CA, July 1-5 2018. The book contains contributions from academia and industry, establishing the core products of PSE, defining the new and changing scope of our results, and future challenges. Plenary and keynote lectures discuss real-world challenges (globalization, energy, environment and health) and contribute to discussions on the widening scope of PSE versus the consolidation of the core topics of PSE. Highlights how the Process Systems Engineering community contributes to the sustainability of modern society Establishes the core products of Process Systems Engineering Defines the future challenges of Process Systems Engineering

This handbook provides a comprehensive but concise reference resource for the vast field of petroleum technology. Built on the successful book "Practical Advances in Petroleum Processing" published in 2006, it has been extensively revised and expanded to include upstream technologies. The book is divided into four parts: The first part on petroleum characterization offers an in-depth review of the chemical composition and physical properties of petroleum, which determine the possible uses and the quality of the products. The second part provides a brief overview of petroleum geology and upstream practices. The third part exhaustively discusses established and emerging refining technologies from a practical perspective, while the final part describes the production of various refining products, including fuels and lubricants, as well as petrochemicals, such as olefins and polymers. It also covers process automation and real-time refinery-wide process optimization. Two key chapters provide an integrated view of petroleum technology, including environmental and safety issues. Written by international experts from academia, industry and research institutions, including integrated oil companies, catalyst suppliers, licensors, and consultants, it is an invaluable resource for researchers and graduate students as well as practitioners and professionals.

Nonlinear Model Predictive Control is a thorough and rigorous introduction to nonlinear model predictive control (NMPC) for discrete-time and sampled-data systems. NMPC is interpreted as an approximation of infinite-horizon optimal control so that important properties like closed-loop stability, inverse optimality and suboptimality can be derived in a uniform manner. These results are complemented by discussions of feasibility and robustness. NMPC schemes with and without stabilizing terminal constraints are detailed and intuitive examples illustrate the performance of different NMPC variants. An introduction to nonlinear optimal control algorithms gives insight into how the nonlinear optimisation routine – the core of any NMPC controller – works. An appendix covering NMPC software and accompanying software in MATLAB® and C++(downloadable from www.springer.com/ISBN) enables readers to perform computer experiments exploring the possibilities and limitations of NMPC.

The economics profession has become a favourite punching bag in the aftermath of the global financial crisis. Economists are widely reviled and their influence derided by the general public. Yet their services have never been in greater demand. To unravel the paradox, we need to understand both the strengths and weaknesses of economics. This book offers both a defence and critique of economics. Economists' way of thinking about social phenomena has great advantages. But the flexible, contextual nature of economics is also its Achilles' heel in the hands of clumsy practitioners.

Economic Effects of Natural Disasters explores how natural disasters affect sources of economic growth and development. Using theoretical econometrics and real-world data, and drawing on advances in climate change economics, the book shows scholars and researchers how to use various research methods and techniques to investigate and respond to natural disasters. No other book presents empirical frameworks for the evaluation of the quality of macroeconomic research practice with a focus on climate

change and natural disasters. Because many of these subjects are so large, different regions of the world use different approaches, hence this resource presents tailored economic applications and evidence. Connects economic theories and empirical work in climate change to natural disaster research Shows how advances in climate change and natural disaster research can be implemented in micro- and macroeconomic simulation models Addresses structural changes in countries afflicted by climate change and natural disasters

In this thesis, we introduce the novel concept of relaxed barrier function based model predictive control and present a comprehensive theoretical and algorithmic framework for the design, analysis, and implementation of relaxed barrier function based MPC approaches. Instead of treating the underlying optimization as an idealized static map, a key motive of the MPC results and algorithms presented in this thesis is to study the interconnected dynamics of controlled plant and iterative optimization algorithm in an integrated barrier function based framework and to analyze the resulting overall closed-loop system both from a systems theoretic and algorithmic perspective. One of the presented main results is a novel class of barrier function based anytime MPC algorithms that guarantee important properties of the closed-loop system independently of the number of optimization algorithm iterations that are performed at each sampling step. The obtained theoretical results are illustrated by various numerical examples and benchmark tests as well as by an experimental case study in which the proposed class of barrier function based MPC algorithms is applied to the predictive control of a self-driving car.

