

Input/output Intensive Massively Parallel Computing

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Massively parallel processing is currently the most promising answer to the quest for increased computer performance. This has resulted in the development of new programming languages and programming environments and has stimulated the design and production of massively parallel supercomputers. The efficiency of concurrent computation and input/output essentially depends on the proper utilization of specific architectural features of the underlying hardware. This book focuses on development of runtime systems supporting execution of parallel code and on supercompilers automatically parallelizing code written in a sequential language. Fortran has been chosen for the presentation of the material because of its dominant role in high-performance programming for scientific and engineering applications.

Input/Output Intensive Massively Parallel Computing

The major research results from the Scalable Input/Output Initiative, exploring software and algorithmic solutions to the I/O imbalance. As we enter the "decade of data," the disparity between the vast amount of data storage capacity (measurable in terabytes and petabytes) and the bandwidth available for accessing it has created an input/output bottleneck that is proving to be a major constraint on the effective use of scientific data for research. Scalable Input/Output is a summary of the major research results of the Scalable I/O Initiative, launched by Paul Messina, then Director of the Center for Advanced Computing Research at the California Institute of Technology, to explore software and algorithmic solutions to the I/O imbalance. The contributors explore techniques for I/O optimization, including: I/O characterization to understand application and system I/O patterns; system checkpointing strategies; collective I/O and parallel database support for scientific applications; parallel I/O libraries and strategies for file striping, prefetching, and write behind; compilation strategies for out-of-core data access; scheduling and shared virtual memory alternatives; network support for low-latency data transfer; and parallel I/O application programming interfaces.

Scalable Input/Output

This book contains four review articles in the area of scalable computing. Two of the articles discuss methods and tools for the parallel solution of irregular problems, which have been satisfactorily worked out in heterogeneous systems. One surveys the technology

and applications of multimedia server clusters, which are playing an increasing role in the current networked environment. An additional article discusses SilkRoad, which adds distributed shared memory capabilities to the Cilk parallel programming system. Once again, the book represents a new set of steps forward in parallel systems.

Annual Review of Scalable Computing

This book constitutes the refereed proceedings of the Fourth International Conference on Parallel Computing Technologies, PaCT-97, held in Yaroslavl, Russia, in September 1997. The volume presents a total of 54 contributions: 21 full papers, 20 short papers, 10 posters, and three tutorials. All papers were selected for inclusion in the proceedings from numerous submissions on the basis of three independent reviews. The volume covers all current topics in parallel processing; it is divided into sections on theory, software, hardware and architecture, applications, posters, and tutorials.

Parallel Computing Technologies

This book constitutes the refereed proceedings of the Third International Euro-Par Conference, held in Passau, Germany, in August 1997. The 178 revised papers presented were selected from more than 300 submissions on the basis of 1101 reviews. The papers are organized in accordance with the conference workshop structure in tracks on support tools and environments, routing and communication, automatic parallelization, parallel and distributed algorithms, programming languages, programming models and methods, numerical algorithms, parallel architectures, HPC applications, scheduling and load balancing, performance evaluation, instruction-level parallelism, database systems, symbolic computation, real-time systems, and an ESPRIT workshop.

Euro-Par'97 Parallel Processing

The book is aimed at graduate students, researchers, engineers and physicists involved in fluid computations. An up-to-date account is given of the present state of the art of numerical methods employed in computational fluid dynamics. The underlying numerical principles are treated with a fair amount of detail, using elementary methods. Attention is given to the difficulties arising from geometric complexity of the flow domain. Uniform accuracy for singular perturbation problems is studied, pointing the way to accurate computation of flows at high Reynolds number. Unified methods for compressible and incompressible flows are discussed. A treatment of the shallow-water equations is included. A basic introduction is given to efficient iterative solution methods. Many pointers are given to the current literature, facilitating further study.

Computing and Combinatorics

This book constitutes the strictly refereed proceedings of the 9th International Conference on Computer Aided Verification, CAV '97, held in Haifa, Israel, in June 1997. The volume presents 34 revised full papers selected from a total of 84 submissions. Also included are 7 invited contributions as well as 12 tool descriptions. The volume is dedicated to the theory and practice of computer aided formal methods for software and hardware verification, with an emphasis on verification tools and algorithms and the techniques needed for their implementation. The book is a unique record documenting the recent progress in the area.

