

Panos M. Pardalos
Editor

Parallel Processing of Discrete Problems



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Parallel Processing Of Discrete Problems

Ivan V. Sergienko



Parallel Processing Of Discrete Problems:

Parallel Processing of Discrete Problems Panos M. Pardalos, 1999 In the past two decades breakthroughs in computer technology have made a tremendous impact on optimization In particular availability of parallel computers has created substantial interest in exploring the use of parallel processing for solving discrete and global optimization problems The chapters in this volume cover a broad spectrum of recent research in parallel processing of discrete and related problems The topics discussed include distributed branch and bound algorithms parallel genetic algorithms for large scale discrete problems simulated annealing parallel branch and bound search under limited memory constraints parallelization of greedy randomized adaptive search procedures parallel optimal models of computing randomized parallel algorithms general techniques for the design of parallel discrete algorithms parallel algorithms for the solution of quadratic assignment and satisfiability problems The book will be a valuable source of information to faculty students and researchers in combinatorial optimization and related areas

Parallel Processing for Scientific Computing Michael A. Heroux, Padma Raghavan, Horst D. Simon, 2006-01-01 Scientific computing has often been called the third approach to scientific discovery emerging as a peer to experimentation and theory Historically the synergy between experimentation and theory has been well understood experiments give insight into possible theories theories inspire experiments experiments reinforce or invalidate theories and so on As scientific computing has evolved to produce results that meet or exceed the quality of experimental and theoretical results it has become indispensable Parallel processing has been an enabling technology in scientific computing for more than 20 years This book is the first in depth discussion of parallel computing in 10 years it reflects the mix of topics that mathematicians computer scientists and computational scientists focus on to make parallel processing effective for scientific problems Presently the impact of parallel processing on scientific computing varies greatly across disciplines but it plays a vital role in most problem domains and is absolutely essential in many of them Parallel Processing for Scientific Computing is divided into four parts The first concerns performance modeling analysis and optimization the second focuses on parallel algorithms and software for an array of problems common to many modeling and simulation applications the third emphasizes tools and environments that can ease and enhance the process of application development and the fourth provides a sampling of applications that require parallel computing for scaling to solve larger and realistic models that can advance science and engineering This edited volume serves as an up to date reference for researchers and application developers on the state of the art in scientific computing It also serves as an excellent overview and introduction especially for graduate and senior level undergraduate students interested in computational modeling and simulation and related computer science and applied mathematics aspects Contents List of Figures List of Tables Preface Chapter 1 Frontiers of Scientific Computing An Overview Part I Performance Modeling Analysis and Optimization Chapter 2 Performance Analysis From Art to Science Chapter 3 Approaches to Architecture Aware Parallel Scientific Computation Chapter 4 Achieving High

Performance on the BlueGene L Supercomputer Chapter 5 Performance Evaluation and Modeling of Ultra Scale Systems Part II Parallel Algorithms and Enabling Technologies Chapter 6 Partitioning and Load Balancing Chapter 7 Combinatorial Parallel and Scientific Computing Chapter 8 Parallel Adaptive Mesh Refinement Chapter 9 Parallel Sparse Solvers Preconditioners and Their Applications Chapter 10 A Survey of Parallelization Techniques for Multigrid Solvers Chapter 11 Fault Tolerance in Large Scale Scientific Computing Part III Tools and Frameworks for Parallel Applications Chapter 12 Parallel Tools and Environments A Survey Chapter 13 Parallel Linear Algebra Software Chapter 14 High Performance Component Software Systems Chapter 15 Integrating Component Based Scientific Computing Software Part IV Applications of Parallel Computing Chapter 16 Parallel Algorithms for PDE Constrained Optimization Chapter 17 Massively Parallel Mixed Integer Programming Chapter 18 Parallel Methods and Software for Multicomponent Simulations Chapter 19 Parallel Computational Biology Chapter 20 Opportunities and Challenges for Parallel Computing in Science and Engineering Index

