

## Algorithms And Architectures For Parallel Processing 15th International Conference Ica3pp 2015 Zhangjiajie China November 18 20 2015 Proceedings Part I Lecture Notes In Computer Science

The two-volume set LNCS 11944-11945 constitutes the proceedings of the 19th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2019, held in Melbourne, Australia, in December 2019. The 73 full and 29 short papers presented were carefully reviewed and selected from 251 submissions. The papers are organized in topical sections on: Parallel and Distributed Architectures, Software Systems and Programming Models, Distributed and Parallel and Network-based Computing, Big Data and its Applications, Distributed and Parallel Algorithms, Applications of Distributed and Parallel Computing, Service Dependability and Security, IoT and CPS Computing, Performance Modelling and Evaluation.

Welcome to the proceedings of the 8th International Conference on Algorithms and Architectures for Parallel Processing (ICA3PP 2008). ICA3PP 2008 consist of two keynote addresses, seven technical sessions, and one tutorial. Included in these proceedings are papers whose authors are from Australia, Brazil, Canada, China, Cyprus, France, India, Iran, Israel, Italy, Japan, Korea, Germany, Greece, Mexico, Poland, Portugal, Romania, Spain, Switzerland, Taiwan, Tunisia, UAE, UK, and USA. Each paper was rigorously reviewed by at least three Program Committee members and/or external reviewers, and the acceptance ratio is 35%. These papers were presented over seven technical sessions. Based on the paper review results, three papers were selected as the best papers. We would like to thank the many people who helped make this conference a successful event. We thank all authors who submitted their work to ICA3PP 2008, and all Program Committee members and additional reviewers for their diligent work in the paper review process ensuring a collection of high-quality papers. We are grateful to Hong Shen University of Adelaide, Australia and Kleanthis Psarris University of Texas at San Antonio, United States, for their willingness to be the keynote speakers. Our thanks go to Hai Jin and George Papapodoulos, the conference General Co-chairs, and Andrzej Goscinski, W-lei Zhou and Yi Pan, the conference Steering Committee Co-chairs for help in many aspects of organizing this conference. Finally, we thank all the conference participants for traveling to Cyprus.

This book constitutes the refereed proceedings of the Workshops and Symposiums of the 15th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2015, held in Zhangjiajie, China, in November 2015. The program of this year consists of 6 symposiums/workshops that cover a wide range of research topics on parallel processing technology: the Sixth International Workshop on Trust, Security and Privacy for Big Data, TrustData 2015; the Fifth International Symposium on Trust, Security and Privacy for Emerging Applications, TSP 2015; the Third International Workshop on Network Optimization and Performance Evaluation, NOPE 2015; the Second International Symposium on Sensor-Cloud Systems, SCS 2015; the Second International Workshop on Security and Privacy Protection in Computer and Network Systems, SPPCN 2015; and the First International Symposium on Dependability in Sensor, Cloud, and Big Data Systems and Applications, DependSys 2015. The aim of these symposiums/workshops is to provide a forum to bring together practitioners and researchers from academia and industry for discussion and presentations on the current research and future directions related to parallel processing technology. The themes and topics of these symposiums/workshops are a valuable complement to the overall scope of ICA3PP 2015 and give additional values and interests.

Introduction to Parallel Algorithms and Architectures: Arrays Trees Hypercubes provides an introduction to the expanding field of parallel algorithms and architectures. This book focuses on parallel computation involving the most popular network architectures, namely, arrays, trees, hypercubes, and some closely related networks. Organized into three chapters, this book begins with an overview of the simplest architectures of arrays and trees. This text then presents the structures and relationships between the dominant network architectures, as well as the most efficient parallel algorithms for a wide variety of problems. Other chapters focus on fundamental results and techniques and on rigorous analysis of algorithmic performance. This book discusses as well a hybrid of network architecture based on arrays and trees called the mesh of trees. The final chapter deals with the most important properties of hypercubes. This book is a valuable resource for readers with a general technical background.

The two volume set LNCS 7439 and 7440 comprises the proceedings of the 12th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2012, as well as some workshop papers of the CDCN 2012 workshop which was held in conjunction with this conference. The 40 regular paper and 26 short papers included in these proceedings were carefully reviewed and selected from 156 submissions. The CDCN workshop attracted a total of 19 original submissions, 8 of which are included in part II of these proceedings. The papers cover many dimensions of parallel algorithms and architectures, encompassing fundamental theoretical approaches, practical experimental results, and commercial components and systems.