Computer Aided Verification

Content Description #Includes bibliographical references and index.

Worldwide Computing and Its Applications

The related fields of fractal image encoding and fractal image analysis have blossomed in recent years. This book, originating from a NATO Advanced Study Institute held in 1995, presents work by leading researchers. It is developing the subjects at an introductory level, but it also has some recent and exciting results in both fields. The book contains a thorough discussion of fractal image compression and decompression, including both continuous and discrete formulations, vector space and hierarchical methods, and algorithmic optimizations. The book also discusses multifractal approaches to image analysis, segmentation, and recognition, including medical applications.

Computer Science Logic

This book constitutes the refereed proceedings of the First International Conference on Scale-Space Theory for Computer Vision, Scale-Space '97, held in Utrecht, The Netherlands, in July 1997. The volume presents 21 revised full papers selected from a total of 41 submissions. Also included are 2 invited papers and 13 poster presentations. This book is the first comprehensive documentation of the application of Scale-Space techniques in computer vision and, in the broader context, in image processing and pattern recognition.

Scale-Space Theory in Computer Vision

Content Description #Includes bibliographical references and index.

Theoretical Aspects of Computer Software

This book constitutes the refereed proceedings of the 5th Kurt Gödel Colloquium on Computational Logic and Proof Theory, KGC '97, held in Vienna, Austria, in August 1997. The volume presents 20 revised full papers selected from 38 submitted papers. Also included are seven invited contributions by leading experts in the area. The book documents interdisciplinary work done in the area of computer science and mathematical logics by combining research on provability, analysis of proofs, proof search, and complexity.

Computational Logic and Proof Theory

This volume constitutes the refereed proceedings of the 9th International Symposium on Programming Languages, Implementations, Logics and Programs, PLILP '97, held in Southampton, UK, in September 1997, including a special track on Declarative Programming in Education. The volume presents 25 revised full papers selected from 68 submissions. Also included are one invited paper and three posters. The papers are devoted to exploring the relation between implementation techniques, the logic of the languages, and the use of the languages in constructing real programs. Topics of interest include implementation of declarative concepts, integration of paradigms, program analysis and transformation, programming environments, executable specifications, reasoning about language constructs, etc.

Programming Languages: Implementations, Logics, and Programs

This book presents the thoroughly refereed post-workshop proceedings of the 9th International Workshop on Languages and Compilers for Parallel Computing, LCPC'96, held in San Jose, California, in August 1996. The book contains 35 carefully revised full papers together with nine poster presentations. The papers are organized in topical sections on automatic data distribution and locality enhancement, program analysis, compiler algorithms for fine-grain parallelism, instruction scheduling and register allocation, parallelizing compilers, communication optimization, compiling HPF, and run-time control of parallelism.

LCPC'97

This book constitutes the strictly refereed proceedings of the 12th International Symposium on Applied Algebra, Algebraic Algorithms and Error-Correcting Codes, AAECC-12, held in Toulouse, France, June 1997. The 27 revised full papers presented were carefully selected by the program committee for inclusion in the volume. The papers address a broad range of current issues in coding theory and computer algebra spanning polynomials, factorization, commutative algebra, real geometry, group theory, etc. on the mathematical side as well as software systems, telecommunication, complexity theory, compression, signal processing,

etc. on the computer science and engineering side.

Applied Algebra, Algebraic Algorithms and Error-Correcting Codes

This book constitutes the strictly refereed post-conference proceedings recording the scientific progress achieved at the First International Conference on Evolvable Systems: From Biology to Hardware, ICES'96, held in Tsukuba, Japan, in October 1996. The volume presents 33 revised full papers including several invited contributions surveying the state of the art in this emerging area of research and development. The volume is divided into topical sections on evolware, cellular systems, engineering applications of evolvable hardware systems, evolutionary robotics, innovative architectures, evolvable systems, evolvable hardware, and genetic programming.

Evolvable Systems: From Biology to Hardware

This book constitutes the refereed proceedings of the 8th International Conference on Concurrency Theory, CONCUR'97, held in Warsaw, Poland, in July 1997. The 24 revised full papers presented were selected by the program committee for inclusion in the volume from a total of 41 high-quality submissions. The volume covers all current topics in the science of concurrency theory and its applications, such as reactive systems, hybrid systems, model checking, partial orders, state charts, program logic calculi, infinite state systems, verification, and others.