Model Predictive Control System Design and Implementation Using MATLAB® proposes methods for design and implementation of MPC systems using basis functions that confer the following advantages: - continuous- and discrete-time MPC problems solved in similar design frameworks; - a parsimonious parametric representation of the control trajectory gives rise to computationally efficient algorithms and better on-line performance; and - a more general discrete-time representation of MPC design that becomes identical to the traditional approach for an appropriate choice of parameters. After the theoretical presentation, coverage is given to three industrial applications. The subject of quadratic programming, often associated with the core optimization algorithms of MPC is also introduced and explained. The technical contents of this book is mainly based on advances in MPC using state-space models and basis functions. This volume includes numerous analytical examples and problems and MATLAB® programs and exercises.

Solving Urban Infrastructure Problems Using Smart City Technologies is the most complete guide for integrating next generation smart city technologies into the very foundation of urban areas worldwide, showing how to make urban areas more efficient, more sustainable, and safer. Smart cities are complex systems of systems that encompass all aspects of modern urban life. A key component of their success is creating an ecosystem of smart infrastructures that can work together to enable dynamic, real-time interactions between urban subsystems such as transportation, energy, healthcare, housing, food, entertainment, work, social interactions, and governance. Solving Urban Infrastructure Problems Using Smart City Technologies is a complete reference for building a holistic, system-level perspective on smart and sustainable cities, leveraging big data analytics and strategies for planning, zoning, and public policy. It offers in-depth coverage and practical solutions for how smart cities can utilize resident's intellectual and social capital, press environmental sustainability, increase personalization, mobility, and higher quality of life. Brings together experts from academia, government and industry to offer state-of-the-art solutions for urban system problems, showing how smart technologies can be used to improve the lives of the billions of people living in cities across the globe Demonstrates practical implementation solutions through real-life case studies Enhances reader comprehension with learning aid such as hands-on exercises, questions and answers, checklists, chapter summaries, chapter review questions, exercise problems, and more

The Foundations of Positive and Normative Economics: A Handbook is the first book in a new series by Andrew Caplin and Andrew Schotter. There is currently no guide available on the rapidly changing methodological frontiers of the field of economics. Economists have been introducing new theories and new sources of data at a remarkable rate in recent years, and there are widely divergent views both on how productive these expansions have been in the past, and how best to make progress in the future. The speed of these changes has left economists ill at ease, and has created a backlash against new methods. The series will debate these critical issues, allowing proponents of a particular research method to present proposals in a safe yet critical context, with alternatives being clarified. This first volume, written by some of the most prominent researchers in the discipline, reflects the challenges that are opened by new research opportunities. The goal of the current volume and the series it presages, is to formally open a dialog on methodology. The editors' conviction is that such a debate will rebound to the benefit of social science in general, and economics in particular. The issues under discussion strike to the very heart of the social scientific enterprise. This work is of tremendous importance to all who are interested in the contributions that academic research can make not only to our scientific understanding, but also to matters of policy.

An award-winning professor of economics at MIT and a Harvard University political scientist and economist evaluate the reasons that some nations are poor while others succeed, outlining provocative perspectives that support theories about the importance of institutions.

Presenting a comprehensive analysis of the use of alternative sources of energy and technologies to produce fuels and power, this book describes the energy value chain from harvesting the raw material, (i.e solar, wind, biomass or shale gas) followed by analysis of the processing steps into power, fuels and/or chemicals and finally the distribution of the products. Featuring an examination of the techno-economic processes and integration opportunities which can add value to by-products or promote the use of different sources of energy within the same facility, this book looks at the tools that can make this integration possible as well as utilising a real world case study. The case study of the operation of "El hierro" island is used as an example of the current effort towards more efficient use of the resources available. Tackling

head on the open challenges of the supply, the variability of the source and its prediction, the description of novel processes that are being developed and evaluated for their transformation as well as how we can distribute them to the consumer and how we can integrate the new chemicals, fuels and power within the current system and infrastructure, the book takes a process based perspective with such an approach able to help us in the use and integration of these sources of energy and novel technologies.