Parallel Processing of Discrete Problems Panos M. Pardalos, 2011-09-26 In the past two decades breakthroughs in computer technology have made a tremendous impact on optimization In particular availability of parallel computers has created substantial interest in exploring the use of parallel processing for solving discrete and global optimization problems The chapters in this volume cover a broad spectrum of recent research in parallel processing of discrete and related problems The topics discussed include distributed branch and bound algorithms parallel genetic algorithms for large scale discrete problems simulated annealing parallel branch and bound search under limited memory constraints parallelization of greedy randomized adaptive search procedures parallel optical models of computing randomized parallel algorithms general techniques for the design of parallel discrete algorithms parallel algorithms for the solution of quadratic assignment and satisfiability problems The book will be a valuable source of information to faculty students and researchers in combinatorial optimization and related areas

Nonlinear Assignment Problems Panos M. Pardalos, L.S. Pitsoulis, 2013-03-09

Nonlinear Assignment Problems NAPs are natural extensions of the classic Linear Assignment Problem and despite the efforts of many researchers over the past three decades they still remain some of the hardest combinatorial optimization problems to solve exactly The purpose of this book is to provide in a single volume major algorithmic aspects and applications of NAPs as contributed by leading international experts The chapters included in this book are concerned with major applications and the latest algorithmic solution approaches for NAPs Approximation algorithms polyhedral methods semidefinite programming approaches and heuristic procedures for NAPs are included while applications of this problem class in the areas of multiple target tracking in the context of military surveillance systems of experimental high energy physics and of parallel processing are presented Audience Researchers and graduate students in the areas of combinatorial optimization mathematical programming operations research physics and computer science

Parallel Algorithms For Knapsack Type Problems Vassil N Aleksandrov, G M Megson, 1999-06-01 This book brings together current research

direction in the mapping of dynamic programming recurrence equations for Knapsack Type problems which include Unbounded Knapsack Problem 0 1 Knapsack Problem Subset Sum Problem Change Making Problem onto so called regular parallel architectures In particular it focuses on heuristic and more formal techniques for mapping The text is based on substantially revised papers published by the authors and their colleagues in the literature but re written to provide an overall view of the subject area

Satisfiability Problem Dingzhu Du,Jun Gu,Panos M. Pardalos,1997-01-01 The satisfiability SAT problem is central in mathematical logic computing theory and many industrial applications There has been a strong relationship between the theory the algorithms and the applications of the SAT problem This book aims to bring together work by the best theorists algorithmists and practitioners working on the sat problem and on industrial applications as well as to enhance the interaction between the three research groups The book features the applications of theoretical algorithmic results to practical problems and presents practical examples for theoretical algorithmic study Major topics covered in the book include practical and industrial SAT problems and benchmarks significant case studies and applications of the SAT problem and SAT algorithms new algorithms and improved techniques for satisfiability testing specific data structures and implementation details of the SAT algorithms and the theoretical study of the SAT problem and SAT algorithms

Encyclopedia of Optimization Christodoulos A. Floudas,Panos M. Pardalos,2008-09-04 The goal of the Encyclopedia of Optimization is to introduce the reader to a complete set of topics that show the spectrum of research the richness of ideas and the breadth of applications that has come from this field The second edition builds on the success of the former edition with more than 150 completely new entries designed to ensure that the reference addresses recent areas where optimization theories and techniques have advanced Particularly heavy attention resulted in health science and transportation with entries such as Algorithms for Genomics Optimization and Radiotherapy Treatment Design and Crew Scheduling