CONCUR '97

Ada 95, the enhanced version of the Ada programming language, is now in place and has attracted much attention in the community since the International Standard ISO/IEC 8652:1995(E) for the language was approved in 1995. The Ada 95 Rationale comes in four parts. The introductory part is a general discussion of the scope and objectives of Ada 95 and its major technical features. The second part contains a more detailed step by step account of the core language. The third part consists of several annexes addressing the predefined environment and specialized application areas. Finally, the three appendices of the fourth part are devoted to the upward compatibility with Ada 83, a few changes since the drafts of the standard were made public, and a summary of requirements.

Ada 95 Rationale

This book constitutes the refereed proceedings of the 10th International Conference on Theorem Proving in Higher Order Logics, TPHOLs '97, held in Murray Hill, NJ, USA, in August 1997. The volume presents 19 carefully revised full papers selected from 32 submissions during a thorough reviewing process. The papers cover work related to all

aspects of theorem proving in higher order logics, particularly based on secure mechanization of those logics; the theorem proving systems addressed include Coq, HOL, Isabelle, LEGO, and PVS.

Theorem Proving in Higher Order Logics

This book constitutes the strictly refereed post-workshop proceedings of the German Conference on Bioinformatics, GCB'96, held in Leipzig, Germany, in September/October 1996. The volume presents 18 revised full papers together with three invited papers; these contributions were selected after a second round of reviewing from the 91 conference presentations. The book addresses current issues in computational biology and biologically inspired computing. The papers are organized in sections on biological and metabolic pathways, sequence analysis, molecular modeling, visualization, and formal languages, and DNA.

Bioinformatics

This book constitutes the refereed proceedings of the Second International Symposium on Intelligent Data Analysis, IDA-97, held in London, UK, in August 1997. The volume presents 50 revised full papers selected from a total of 107 submissions. Also included is a keynote, Intelligent Data Analysis: Issues and Opportunities, by David J. Hand. The papers are organized in sections on exploratory data analysis, preprocessing and tools; classification and feature selection; medical applications; soft computing; knowledge discovery and data mining; estimation and clustering; data quality; qualitative models.

Advances in Intelligent Data Analysis. Reasoning about Data

This book constitutes the refereed proceedings of the First International Joint Conference on Qualitative and Quantitative Practical Reasoning, ECSQARU-FAPR'97, held in Bad Honnef, Germany, in June 1997. The volume presents 33 revised full papers carefully selected for inclusion in the book by the program committee as well as 12 invited contributions. Among the various aspects of human practical reasoning addressed in the papers are nonmonotonic logics, default reasoning, modal logics, belief function theory, Bayesian networks, fuzzy logic, possibility theory, inference algorithms, dynamic reasoning with partial models, and user modeling approaches.

Qualitative and Quantitative Practical Reasoning

This book constitutes the refereed proceedings of the 1997 Ada-Europe International Conference on Reliable Software Technologies, held in London, UK, in June 1997. The 25 revised full papers presented were carefully selected for inclusion by the program

committee. All current issues explored in the Ada community are addressed; beyond the Ada language aspects, software engineering technologies for reliable and for reactive systems are discussed in a more general context.

Reliable Software Technologies - Ada-Europe '97

In these notes on 'Projective Modules and Complete Intersections' an account on the recent developments in research on this subject is presented. The author's preference for the technique of Patching isotopic isomorphisms due to Quillen, formalized by Plumsted, over the techniques of elementary matrices is evident here. The treatment of Basic Element theory here incorporates Plumstead's idea of the 'generalized dimension functions'. These notes are highly selfcontained and should be accessible to any graduate student in commutative algebra or algebraic geometry. They include fully self-contained presentations of the theorems of Ferrand-Szpiro, Cowsik-Nori and the techniques of Lindel.