Modern engineering processes and tasks are highly complex, multi- and interdisciplinary, requiring the cooperative effort of different specialists from engineering, mathematics, computer science and even social sciences. Optimization methodologies are fundamental instruments to tackle this complexity, giving the possibility to unite synergistically team members' inputs and thus decisively contribute to solving new engineering technological challenges. With this context in mind, the main goal of Engineering Optimization 2014 is to unite engineers, applied mathematicians, computer and other applied scientists working on research, development and practical application of optimization methods applied to all engineering disciplines, in a common scientific forum to present, analyze and discuss the latest developments in this area. Engineering Optimization 2014 contains the edited papers presented at the 4th International Conference on Engineering Optimization (ENGOPT2014, Lisbon, Portugal, 8-11 September 2014). ENGOPT2014 is the fourth edition of the biennial "International Conference on Engineering Optimization". The first conference took place in 2008 in Rio de Janeiro, the second in Lisbon in 2010 and the third in Rio de Janeiro in 2012. The contributing papers are organized around the following major themes: - Numerical Optimization Techniques - Design Optimization and Inverse Problems - Efficient Analysis and Reanalysis Techniques - Sensitivity Analysis - Industrial Applications - Topology Optimization For Structural Static and Dynamic Failures - Optimization in Oil and Gas Industries - New Advances in Derivative-Free Optimization Methods for Engineering Optimization - Optimization Methods in Biomechanics and Biomedical Engineering - Optimization of Laminated Composite Materials - Inverse Problems in Engineering Engineering Optimization 2014 will be of great interest to engineers and academics in engineering, mathematics and computer science.

Coulson and Richardson's Chemical Engineering: Volume 3B: Process Control, Fourth Edition, covers reactor design, flow modeling, and gas-liquid and gas-solid reactions and reactors. Converted from textbooks into fully revised reference material Content ranges from foundational through to technical Added emerging applications, numerical methods and computational tools

This book addresses several problems related to automated valuation methodologies (AVM). Following the non-agency mortgage crisis, it offers a variety of approaches to improve the efficiency and quality of an automated valuation methodology (AVM) dealing with emerging problems and different contexts. Spatial issue, evolution of AVM standards, multilevel models, fuzzy and rough set applications and quantitative methods to define comparables are just some of the topics discussed.

Recent developments in model-predictive control promise remarkable opportunities for designing multi-input, multi-output control systems and improving the control of single-input, single-output systems. This volume provides a definitive survey of the latest model-predictive control methods available to engineers and scientists today. The initial set of chapters present various methods for managing uncertainty in systems, including stochastic model-predictive control. With the advent of affordable and fast computation, control engineers now need to think about using "computationally intensive controls," so the second part of this book addresses the solution of optimization problems in "real" time for model-predictive control. The theory and applications of control theory often influence each other, so the last section of Handbook of Model Predictive Control rounds out the book with representative applications to automobiles, healthcare, robotics, and finance. The chapters in this volume will be useful to working engineers, scientists, and mathematicians, as well as students and faculty interested in the progression of control theory. Future developments in MPC will no doubt build from concepts demonstrated in this book and anyone with an interest in MPC will find fruitful information and suggestions for additional reading.

