Design And Implementation Of Model Predictive Control

Xin Lin

Design And Implementation Of Model Predictive Control:

   Model Predictive Control System Design and Implementation Using MATLAB® Liuping Wang,2009-02-14 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   *Incremental Model Predictive Control System Design and Implementation Using MATLAB/Simulink* Xin Lin,2013 The integral and model predictive controller MPC drive controlled outputs to their desired targets and this thesis addresses the problem of integral controller incremental and integral MPC when tracking the constant or inconstant references Design and implementation of the MPC under MATLAB Simulink environment are discussed both in incremental and integral form Also one CSTR example is presented to compare the control performances among different integral controller and MPCs   *Learning-based Model Predictive Control with closed-loop guarantees* Raffaele Soloperto,2023-11-13 The performance of model predictive control MPC largely depends on the accuracy of the prediction model and of the constraints the system is subject to However obtaining an accurate knowledge of these elements might be expensive in terms of money and resources if at all possible In this thesis we develop novel learning based MPC frameworks that actively incentivize learning of the underlying system dynamics and of the constraints while ensuring recursive feasibility constraint satisfaction and performance bounds for the closed loop In the first part we focus on the case of inaccurate models and analyze learning based MPC schemes that include in addition to the primary cost a learning cost that aims at generating informative data by inducing excitation in the system In particular we first propose a nonlinear MPC framework that ensures desired performance bounds for the resulting closed loop and then we focus on linear systems subject to uncertain parameters and noisy output measurements In order to ensure that the desired learning phase occurs in closed loop operations we then propose an MPC framework that is able to guarantee closed loop learning of the controlled system In the last part of the thesis we investigate the scenario where the system is known but evolves in a partially unknown environment In such a setup we focus on a learning based MPC scheme that incentivizes safe exploration if and only if this might yield to a performance improvement   *Design and Implementation of Model Predictive Control Algorithms for Small Satellite Three-axis Stabilization* Chen, Xi,2011   **Uncertainty in Mechanical Engineering** Holger

Hanselka,Peter Groche,Roland Platz,2011-09-27 Selected peer reviewed papers from the 1st International Conference on Uncertainty in Mechanical Engineering ICUME 2011 November 14 15 2011 Darmstadt Germany **Model Predictive Control of Wind Energy Conversion Systems** Venkata Yaramasu,Bin Wu,2016-11-23 Model Predictive Control of Wind Energy Conversion Systems addresses the predicative control strategy that has emerged as a promising digital control tool within the field of power electronics variable speed motor drives and energy conversion systems The authors provide a comprehensive analysis on the model predictive control of power converters employed in a wide variety of variable speed wind energy conversion systems WECS The contents of this book includes an overview of wind energy system configurations power converters for variable speed WECS digital control techniques MPC modeling of power converters and wind generators for MPC design Other topics include the mapping of continuous time models to discrete time models by various exact approximate and quasi exact discretization methods modeling and control of wind turbine grid side two level and multilevel voltage source converters The authors also focus on the MPC of several power converter configurations for full variable speed permanent magnet synchronous generator based WECS squirrel cage induction generator based WECS and semi variable speed doubly fed induction generator based WECS Furthermore this book Analyzes a wide variety of practical WECS illustrating important concepts with case studies simulations and experimental results Provides a step by step design procedure for the development of predictive control schemes for various WECS configurations Describes continuous and discrete time modeling of wind generators and power converters weighting factor selection discretization methods and extrapolation techniques Presents useful material for other power electronic applications such as variable speed motor drives power quality conditioners electric vehicles photovoltaic energy systems distributed generation and high voltage direct current transmission Explores S Function Builder programming in MATLAB environment to implement various MPC strategies through the companion website Reflecting the latest technologies in the field Model Predictive Control of Wind Energy Conversion Systems is a valuable reference for academic researchers practicing engineers and other professionals It can also be used as a textbook for graduate level and advanced undergraduate courses **Moving Horizon Strategies for the Constrained Monitoring and Control of Nonlinear Discrete-time Systems** Christopher V. Rao,2000 *Predictive Control in Process Engineering* Robert Haber,Ruth Bars,Ulrich Schmitz,2012-09-19 Describing the principles and applications of single input single output and multivariable predictive control in a simple and lively manner this practical book discusses topics such as the handling of on off control nonlinearities and numerical problems It gives guidelines and methods for reducing the computational demand for real time applications With its many examples and several case studies incl injection molding machine and waste water treatment and industrial applications stripping column distillation column furnace this is invaluable reading for students and engineers who would wish to understand and apply predictive control in a wide variety of process engineering application areas **Model Predictive Control Enabling Flexible Operation of Data**