Multi-Agent Rationality

Input/Output in Parallel and Distributed Computer Systems has attracted increasing attention over the last few years, as it has become apparent that input/output performance, rather than CPU performance, may be the key limiting factor in the performance of future systems. This I/O bottleneck is caused by the increasing speed mismatch between processing units and storage devices, the use of multiple processors operating simultaneously in parallel and distributed systems, and by the increasing I/O demands of new classes of applications, like multimedia. It is also important to note that, to varying degrees, the I/O bottleneck exists at multiple levels of the memory hierarchy. All indications are that the I/O bottleneck will be with us for some time to come, and is likely to increase in importance. Input/Output in Parallel and Distributed Computer Systems is based on papers presented at the 1994 and 1995 IOPADS workshops held in conjunction with the International Parallel Processing Symposium. This book is divided into three parts. Part I, the Introduction, contains four invited chapters which provide a tutorial survey of I/O issues in parallel and distributed systems. The chapters in Parts II and III contain selected research papers from the 1994 and 1995 IOPADS workshops; many of these papers have been substantially revised and updated for inclusion in this volume. Part II collects the papers from both years which deal with various aspects of system software, and Part III addresses architectural issues. Input/Output in Parallel and Distributed Computer Systems is suitable as a secondary text for graduate level courses in computer architecture, software engineering, and multimedia systems, and as a reference for researchers and practitioners in industry.

Input/Output in Parallel and Distributed Computer Systems

LEARNING OBJECTIVES □ To understand the basic concepts of computer system □ To know the uses of computers in various fields □ To understand the computing process □ To

understand the characteristics of computers □ To do the classification of computers □ To discuss various generations of computers □ To understand the various functions of CPU □ To know the concept of Virtual Memory

Computer Fundamentals

This book constitutes a carefully arranged selection of revised full papers chosen from the presentations given at the Second International Conference on Vector and Parallel Processing - Systems and Applications, VECPAR'96, held in Porto, Portugal, in September 1996. Besides 10 invited papers by internationally leading experts, 17 papers were accepted from the submitted conference papers for inclusion in this documentation following a second round of refereeing. A broad spectrum of topics and applications for which parallelism contributes to progress is covered, among them parallel linear algebra, computational fluid dynamics, data parallelism, implementational issues, optimization, finite element computations, simulation, and visualisation.

Vector and Parallel Processing - VECPAR'96

This book constitutes the refereed proceedings of the International Conference on Computational Intelligence held in Dortmund, Germany, as the 5th Fuzzy Days, in April 1997. Besides three invited contributions, the book presents 53 revised full papers selected from a total of 130 submissions. Also included are 35 posters documenting a broad scope of applications of computational intelligence techniques in a variety of areas. The volume addresses all current issues in computational intelligence, e.g. fuzzy logic, fuzzy control, neural networks, evolutionary algorithms, genetic programming, neuro-fuzzy systems, adaptation and learning, machine learning, etc.

Computational Intelligence. Theory and Applications

Papers from the October 1996 symposium combine perspectives on architecture applications and systems, with special focus on future systems concepts, especially petaflops computing. Includes sections on scheduling and routing, applications and algorithms, petaflops computing and point design studies, SIMD, I/O techniques, memory management, synchronization, networks, and performance analysis. Specific subjects include a quasi-barrier technique to improve performance of an irregular application, hardware-controlled prefetching in directory-based cache coherent systems, and point designs for 100 TF computers using PIM technologies. No index. Annotation copyrighted by Book News, Inc., Portland, OR.

Frontiers'96, the Sixth Symposium on the Frontiers of Massively Parallel Computation : October 27-31, 1996, Annapolis, Maryland : Proceedings

The book summarises contemporary knowledge about the theory of atomic and molecular clusters. New results are discussed on a high theoretical level. Access to this field of research is given by an explanation of the various subjects in introductory chapters.

Structures in Logic and Computer Science

The state of the art of the bioengineering aspects of the morphology of microorganisms and their relationship to process performance are described in this volume. Materials and methods of the digital image analysis and mathematical modeling of hyphal elongation, branching and pellet formation as well as their application to various fungi and actinomycetes during the production of antibiotics and enzymes are presented.

Foundations of Inductive Logic Programming

A Sobolev gradient of a real-valued functional is a gradient of that functional taken relative to the underlying Sobolev norm. This book shows how descent methods using such gradients allow a unified treatment of a wide variety of problems in differential equations. Equal emphasis is placed on numerical and theoretical matters. Several concrete applications are made to illustrate the method. These applications include (1) Ginzburg-Landau functionals of superconductivity, (2) problems of transonic flow in which type depends locally on nonlinearities, and (3) minimal surface problems. Sobolev gradient constructions rely on a study of orthogonal projections onto graphs of closed densely defined linear transformations from one Hilbert space to another. These developments use work of Weyl, von Neumann and Beurling.