In this thesis, we study model predictive control (MPC) schemes for control tasks which go beyond the classical objective of setpoint stabilization. In particular, we consider two classes of such control problems, namely distributed MPC for cooperative control in networks of multiple interconnected systems, and economic MPC, where the main focus is on the optimization of some general performance criterion which is possibly related to the economics of a system. The contributions of this thesis are to analyze various systems theoretic properties occurring in these type of control problems, and to develop distributed and economic MPC schemes with certain desired (closed-loop) guarantees. To be more precise, in the field of distributed MPC we propose different algorithms which are suitable for general cooperative control tasks in networks of interacting systems. We show that the developed distributed MPC frameworks are such that the desired cooperative goal is achieved, while coupling constraints between the systems are satisfied. Furthermore, we discuss implementation and scalability issues for the derived algorithms, as well as the necessary communication requirements between the systems. In the field of economic MPC, the contributions of this thesis are threefold. Firstly, we analyze a crucial dissipativity condition, in particular its necessity for optimal steady-state operation of a system and its robustness with respect to parameter changes. Secondly, we develop economic MPC schemes which also take average constraints into account. Thirdly, we propose an economic MPC framework with self-tuning terminal cost and a generalized terminal constraint, and we show how self-tuning update rules for the terminal weight can be derived such that desirable closed-loop performance bounds can be established.

Forecasting is required in many situations. Stocking an inventory may require forecasts of demand months in advance.

Telecommunication routing requires traffic forecasts a few minutes ahead. Whatever the circumstances or time horizons involved, forecasting is an important aid in effective and efficient planning. This textbook provides a comprehensive introduction to forecasting methods and presents enough information about each method for readers to use them sensibly.

Economic Model Predictive Control Theory, Formulations and Chemical Process Applications Springer

This book presents a set of approaches for the real-time monitoring and control of drinking-water networks based on advanced information and communication technologies. It shows the reader how to achieve significant improvements in efficiency in terms of water use, energy consumption, water loss minimization, and water quality guarantees. The methods and approaches presented are illustrated and have been applied using real-life pilot demonstrations based on the drinking-water network in Barcelona, Spain. The proposed approaches and tools cover: • decision-making support for real-time optimal control of water transport networks,

explaining how stochastic model predictive control algorithms that take explicit account of uncertainties associated with energy prices and real demand allow the main flow and pressure actuators—pumping stations and pressure regulation valves— and intermediate storage tanks to be operated to meet demand using the most sustainable types of source and with minimum electricity costs;• decision-making support for monitoring water balance and distribution network quality in real time, implementing fault detection and diagnosis techniques and using information from hundreds of flow, pressure, and water-quality sensors together with hydraulic and quality-parameter-evolution models to detect and locate leaks in the network, possible breaches in water quality, and failures in sensors and/or actuators;• consumer-demand prediction, based on smart metering techniques, producing detailed analyses and forecasts of consumption patterns, providing a customer communications service, and suggesting economic measures intended to promote more efficient use of water at the household level. Researchers and engineers working with drinking-water networks will find this a vital support in overcoming the problems associated with increased population, environmental sensitivities and regulation, aging infrastructures, energy requirements, and limited water sources.

This book is a printed edition of the Special Issue "Real-Time Optimization" that was published in Processes

This book provides an overview of the nonlinear model predictive control (NMPC) concept for application to innovative combustion engines. Readers can use this book to become more expert in advanced combustion engine control and to develop and implement their own NMPC algorithms to solve challenging control tasks in the field. The significance of the advantages and relevancy for practice is demonstrated by real-world engine and vehicle application examples. The author provides an overview of fundamental engine control systems, and addresses emerging control problems, showing how they can be solved with NMPC. The implementation of NMPC involves various development steps, including: reduced-order modeling of the process; analysis of system dynamics; formulation of the optimization problem; and real-time feasible numerical solution of the optimization problem. Readers will see the entire process of these steps, from the fundamentals to several innovative applications. The application examples highlight the actual difficulties and advantages when implementing NMPC for engine control applications. Nonlinear Model Predictive Control of Combustion Engines targets engineers and researchers in academia and industry working in the field of engine control. The book is laid out in a structured and easy-to-read manner, supported by code examples in MATLAB®/Simulink®, thus expanding its readership to students and academics who would like to understand the fundamental concepts of NMPC. Advances in Industrial Control reports and encourages the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