This book constitutes the refereed proceedings of the 6th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2005, held in Melbourne, Australia in October 2005. The 27 revised full papers and 25 revised short papers presented were carefully reviewed and selected from 95 submissions. The book covers new architectures of parallel and distributed systems, new system management facilities, and new application algorithms with special focus on two broad areas of parallel and distributed computing, i.e., architectures, algorithms and networks, and systems and applications.

This two volume set LNCS 8285 and 8286 constitutes the proceedings of the 13th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2013, held in

Vietri sul Mare, Italy in December 2013. The first volume contains 10 distinguished and 31 regular papers selected from 90 submissions and covering topics such as big data, multi-core programming and software tools, distributed scheduling and load balancing, high-performance scientific computing, parallel algorithms, parallel architectures, scalable and distributed databases, dependability in distributed and parallel systems, wireless and mobile computing. The second volume consists of four sections including 35 papers from one symposium and three workshops held in conjunction with ICA3PP 2013 main conference. These are 13 papers from the 2013 International Symposium on Advances of Distributed and Parallel Computing (ADPC 2013), 5 papers of the International Workshop on Big Data Computing (BDC 2013), 10 papers of the International Workshop on Trusted Information in Big Data (TIBiDa 2013) as well as 7 papers belonging to Workshop on Cloud-assisted Smart Cyber-Physical Systems (C-Smart CPS 2013).

The four-volume set LNCS 11334-11337 constitutes the proceedings of the 18th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2018, held in Guangzhou, China, in November 2018. The 141 full and 50 short papers presented were carefully reviewed and selected from numerous submissions. The papers are organized in topical sections on Distributed and Parallel Computing; High Performance Computing; Big Data and Information Processing; Internet of Things and Cloud Computing; and Security and Privacy in Computing.

This book constitutes the refereed proceedings of the 16th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2016, held in Granada, Spain, in December 2016. The 30 full papers and 22 short papers presented were carefully reviewed and selected from 117 submissions. They cover many dimensions of parallel algorithms and architectures, encompassing fundamental theoretical approaches, practical experimental projects, and commercial components and systems trying to push beyond the limits of existing technologies, including experimental efforts, innovative systems, and investigations that identify weaknesses in existing parallel processing technology.

Although there has been a tremendous growth of interest in parallel architecture and parallel processing in recent years, comparatively little work has been done on the problem of characterizing parallelism in programs and algorithms. This book, a collection of original papers, specifically addresses that topic. The editors and two dozen other contributors have produced a work that cuts across numerical analysis, artificial intelligence, and database management, speaking to questions that lie at the heart of current research in these and many other fields of knowledge: How much commonality in algorithm structure is there across problem domains? What attributes of algorithms are the most important in dictating the structure of a parallel algorithm? How can algorithms be matched with languages and architectures? Their book provides an important starting place for a comprehensive taxonomy of parallel algorithms. The authors are all in the Department of Electrical Engineering at Purdue University. Leah H. Jamieson is a professor, Dennis Gannon an associate professor, and Robert Douglass head of Machine Intelligence. The Characteristics of Parallel Algorithms is included in the Scientific Computation Series, edited by Dennis Gannon.

This two volume set LNCS 7016 and LNCS 7017 constitutes the refereed proceedings of the 11th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2011, held in Melbourne, Australia, in October 2011. The first volume presents 24 revised regular papers and 17 revised short papers together with the abstract of the keynote lecture - all carefully reviewed and selected from 85 initial submissions. The papers cover the many dimensions of parallel algorithms and architectures, encompassing fundamental theoretical approaches, practical experimental results, and commercial components and systems and focus on two broad areas of parallel and distributed computing, i.e., architectures, algorithms and networks, and systems and applications.

This four volume set LNCS 9528, 9529, 9530 and 9531 constitutes the refereed proceedings of the 15th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2015, held in Zhangjiajie, China, in November 2015. The 219 revised full papers presented together with 77 workshop papers in these four volumes were carefully reviewed and selected from 807 submissions (602 full papers and 205 workshop papers). The first volume comprises the following topics: parallel and distributed architectures; distributed and network-based computing and internet of things and cyber-physical-social computing. The second volume comprises topics such as big data and its applications and parallel and distributed algorithms. The topics of the third volume are: applications of parallel and distributed computing and service dependability and security in distributed and parallel systems. The covered topics of the fourth volume are: software systems and programming models and performance modeling and evaluation.