Centers Tianyou Shao,2018-02-21 Master s Thesis from the year 2017 in the subject Engineering Power Engineering grade 2 0 RWTH Aachen University Institute for Automation of Complex Power Systems language English abstract To rise to the challenge of the growing number of distributed Renewable Energy Sources RES for grid integration Ancillary Service AS is increasingly crucial to maintaining the stability of power grid worldwide In recent years discussions about Data Centers DCs no longer limit to their energy efficiency Considering the rising rigid demand from ICT customer and the high energy demand of DC it is possible for DC to be one of Demand Response DR resources providing ASs in the smart grid This thesis presents an online energy aware scheduling algorithm based on Model Predictive Control MPC which realizes a proper adjustment of DC power demand enabling the flexible operation of DC The present work focuses on the identification and implementation of an MPC strategy which aims at a proper scheduling for DC which makes the total power consumption of DC flexible to track the reference signal in a DR context It is demonstrated how the combination and interaction of the components under DC architecture can be utilized to achieve the realizable potential of operational flexibility for AS Numerical simulation results have been carried out aimed at the later application in real pilot DCs Furthermore the capacity of resisting disturbance of this MPC approach has been discussed **Towards Autonomous Robotic Systems** Lyuba Alboul,Dana Damian,Jonathan M. Aitken,2016-06-24 This book constitutes the refereed proceedings of the 17th Annual Conference on Towards Autonomous Robotics TAROS 2016 held in Sheffield UK in June July 2016 The 23 revised full papers presented together with 15 short papers were carefully reviewed and selected from 56 submissions The overall program covers various aspects of robotics including navigation planning sensing and perception flying and swarm robots ethics humanoid robotics human robot interaction and social robotics **Advanced Control in Computer Integrated Manufacturing** Henry M. Morris,E. J. Kompass,Theodore Joseph Williams,1987 **AIChE Symposium Series** American Institute of Chemical Engineers,1997 **Fundamental Process Control** David M. Prett,Carlos E. García,1988 Presents a unifying theoretical framework that includes real practical issues such as process constraints and model errors Modern process control methodologies are compared in light of this framework to allow the development of a new design methodology for controllers Written for control design experts and graduate level students Annotation copyrighted by Book News Inc Portland OR The Proceedings of the Third IEEE Conference on Control Applications, August 24th-26th, 1994, Venue, the University of Strathclyde, Glasgow, Scotland, UK IEEE Control Systems Society,1994 **The Proceedings of the Third IEEE Conference on Control Applications** IEEE Control Systems Society,1994 Predictive Control for Linear and Hybrid Systems Francesco Borrelli,Alberto Bemporad,Manfred Morari,2017-06-22 Model Predictive Control MPC the dominant advanced control approach in industry over the past twenty five years is presented comprehensively in this unique book With a simple unified approach and with attention to real time implementation it covers predictive control theory including the stability feasibility and robustness of MPC controllers The theory of explicit MPC where the nonlinear

optimal feedback controller can be calculated efficiently is presented in the context of linear systems with linear constraints switched linear systems and more generally linear hybrid systems Drawing upon years of practical experience and using numerous examples and illustrative applications the authors discuss the techniques required to design predictive control laws including algorithms for polyhedral manipulations mathematical and multiparametric programming and how to validate the theoretical properties and to implement predictive control policies The most important algorithms feature in an accompanying free online MATLAB toolbox which allows easy access to sample solutions Predictive Control for Linear and Hybrid Systems is an ideal reference for graduate postgraduate and advanced control practitioners interested in theory and or implementation aspects of predictive control **Automatic Control World Congress, 1987** International Federation of Automatic Control. World Congress,Rolf Isermann,1988 Contains 60 research and survey papers on power systems analysis modelling simulation control optimization coordination and multilever control Basic industry systems analysis modelling simulation and measurement filtering Chemical systems analysis modelling simulation control robust and adaptive control optimization coordination and multilever control <u>Chemical Process Control-VI</u> James Blake Rawlings,Babatunde Ayodeji Ogunnaike,John W. Eaton,2002 Electronic version of the proceedings and papers of the conference along with an ISO9660 file system with Rock Ridge attributes **Handbook of Model Predictive Control** Saša V. Raković,William S. Levine,2018-09-01 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 **Explicit Nonlinear Model Predictive Control** Alexandra Grancharova,Tor Arne Johansen,2012-03-22 Nonlinear Model Predictive Control NMPC has become the accepted methodology to solve complex control problems related to process industries The main motivation behind explicit NMPC is that an explicit state feedback law avoids the need for executing a numerical optimization algorithm in real time The benefits of an explicit solution in addition to the efficient on line computations include also verifiability of the implementation and the possibility to design embedded control systems with low software and

hardware complexity This book considers the multi parametric Nonlinear Programming mp NLP approaches to explicit approximate NMPC of constrained nonlinear systems developed by the authors as well as their applications to various NMPC problem formulations and several case studies The following types of nonlinear systems are considered resulting in different NMPC problem formulations Nonlinear systems described by first principles models and nonlinear systems described by black box models Nonlinear systems with continuous control inputs and nonlinear systems with quantized control inputs Nonlinear systems without uncertainty and nonlinear systems with uncertainties polyhedral description of uncertainty and stochastic description of uncertainty Nonlinear systems consisting of interconnected nonlinear sub systems The proposed mp NLP approaches are illustrated with applications to several case studies which are taken from diverse areas such as automotive mechatronics compressor control combustion plant control reactor control pH maintaining system control cart and spring system control and diving computers

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