A Function Approximation Approach for Parametric Optimization

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Sergejs Rogovs

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Abstract

We present a novel approach for approximating the primal and dual parameter dependent solution functions of parametric optimization problems. We start with an equation reformulation of the first order necessary optimality conditions. Then, we replace the primal and dual solutions with some approximating functions and find for some test parameters optimal coefficients as solution of a single nonlinear least-squares problem. Under mild assumptions it can be shown that stationary points are global minima and that the function approximations interpolate the solution functions at all test parameters. Further, we have a cheap function evaluation criteria to estimate the approximation error. Finally, we present some preliminary numerical results showing the viability of our approach.

Keywords: Parametric Optimization, Function Approximation, Radial Basis Functions, Nonlinear Least-Squares Problem, Global Minima.

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Parametric Optimization And Approximation

Annelies Wilder-Smith

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    Parametric Optimization and Approximation F. Brosowski,1985-04-01   **Parametric Optimization and Approximation** PARAMETRIC,BROSOWSKI,DEUTSCH,2013-11-21   **Parametric Optimization and Approximation** PARAMETRIC,BROSOWSKI,DEUTSCH,1985-01-01   <u>Parametric Optimization and Related Topics</u> Jürgen Guddat,Hubertus Th. Jongen,Bernd Kummer,František Nožička,1987-12-31 No detailed description available for Parametric Optimization and Related Topics   <u>Multi-parametric Optimization and Control</u> Efstratios N. Pistikopoulos,Nikolaos A. Diangelakis,Richard Oberdieck,2020-11-24 Recent developments in multi parametric optimization and control Multi Parametric Optimization and Control provides comprehensive coverage of recent methodological developments for optimal model based control through parametric optimization It also shares real world research applications to support deeper understanding of the material Researchers and practitioners can use the book as reference It is also suitable as a primary or a supplementary textbook Each chapter looks at the theories related to a topic along with a relevant case study Topic complexity increases gradually as readers progress through the chapters The first part of the book presents an overview of the state of the art multi parametric optimization theory and algorithms in multi parametric programming The second examines the connection between multi parametric programming and model predictive control from the linear quadratic regulator over hybrid systems to periodic systems and robust control The third part of the book addresses multi parametric optimization in process systems engineering A step by step procedure is introduced for embedding the programming within the system engineering which leads the reader into the topic of the PAROC framework and software platform PAROC is an integrated framework and platform for the optimization and advanced model based control of process systems Uses case studies to illustrate real world applications for a better understanding of the concepts presented Covers the fundamentals of optimization and model predictive control Provides information on key topics such as the basic sensitivity theorem linear programming quadratic programming mixed integer linear programming optimal control of continuous systems and multi parametric optimal control An appendix summarizes the history of multi parametric optimization algorithms It also covers the use of the parametric optimization toolbox POP which is comprehensive software for efficiently solving multi parametric programming problems   **Approximation Methods for Multiobjective and Parametric Optimization Problems** Arne Herzel,2022   **Non-Linear Parametric Optimization** BANK,GUDDAT,KLATTE,KUMMER,TAMMER,2013-12-21   **Parametric Optimization and Related Topics** ,1991   *Parametric Optimization and Related Topics III* Jürgen Guddat,1993 This volume contains the proceedings of the third conference on Parametric Optimization and Related Topics held in Gustrow from 30 August until 5 September 1991 Parametric optimization as a part of mathematical programming investigates the behaviour of solutions to optimization problems under data pertubations This behaviour like continuity and differentiability plays a fundamental role for a series of further questions that are of interest from a practical as well as a theoretical point of

view Many relations to other disciplines of operations research like stochastic programming modelbuilding numerical methods multiobjective optimization and optimal control originate from this behaviour The presented articles all refereed are topical and original papers reflecting recent results to current directions of research in theory and applications

Computing and Combinatorics Ding-Zhu Du,Zhenhua Duan,Cong Tian,2019-07-24 This book constitutes the proceedings of the 25th International Conference on Computing and Combinatorics COCOON 2019 held in Xi an China in July 2019 The 55 papers presented in this volume were carefully reviewed and selected from 124 submissions The papers cover various topics including algorithm design approximation algorithm graph theory complexity theory problem solving optimization computational biology computational learning communication network logic and game theory **Parametric Optimization** Jürgen Guddat,F. Guerra Vazquez,Hubertus Th. Jongen,1990-12-21 Explores optimization problems in which some or all of the individual data involved depends on one parameter Beginning with a preliminary survey of solution algorithms in one parametric optimization the text moves on to examine the pathfollowing curves of local minimizers pathfollowing along a connected component in the Karush Kuhn Tucker set and in the critical set pathfollowing in the set of local minimizers and in the set of critical points In addition practical applications are included *Nonlinear Parameter Optimization Using R Tools* John C. Nash,2014-05-27 Nonlinear Parameter Optimization Using R John C Nash Telfer School of Management University of Ottawa Canada A systematic and comprehensive treatment of optimization software using R In recent decades optimization techniques have been streamlined by computational and artificial intelligence methods to analyze more variables especially under non linear multivariable conditions more quickly than ever before Optimization is an important tool for decision science and for the analysis of physical systems used in engineering Nonlinear Parameter Optimization with R explores the principal tools available in R for function minimization optimization and nonlinear parameter determination and features numerous examples throughout Nonlinear Parameter Optimization with R Provides a comprehensive treatment of optimization techniques Examines optimization problems that arise in statistics and how to solve them using R Enables researchers and practitioners to solve parameter determination problems Presents traditional methods as well as recent developments in R Is supported by an accompanying website featuring R code examples and datasets Researchers and practitioners who have to solve parameter determination problems who are users of R but are novices in the field optimization or function minimization will benefit from this book It will also be useful for scientists building and estimating nonlinear models in various fields such as hydrology sports forecasting ecology chemical engineering pharmaco kinetics agriculture economics and statistics **Proceedings of the Second International Colloquium on Numerical Analysis** D. Bainov,V. Covachev,2020-05-18 No detailed description available for Proceedings of the Second International Colloquium on Numerical Analysis *Smart Manufacturing* Masoud Soroush,Michael Baldea,Thomas F. Edgar,2020-08-04 Research efforts in the past ten years have led to considerable advances in the concepts and methods of smart manufacturing