In this thesis, we develop a novel framework for model predictive control (MPC) which combines the concepts of robust MPC and economic MPC. The goal of this thesis is to develop and analyze MPC schemes for nonlinear discrete-time systems which explicitly consider the influence of disturbances on arbitrary performance criteria. Instead of regarding the two aspects separately, we propose robust economic MPC approaches that integrate information which is available about the disturbance directly into the economic framework. In more detail, we develop three concepts which differ in which information about the disturbance is used and how this information is taken into account. Furthermore, we provide a thorough theoretical analysis for each of the three approaches. To this end, we present results on the asymptotic average performance as well as on optimal operating regimes. Optimal operating regimes are closely related to the notion of dissipativity, which is therefore analyzed for the presented concepts. Under suitable assumptions, results on necessity and sufficiency of dissipativity for optimal steady-state operation are established for all three robust economic MPC concepts. A detailed discussion is provided which compares the different performance statements derived for the approaches as well as the respective notions of dissipativity.

Economic Model Predictive Control (EMPC) is a control strategy that moves process operation away from the steady-state paradigm toward a potentially time-varying operating strategy to improve process profitability. The EMPC literature is replete with evidence that this new paradigm may enhance process profits when a model of the chemical process provides a sufficiently accurate representation of the process dynamics. Systems using EMPC often neglect the dynamics associated with equipment and are often neglected when modeling a chemical process. Recent studies have shown they can significantly impact the effectiveness of an EMPC system. Concentrating on valve behavior in a chemical process, this monograph develops insights into the manner in which equipment behavior should impact the design process for EMPC and to provide a perspective on a number of open research topics in this direction. Written in tutorial style, this monograph provides the reader with a full literature review of the topic and demonstrates how these techniques can be adopted in a practical system.

The objective of this thesis is the development of novel model predictive control (MPC) schemes for nonlinear continuous-time systems with and without time-delays in the states which guarantee asymptotic stability of the closed-loop. The most well-studied MPC approaches with guaranteed stability use a control Lyapunov function as terminal cost. Since the actual calculation of such a function can be difficult, it is desirable to replace this assumption by a less restrictive controllability assumption. For discrete-time systems, the latter assumption has been used in the literature for the stability analysis of so-called unconstrained MPC, i.e., MPC without terminal cost and terminal constraints. The contributions of this thesis are twofold. In the first part, we propose novel MPC schemes with guaranteed stability based on a controllability assumption, whereas we extend different MPC schemes with guaranteed stability to nonlinear time-delay systems in the second part. In the first part of this thesis, we derive explicit stability conditions on the prediction horizon as well as performance guarantees for unconstrained MPC. Starting from this result, we propose novel alternative MPC formulations based on combinations of the controllability assumption with terminal cost and terminal constraints. One of the main contributions is the development of a unifying MPC framework which allows to consider both MPC schemes with terminal cost and terminal constraints as well as unconstrained MPC as limit cases of our framework. In the second part of this thesis, we show that several MPC schemes with and without terminal constraints can be extended to nonlinear time-delay systems. Due to the infinite-dimensional nature of these systems, the problem is more involved and additional assumptions are required in the controller design. We investigate different MPC schemes with and without terminal constraints and/or terminal cost terms and derive novel stability conditions. Furthermore, we pay particular attention to the calculation of the involved control design parameters.

This book presents recent research on predictive econometrics and big data. Gathering edited papers presented at the 11th International Conference of the Thailand Econometric Society (TES2018), held in Chiang Mai, Thailand, on January 10-12, 2018, its main focus is on predictive techniques – which directly aim at predicting economic phenomena; and big data techniques – which enable us to handle the enormous amounts of data generated by modern computers in a reasonable time. The book also

discusses the applications of more traditional statistical techniques to econometric problems. Econometrics is a branch of economics that employs mathematical (especially statistical) methods to analyze economic systems, to forecast economic and financial dynamics, and to develop strategies for achieving desirable economic performance. It is therefore important to develop data processing techniques that explicitly focus on prediction. The more data we have, the better our predictions will be. As such, these techniques are essential to our ability to process huge amounts of available data.