Handbook of Metaheuristics Michel Gendreau,Jean-Yves Potvin,2018-09-20 The third edition of this handbook is designed to provide a broad coverage of the concepts implementations and applications in metaheuristics The book s chapters serve as stand alone presentations giving both the necessary underpinnings as well as practical guides for implementation The nature of metaheuristics invites an analyst to modify basic methods in response to problem characteristics past experiences and personal preferences and the chapters in this handbook are designed to facilitate this process as well This new edition has been fully revised and features new chapters on swarm intelligence and automated design of metaheuristics from flexible algorithm frameworks The authors who have contributed to this volume represent leading figures from the metaheuristic community and are responsible for pioneering contributions to the fields they write about Their collective work has significantly enriched the field of optimization in general and combinatorial optimization in particular Metaheuristics are solution methods that orchestrate an interaction between local improvement procedures and higher level strategies to create a process capable of escaping from local optima and performing a robust search of a solution

space In addition many new and exciting developments and extensions have been observed in the last few years Hybrids of metaheuristics with other optimization techniques like branch and bound mathematical programming or constraint programming are also increasingly popular On the front of applications metaheuristics are now used to find high quality solutions to an ever growing number of complex ill defined real world problems in particular combinatorial ones This handbook should continue to be a great reference for researchers graduate students as well as practitioners interested in metaheuristics

Parallel Processing for Scientific Computing G. Rodrigue, Society for Industrial and Applied Mathematics, 1989-01-01 Mathematics of Computing Parallelism

Parallel Computations Garry Rodrigue, 2014-05-10 Parallel Computations focuses on parallel computation with emphasis on algorithms used in a variety of numerical and physical applications and for many different types of parallel computers Topics covered range from vectorization of fast Fourier transforms FFTs and of the incomplete Cholesky conjugate gradient ICCG algorithm on the Cray 1 to calculation of table lookups and piecewise functions Single tridiagonal linear systems and vectorized computation of reactive flow are also discussed Comprised of 13 chapters this volume begins by classifying parallel computers and describing techniques for performing matrix operations on them The reader is then introduced to FFTs and the tridiagonal linear system as well as the ICCG method Different versions of the conjugate gradient method for solving the time dependent diffusion equation are considered Subsequent chapters deal with two and three dimensional fluid flow calculations paying particular attention to the principal issues in designing efficient numerical methods for hydrodynamic calculations the decisions that a numerical modeler must make to optimize chemically reactive flow simulations and how to handle disk to core data transfer and storage allocation for the solution of the implicit equations for three dimensional flows The book also describes the time split finite difference scheme for solving the two dimensional Navier Stokes equation for flows through slotted nozzles Finally the large scale stimulation of plasmas as carried out on a small computer with an array processor is discussed This monograph should be of interest to specialists in computer science

Handbook of Metaheuristics Fred W. Glover, Gary A. Kochenberger, 2006-04-11 Metaheuristics in their original definition are solution methods that orchestrate an interaction between local improvement procedures and higher level strategies to create a process capable of escaping from local optima and performing a robust search of a solution space Over time these methods have also come to include any procedures that employ strategies for overcoming the trap of local optimality in complex solution spaces especially those procedures that utilize one or more neighborhood structures as a means of defining admissible moves to transition from one solution to another or to build or destroy solutions in constructive and destructive processes The degree to which neighborhoods are exploited varies according to the type of procedure In the case of certain population based procedures such as genetic algorithms neighborhoods are implicitly and somewhat restrictively defined by reference to replacing components of one solution with those of another by variously chosen rules of exchange popularly given the name of crossover In other population based

methods based on the notion of path relinking neighborhood structures are used in their full generality including constructive and destructive neighborhoods as well as those for transitioning between complete solutions Certain hybrids of classical evolutionary approaches which link them with local search also use neighborhood structures more fully though apart from the combination process itself **Handbook of Combinatorial Optimization** Ding-Zhu Du, Panos M.