Smart Manufacturing Concepts and Methods puts these advances in perspective showing how process industries can benefit from these new techniques The book consolidates results developed by leading academic and industrial groups in the area providing a systematic comprehensive coverage of conceptual and methodological advances made to date Written by leaders in the field from around the world Smart Manufacturing Concepts and Methods is essential reading for graduate students researchers process engineers and managers It is complemented by a companion book titled Smart Manufacturing Applications and Case Studies which covers the applications of smart manufacturing concepts and methods in process industries and beyond Takes a process systems engineering approach to design monitoring and control of smart manufacturing systems Brings together the key concepts and methods of smart manufacturing including the advances made in the past decade Includes coverage of computation methods for process optimization control and safety as well as advanced modelling techniques   *Parameterized and Exact Computation* Hans L. Bodlaender,2006-09-12 Here are the refereed proceedings of the Second International Workshop on Parameterized and Exact Computation IWPEC 2006 held in the context of the combined conference ALGO 2006 The book presents 23 revised full papers together with 2 invited lectures Coverage includes research in all aspects of parameterized and exact computation and complexity including new techniques for the design and analysis of parameterized and exact algorithms parameterized complexity theory and more   Encyclopedia of Operations Research and Management Science Saul I. Gass,Carl M. Harris,2012-12-06 Operations Research 1934 1941 35 1 143 152 British The goal of the Encyclopedia of Operations Research and Operational Research in World War II 35 3 453 470 Management Science is to provide to decision makers and U S Operations Research in World War II 35 6 910 925 problem solvers in business industry government and and the 1984 article by Harold Lardner that appeared in academia a comprehensive overview of the wide range of Operations Research The Origin of Operational Research ideas methodologies and synergistic forces that combine to 32 2 465 475 form the preeminent decision aiding fields of operations re search and management science OR MS To this end we The Encyclopedia contains no entries that define the fields enlisted a distinguished international group of academics of operations research and management science OR and MS and practitioners to contribute articles on subjects for are often equated to one another If one defines them by the which they are renowned methodologies they employ the equation would probably The editors working with the Encyclopedia s Editorial stand inspection If one defines them by their historical Advisory Board surveyed and divided OR MS into specific developments and the classes of problems they encompass topics that collectively encompass the foundations applica the equation becomes fuzzy The formalism OR grew out of tions and emerging elements of this ever changing field We the operational problems of the British and U s military also wanted to establish the close associations that OR MS efforts in World War II   **Pareto Optimality, Game Theory and Equilibria** Panos M. Pardalos,A. Migdalas,Leonidas Pitsoulis,2008-07-02 This comprehensive work examines important recent developments and modern applications in the fields of optimization control

game theory and equilibrium programming In particular the concepts of equilibrium and optimality are of immense practical importance affecting decision making problems regarding policy and strategies and in understanding and predicting systems in different application domains ranging from economics and engineering to military applications The book consists of 29 survey chapters written by distinguished researchers in the above areas OCM 2025 - 7th International Conference on Optical Characterization of Materials, March 26th – 27th, 2025, Karlsruhe, Germany : Conference Proceedings Beyerer, Jürgen,Längle, Thomas,Heizmann, Michael ,2025-04-07 The state of the art in the optical characterization of materials is advancing rapidly New insights have been gained into the theoretical foundations of this research and exciting developments have been made in practice driven by new applications and innovative sensor technologies that are constantly evolving The great success of past conferences proves the necessity of a platform for presentation discussion and evaluation of the latest research results in this interdisciplinary field *Advances in Automation* Andrey A. Radionov,Alexander S. Karandaev,2020-02-18 This book reports on innovative research and developments in automation The chapters spans a wide range of disciplines including communication engineering power engineering control engineering instrumentation signal processing and cybersecurity Emphasis is given to methods and findings aimed at fostering better control and monitoring of industrial and manufacturing processes and improving safety Based on the International Russian Automation Conference held in September 8 14 2019 in Sochi Russia the book provides academics and professionals with a timely overview and extensive information on the state of the art in the field of automation and control systems and is expected to foster new idea as well as collaboration between different groups in different countries Adaptive Control, Filtering, and Signal Processing K.J. Aström,G.C. Goodwin,P.R. Kumar,2012-12-06 The area of adaptive systems which encompasses recursive identification adaptive control filtering and signal processing has been one of the most active areas of the past decade Since adaptive controllers are fundamentally nonlinear controllers which are applied to nominally linear possibly stochastic and time varying systems their theoretical analysis is usually very difficult Nevertheless over the past decade much fundamental progress has been made on some key questions concerning their stability convergence performance and robustness Moreover adaptive controllers have been successfully employed in numerous practical applications and have even entered the marketplace

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