first industrial application of MPC was in 1973. A key motivation was to provide better performance than could be obtained with the widely-used PID controller whilst making it easy to replace the PID controller unit or module with his new algorithm. It was the advent of digital control technology and the use of software control algorithms that made this replacement easier and more acceptable to process engineers. A decade of industrial practice with PFC was reported in the archival literature by Jacques Richalet et al. in 1978 in an important seminal *Automatica* paper. Around this time, Cutler and Ramaker published the dynamic matrix control algorithm that also used knowledge of future reference signals to determine a sequence of control signal adjustment. Thus, the theoretical and practical development of predictive control methods was underway and subsequent developments included those of generalized predictive control, and the whole armoury of MPC methods. Jacques Richalet's approach to PFC was to seek an algorithm that was: • easy to understand; • easy to install; • easy to tune and optimise. He sought a new modular control algorithm that could be readily used by the control-technician engineer or the control-instrument engineer. It goes without saying that this objective also forms a good market strategy.

This book is a printed edition of the Special Issue "New Directions on Model Predictive Control" that was published in *Mathematics*. This volume brings about the contemporary results in the field of discrete-time systems. It covers papers written on the topics of robust control, nonlinear systems and recent applications. Although the technical views are different, they all geared towards focusing on the up-to-date knowledge gain by the researchers and providing effective developments along the systems and control arena. Each topic has a detailed discussions and suggestions for future perusal by interested investigators.

This book contains the most sustained and serious attack on mainstream, neoclassical economics in more than forty years. Nelson and Winter focus their critique on the basic question of how firms and industries change overtime. They marshal significant objections to the fundamental neoclassical assumptions of profit maximization and market equilibrium, which they find ineffective in the analysis of technological innovation and the dynamics of competition among firms. To replace these assumptions, they borrow from biology the concept of natural selection to construct a precise and detailed evolutionary theory of business behavior. They grant that firms are motivated by profit and engage in search for ways of improving profits, but they do not consider them to be profit maximizing. Likewise, they emphasize the tendency for the more profitable firms to drive the less profitable ones out of business, but they do not focus their analysis on hypothetical states of industry equilibrium. The results of their new paradigm and analytical framework are impressive. Not only have they been able to develop more coherent and powerful models of competitive firm dynamics under conditions of growth and technological change, but their approach is compatible with findings in psychology and other social sciences. Finally, their work has important implications for welfare economics and for government policy toward industry.

The series *Advances in Industrial Control* aims to report and encourage technology transfer in control engineering. The rapid development of control technology has an impact on 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. The water and wastewater industry has undergone many changes in recent years. Of particular importance has been a renewed emphasis on improving resource management with tighter regulatory controls setting new targets on pricing, industry efficiency and loss reduction for both water and wastewater with more stringent environmental discharge conditions for wastewater. Meantime, the demand for water and wastewater services grows as the population increases and wishes for improved living conditions involving, among other items, domestic appliances that use water. Consequently, the installed infrastructure of the industry has to be continuously upgraded and extended, and employed more effectively to accommodate the new demands, both in throughput and in meeting the new regulatory conditions. Investment in fixed infrastructure is capital-intensive and slow to come on-stream. One outcome of these changes and demands is that the industry is examining the potential benefits of, and in many cases using, more advanced control systems.

27th European Symposium on Computer Aided Process Engineering, Volume 40 contains the papers presented at the 27th European Society of Computer-Aided Process Engineering (ESCAPE) event held in Barcelona, October 1-5, 2017. It is a valuable resource for chemical engineers, chemical process engineers, researchers in industry and academia, students, and consultants for chemical industries. Presents findings and discussions from the 27th European Society of Computer-Aided Process Engineering (ESCAPE) event