Parallel algorithms Made Easy The complexity of today's applications coupled with the widespread use of parallel computing has made the design and analysis of parallel algorithms topics of growing interest. This volume fills a need in the field for an introductory treatment of parallel algorithms-appropriate even at the undergraduate level, where no other textbooks on the subject exist. It features a systematic approach to the latest design techniques, providing analysis and implementation details for each parallel algorithm described in the book. Introduction to Parallel Algorithms covers foundations of parallel computing; parallel algorithms for trees and graphs; parallel algorithms for sorting, searching, and merging; and numerical algorithms. This remarkable book: \* Presents basic concepts in clear and simple terms \* Incorporates numerous examples to enhance students' understanding \* Shows how to develop parallel algorithms for all classical problems in computer science, mathematics, and engineering \* Employs extensive illustrations of new design techniques \* Discusses parallel algorithms in the context of PRAM model \* Includes end-of-chapter exercises and detailed references on parallel computing. This book enables universities to offer parallel algorithm courses at the senior undergraduate level in computer science and engineering. It is also an invaluable text/reference for graduate students, scientists, and engineers in computer science, mathematics, and engineering.

The ability of parallel computing to process large data sets and handle time-consuming operations has resulted in unprecedented advances in biological and scientific computing, modeling, and simulations. Exploring these recent developments, the Handbook of Parallel Computing: Models, Algorithms, and Applications provides comprehensive coverage on a

There is a software gap between the hardware potential and the performance that can be attained using today's software parallel program development tools. The tools need manual intervention by the programmer to parallelize the code. Programming a parallel computer requires closely studying the target algorithm or application, more so than in the traditional sequential programming we have all learned. The programmer must be aware of the communication and data dependencies of the algorithm or application. This book provides the techniques to explore the possible ways to program a parallel computer for a given application.



Motivation It is now possible to build powerful single-processor and multiprocessor systems and use them efficiently for data processing, which has seen an explosive expansion in many areas of computer science and engineering. One approach to meeting the performance requirements of the applications has been to utilize the most powerful single-processor system that is available. When such a system does not provide the performance requirements, pipelined and parallel processing structures can be employed. The concept of parallel processing is a departure from sequential processing. In sequential computation one processor is involved and performs one operation at a time. On the other hand, in parallel computation several processors cooperate to solve a problem, which reduces computing time because several operations can be carried out simultaneously. Using several processors that work together on a given computation illustrates a new paradigm in computer problem solving which is completely different from sequential processing. From the practical point of view, this provides sufficient justification to investigate the concept of parallel processing and related issues, such as parallel algorithms. Parallel processing involves utilizing several factors, such as parallel architectures, parallel algorithms, parallel programming languages and performance analysis, which are strongly interrelated. In general, four steps are involved in performing a computational problem in parallel. The first step is to understand the nature of computations in the specific application domain.

This three-volume set LNCS 12452, 12453, and 12454 constitutes the proceedings of the 20th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2020, in New York City, NY, USA, in October 2020. The total of 142 full papers and 5 short papers included in this proceedings volumes was carefully reviewed and selected from 495 submissions. ICA3PP is covering the many dimensions of parallel algorithms and architectures, encompassing fundamental theoretical approaches, practical experimental projects, and commercial components and systems. As applications of computing systems have permeated in every aspects of daily life, the power of computing system has become increasingly critical. This conference provides a forum for academics and practitioners from countries around the world to exchange ideas for improving the efficiency, performance, reliability, security and interoperability of computing systems and applications. ICA3PP 2020 focus on two broad areas of parallel and distributed computing, i.e. architectures, algorithms and networks, and systems and applications.

THE CONTEXT OF PARALLEL PROCESSING The field of digital computer architecture has grown explosively in the past two decades. Through a steady stream of experimental research, tool-building efforts, and theoretical studies, the design of an instruction-set architecture, once considered an art, has been transformed into one of the most quantitative branches of computer technology. At the same time, better understanding of various forms of concurrency, from standard pipelining to massive parallelism, and invention of architectural structures to support a reasonably efficient and user-friendly programming model for such systems, has allowed hardware performance to continue its exponential growth. This trend is expected to continue in the near future. This explosive growth, linked with the expectation that performance will continue its exponential rise with each new generation of hardware and that (in stark contrast to software) computer hardware will function correctly as soon as it comes off the assembly line, has its down side. It has led to unprecedented hardware complexity and almost intolerable development costs. The challenge facing current and future computer designers is to institute simplicity where we now have complexity; to use fundamental theories being developed in this area to gain performance and ease-of-use benefits from simpler circuits; to understand the interplay between technological capabilities and limitations, on the one hand, and design decisions based on user and application requirements on the other.