Pardalos, 2013-12-01 Combinatorial or discrete optimization is one of the most active fields in the interface of operations research computer science and applied mathematics Combinatorial optimization problems arise in various applications including communications network design VLSI design machine vision air line crew scheduling corporate planning computer aided design and manufacturing database query design cellular telephone frequency assignment constraint directed reasoning and computational biology Furthermore combinatorial optimization problems occur in many diverse areas such as linear and integer programming graph theory artificial intelligence and number theory All these problems when formulated mathematically as the minimization or maximization of a certain function defined on some domain have a commonality of discreteness Historically combinatorial optimization starts with linear programming Linear programming has an entire range of important applications including production planning and distribution personnel assignment finance allocation of economic resources circuit simulation and control systems Leonid Kantorovich and Tjalling Koopmans received the Nobel Prize 1975 for their work on the optimal allocation of resources Two important discoveries the ellipsoid method 1979 and interior point approaches 1984 both provide polynomial time algorithms for linear programming These algorithms have had a profound effect in combinatorial optimization Many polynomial time solvable combinatorial optimization problems are special cases of linear programming e.g. matching and maximum flow In addition linear programming relaxations are often the basis for many approximation algorithms for solving NP hard problems e.g. dual heuristics **Vector and Parallel**

Processing - VECPAR 2000 Jose M.L.M. Palma, Jack Dongarra, Vicente Hernandez, 2003-06-29 This book is the final outcome of VECPAR 2000 4th International Meeting on Vector and Parallel Processing VECPAR constitutes a series of conferences which have been organized by the Faculty of Engineering of the University of Porto since 1993 with the main objective of disseminating new knowledge on parallel computing Readership of This Book The book is aimed at an audience of researchers and graduate students in a broad range of scientific areas including not only computer science but also applied mathematics and numerical analysis physics and engineering Book Plan From a total of 66 papers selected on the basis of extended abstracts for presentation at the conference a subset of 34 papers were chosen during a second review process leading to their inclusion in the book together with the invited talks The book contains a total of 40 papers organized into 6 chapters where each may appeal to people in different but still related scientific areas All chapters with the exception of Chapter 6 are initiated by a short text providing a quick overview of the organization and papers in the chapter The 13 papers in Chapter 1 cover the aspects related to the use of multiple processors Operating systems languages and software tools for

scheduling and code transformation are the topics included in this chapter initiated by the talk on computing over the Internet entitled Grid Computing by Ian Foster

Methods of Optimization and Systems Analysis for Problems of Transcomputational Complexity Ivan V. Sergienko, 2012-07-27 This work presents lines of investigation and scientific achievements of the Ukrainian school of optimization theory and adjacent disciplines These include the development of approaches to mathematical theories methodologies methods and application systems for the solution of applied problems in economy finances energy saving agriculture biology genetics environmental protection hardware and software engineering information protection decision making pattern recognition self adapting control of complicated objects personnel training etc The methods developed include sequential analysis of variants nondifferential optimization stochastic optimization discrete optimization mathematical modeling econometric modeling solution of extremum problems on graphs construction of discrete images and combinatorial recognition etc Some of these methods became well known in the world's mathematical community and are now known as classic methods

Encyclopedia of Microcomputers Allen Kent, James G. Williams, 1993-11-18 The Encyclopedia of Microcomputers serves as the ideal companion reference to the popular Encyclopedia of Computer Science and Technology Now in its 10th year of publication this timely reference work details the broad spectrum of microcomputer technology including microcomputer history explains and illustrates the use of microcomputers throughout academe business government and society in general and assesses the future impact of this rapidly changing technology

Handbook of Multisensor Data Fusion Martin Liggins II, David Hall, James Llinas, 2017-01-06 In the years since the bestselling first edition fusion research and applications have adapted to service oriented architectures and pushed the boundaries of situational modeling in human behavior expanding into fields such as chemical and biological sensing crisis management and intelligent buildings Handbook of Multisensor Data Fusion Theory and Practice Second Edition represents the most current concepts and theory as information fusion expands into the realm of network centric architectures It reflects new developments in distributed and detection fusion situation and impact awareness in complex applications and human cognitive concepts With contributions from the world's leading fusion experts this second edition expands to 31 chapters covering the fundamental theory and cutting edge developments that are driving this field New to the Second Edition Applications in electromagnetic systems and chemical and biological sensors Army command and combat identification techniques Techniques for automated reasoning Advances in Kalman filtering Fusion in a network centric environment Service oriented architecture concepts Intelligent agents for improved decision making Commercial off the shelf COTS software tools From basic information to state of the art theories this second edition continues to be a unique comprehensive and up to date resource for data fusion systems designers