This book presents general methods for the design of economic model predictive control (EMPC) systems for broad classes of nonlinear systems that address key theoretical and practical considerations including recursive feasibility, closed-loop stability, closed-loop performance, and computational efficiency. Specifically, the book proposes: Lyapunov-based EMPC methods for nonlinear systems; two-tier EMPC architectures that are highly computationally efficient; and EMPC schemes handling explicitly uncertainty, time-varying cost functions, time-delays and multiple-time-scale dynamics. The proposed methods employ a variety of tools ranging from nonlinear systems analysis, through Lyapunov-based control techniques to nonlinear dynamic optimization. The applicability and performance of the proposed methods are demonstrated through a number of chemical process examples. The book presents state-of-the-art methods for the design of economic model predictive control systems for chemical processes. In addition to being mathematically rigorous, these methods accommodate key practical issues, for example, direct optimization of process economics, time-varying economic cost functions and computational efficiency. Numerous comments and remarks providing fundamental understanding of the merging of process economics and feedback control into a single framework are included. A control

engineer can easily tailor the many detailed examples of industrial relevance given within the text to a specific application. The authors present a rich collection of new research topics and references to significant recent work making Economic Model Predictive Control an important source of information and inspiration for academics and graduate students researching the area and for process engineers interested in applying its ideas.

Over the past few years significant progress has been achieved in the field of nonlinear model predictive control (NMPC), also referred to as receding horizon control or moving horizon control. More than 250 papers have been published in 2006 in ISI Journals. With this book we want to bring together the contributions of a diverse group of internationally well recognized researchers and industrial practitioners, to critically assess the current status of the NMPC field and to discuss future directions and needs. The book consists of selected papers presented at the International Workshop on Assessment and Future Directions of Nonlinear Model Predictive Control that took place from September 5 to 9, 2008, in Pavia, Italy.

This book highlights the latest achievements concerning the theory, methods and practice of fault diagnostics, fault tolerant systems and cyber safety. When considering the diagnostics of industrial processes and systems, increasingly important safety issues cannot be ignored. In this context, diagnostics plays a crucial role as a primary measure of the improvement of the overall system safety integrity level. Obtaining the desired diagnostic coverage or providing an appropriate level of inviolability of the integrity of a system is now practically inconceivable without the use of fault detection and isolation methods. Given the breadth and depth of its coverage, the book will be of interest to researchers faced with the challenge of designing technical and medical diagnosis systems, as well as junior researchers and students in the fields of automatic control, robotics, computer science and artificial intelligence.

This book uses systemic thinking and applies it to the study of financial crises. It systematically presents how the systemic yoyo model, its thinking logic, and its methodology can be employed as a common playground and intuition to the study of money, international finance, and economic reforms. This book establishes theoretical backings for why some of the most employed interferences of the market and empirical experiences actually work. It has become urgent for economists and policy makers to understand how international speculative capital affects the economic security of various nations. By looking at the issues of monetary movement around the world, this book shows that there are clearly visible patterns behind the flows of capital, and that there are a uniform language and logic of reasoning that can be powerfully employed in the studies of international finance. As shown in this book, many of the conclusions drawn on the basis of these visible patterns, language, and logic of thinking can be practically applied to produce tangible economic benefits. *Currency Wars: Offense and Defense through Systemic Thinking* is divided into six parts. The first part addresses issues related to systemic modeling of economic entities and processes and explains how a few policy changes can adjust the performance of the extremely complex economy. Part II of the book investigates the problem of how instabilities lead to opportunities for currency attacks, the positive and negative effects of foreign capital, and how international capital flows can cause disturbances of various degrees on a nation's economic security. Part III examines how a currency war is initiated, why currency conflicts and wars are inevitable, and a specific way of how currency attacks can take place. In Part IV, the book shows how one nation can potential defend itself by manipulating exchange rate of its currency, how the nation under siege can protect itself against financial attacks by using strategies based on the technique of feedback, and develops a more general approach of self-defense. Part V focuses on issues related to the cleanup of the disastrous aftermath of currency attacks through using policies and reforms. Finally the book concludes in Part VI as it analyzes specific real-life cases and addresses the ultimate problem of whether or not currency wars can be avoided all together.

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