Logical Foundations of Computer Science

This book constitutes the refereed proceedings of the 15th International Conference on Information Processing in Medical Imaging, IPMI'97, held in Poultney, Vermont, USA, in June 1997. The 27 revised full papers presented were selected from a total of 96 submissions; also included are 31 poster presentations. The book is divided into topical sections on shape models and matching, novel imaging methods, segmentation, image quality and statistical character of measured data, registration/mapping, statistical models in functional neuroimaging, and MR analysis and processing.

Information Processing in Medical Imaging

This book constitutes the refereed proceedings of the Third International Workshop on Tools and Algorithms for the Construction and Analysis of Systems, TACAS '97, held in Enschede, The Netherlands, in April 1997. The book presents 20 revised full papers and 5 tool demonstrations carefully selected out of 54 submissions; also included are two extended abstracts and a full paper corresponding to invited talks. The papers are organized in topical sections on space reduction techniques, tool demonstrations, logical techniques, verification support, specification and analysis, and theorem proving, model checking and applications.

Tools and Algorithms for the Construction and Analysis of Systems

This concisely written book gives an elementary introduction to a classical area of mathematics—approximation theory—in a way that naturally leads to the modern field of wavelets. The exposition, driven by ideas rather than technical details and proofs, demonstrates the dynamic nature of mathematics and the influence of classical disciplines on many areas of modern mathematics and applications. Key features and topics: * Description of wavelets in words rather than mathematical symbols * Elementary introduction to approximation using polynomials (Weierstrass' and Taylor's theorems) * Introduction to infinite series, with emphasis on approximation-theoretic aspects * Introduction to Fourier analysis * Numerous classical, illustrative examples and constructions * Discussion of the role of wavelets in digital signal processing and data compression, such as the FBI's use of wavelets to store fingerprints * Minimal prerequisites: elementary calculus * Exercises that may be used in undergraduate and graduate courses on infinite series and Fourier series Approximation Theory: From Taylor Polynomials to Wavelets will be an excellent textbook or self-study reference for students and instructors in pure and applied mathematics, mathematical physics, and engineering. Readers will find motivation and background material pointing toward advanced literature and research topics in pure and applied harmonic analysis and related areas.

Approximation Theory

Content Description #Includes bibliographical references and index.

Advances in Spatial Databases

The book is an introduction to the theory of cubic metaplectic forms on the 3-dimensional hyperbolic space and the author's research on cubic metaplectic forms on special linear and symplectic groups of rank 2. The topics include: Kubota and Bass-Milnor-Serre homomorphisms, cubic metaplectic Eisenstein series, cubic theta functions, Whittaker functions. A special method is developed and applied to find Fourier coefficients of the Eisenstein series and cubic theta functions. The book is intended for readers, with

beginning graduate-level background, interested in further research in the theory of metaplectic forms and in possible applications.

Algorithms and Data Structures

This book constitutes the refereed proceedings of the Eighth Annual Symposium on Combinatorial Pattern Matching, CPM 97, held in Aarhus, Denmark, in June/July 1997. The volume presents 20 revised full papers carefully selected from 32 submissions received; also included are abstracts of two invited contributions. The volume is devoted to the issue of searching and matching strings and more complicated patterns, such as trees, regular expressions, graphs, point sets and arrays. The results presented are particularly relevant to molecular biology, but also to information retrieval, pattern recognition, compiling, data compression and program analysis.

Combinatorial Pattern Matching

This book constitutes the refereed proceedings of the 1998 International Conference on Analytic Tableaux and Related Methods, TABLEUX'98, held in Oisterwijk near Tilburg, The Netherlands, in May 1998. The volume presents 17 revised full papers and three system descriptions selected from 34 submissions; also included are several abstracts of invited lectures, tutorials, and system comparison papers. The book presents new research results for automated deduction in various non-standard logics as well as in classical logic. Areas of application include software verification, systems verification, deductive databases, knowledge representation and its required inference engines, and system diagnosis.

Automated Reasoning with Analytic Tableaux and Related Methods

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