Emergent Computing Methods in Engineering Design D.E. Grierson, P. Hajela, 1996-06-18 The papers in this book show the tremendous potential of emerging computing paradigms such as genetic algorithms evolutionary computing and neural networks for solving problems of engineering

design **Handbook of combinatorial optimization** Dingzhu Du, Panos M. Pardalos, 1998-12-15 Combinatorial or discrete optimization is one of the most active fields in the interface of operations research computer science and applied mathematics Combinatorial optimization problems arise in various applications including communications network design VLSI design machine vision air line crew scheduling corporate planning computer aided design and manufacturing database query design cellular telephone frequency assignment constraint directed reasoning and computational biology Furthermore combinatorial optimization problems occur in many diverse areas such as linear and integer programming graph theory artificial intelligence and number theory All these problems when formulated mathematically as the minimization or maximization of a certain function defined on some domain have a commonality of discreteness Historically combinatorial optimization starts with linear programming Linear programming has an entire range of important applications including production planning and distribution personnel assignment finance allocation of economic resources circuit simulation and control systems Leonid Kantorovich and Tjalling Koopmans received the Nobel Prize 1975 for their work on the optimal allocation of resources Two important discoveries the ellipsoid method 1979 and interior point approaches 1984 both provide polynomial time algorithms for linear programming These algorithms have had a profound effect in combinatorial optimization Many polynomial time solvable combinatorial optimization problems are special cases of linear programming e g matching and maximum flow In addition linear programming relaxations are often the basis for many approximation algorithms for solving NP hard problems e g dual heuristics **Assignment Problems, Revised Reprint** Rainer Burkard, Mauro Dell'Amico, Silvano Martello, 2012-10-31 Assignment Problems is a useful tool for researchers practitioners and graduate students In 10 self contained chapters it provides a comprehensive treatment of assignment problems from their conceptual beginnings through present day theoretical algorithmic and practical developments The topics covered include bipartite matching algorithms linear assignment problems quadratic assignment problems multi index assignment problems and many variations of these Researchers will benefit from the detailed exposition of theory and algorithms related to assignment problems including the basic linear sum assignment problem and its variations Practitioners will learn about practical applications of the methods the performance of exact and heuristic algorithms and software options This book also can serve as a text for advanced courses in areas related to discrete mathematics and combinatorial optimisation The revised reprint provides details on a recent discovery related to one of Jacobi's results new material on inverse assignment problems and quadratic assignment problems and an updated bibliography Structural Engineering, Mechanics and Computation A. Zingoni, 2001-03-16 Following on from the International Conference on Structural Engineering Mechanics and Computation held in Cape Town in April 2001 this book contains the Proceedings in two volumes There are over 170 papers written by Authors from around 40 countries worldwide The contributions include 6 Keynote Papers and 12 Special Invited Papers In line with the aims of the SEMC 2001 International Conference and as may be seen from the List of Contents the papers cover

a wide range of topics under a variety of themes There is a healthy balance between papers of a theoretical nature concerned with various aspects of structural mechanics and computational issues and those of a more practical nature addressing issues of design safety and construction As the contributions in these Proceedings show new and more efficient methods of structural analysis and numerical computation are being explored all the time while exciting structural materials such as glass have recently come onto the scene Research interest in the repair and rehabilitation of existing infrastructure continues to grow particularly in Europe and North America while the challenges to protect human life and property against the effects of fire earthquakes and other hazards are being addressed through the development of more appropriate design methods for buildings bridges and other engineering structures

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