This book constitutes the proceedings of the 17th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2017, held in Helsinki, Finland, in August 2017. The 25 full papers presented were carefully reviewed and selected from 117 submissions. They cover topics such as parallel and distributed architectures; software systems and programming models; distributed and network-based computing; big data and its applications; parallel and distributed algorithms; applications of parallel and distributed computing; service dependability and security in distributed and parallel systems; service dependability and security in distributed and parallel systems; performance modeling and evaluation. This volume also includes 41 papers of four workshops, namely: the 4th International Workshop on Data, Text, Web, and Social Network Mining (DTWSM 2017), the 5th International Workshop on Parallelism in Bioinformatics (PBio 2017), the First International Workshop on Distributed Autonomous Computing in Smart City (DACSC 2017), and the Second International Workshop on Ultrascale Computing for Early Researchers (UCER 2017).

It is our great pleasure to welcome you to the proceedings of the 10th annual event of the International Conference on Algorithms and Architectures for Parallel Processing (ICA3PP). ICA3PP is recognized as the main regular event covering the many dimensions of parallel algorithms and architectures, encompassing fundamental theoretical approaches, practical experimental projects, and commercial components and systems. As applications of computing systems have permeated every aspect of daily life, the power of computing systems has become increasingly critical. Therefore, ICA3PP 2010 aimed to permit researchers and practitioners from industry to exchange information regarding advancements in the state of the art and practice of IT-driven services and applications, as well as to identify emerging research topics and define the future directions of parallel processing. We received a total of 157 submissions this year, showing by both quantity and quality that ICA3PP is a premier conference on parallel processing. In the first stage, all papers submitted were screened for their relevance and general submission requirements. These manuscripts then underwent a rigorous peer-review process with at least three reviewers per paper. In the end, 47 papers were accepted for presentation and included in the main proceedings, comprising a 30% acceptance rate.

Parallel-Algorithms for Regular Architectures is the first book to concentrate exclusively on algorithms and paradigms for programming parallel computers such as the hypercube, mesh, pyramid, and mesh-of-trees. Algorithms are given to solve fundamental tasks such as sorting and matrix operations, as well as problems in the field of image processing, graph theory, and computational geometry. The first chapter defines the computer models, problems to be solved, and notation that will be used throughout the book. It also describes fundamental abstract data movement operations that serve as the foundation to many of the algorithms presented in the book. The remaining chapters describe efficient implementations of these operations for specific models of computation and present algorithms (with asymptotic analyses) that are often based on these operations. The

algorithms presented are the most efficient known, including a number of new algorithms for the hypercube and mesh-of-trees that are better than those that have previously appeared in the literature. The chapters may be read independently, allowing anyone interested in a specific model to read the introduction and then move directly to the chapter(s) devoted to the particular model of interest. Russ Miller is Assistant Professor in the Department of Computer Science, State University of New York at Buffalo. Quentin F. Stout is Associate Professor in the Department of Electrical Engineering and Computer Science at the University of Michigan. *Parallel Algorithms for Regular Architectures* is included in the Scientific Computation series, edited by Dennis Gannon.

This book constitutes the symposia and workshops of the 10th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP. Each of the symposia and workshops focuses on a particular theme and complements the spectrum of the main conference.

This two volume set LNCS 8630 and 8631 constitutes the proceedings of the 14th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2014, held in Dalian, China, in August 2014. The 70 revised papers presented in the two volumes were selected from 285 submissions. The first volume comprises selected papers of the main conference and papers of the 1st International Workshop on Emerging Topics in Wireless and Mobile Computing, ETWMC 2014, the 5th International Workshop on Intelligent Communication Networks, IntelNet 2014, and the 5th International Workshop on Wireless Networks and Multimedia, WNM 2014. The second volume comprises selected papers of the main conference and papers of the Workshop on Computing, Communication and Control Technologies in Intelligent Transportation System, 3C in ITS 2014, and the Workshop on Security and Privacy in Computer and Network Systems, SPCNS 2014.

This book constitutes the refereed proceedings of the 7th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2007, held in Hangzhou, China in June 2007. Focusing on two broad areas of parallel and distributed computing, the papers are organized in topical sections on parallel algorithms, parallel architecture, grid computing, peer-to-peer technologies, and advanced network technologies.

This book presents an extensive survey of the state-of-the-art research in parallel computational algorithms and architectures for robot manipulator control and simulation. It deals not only with specifics but also includes general and broader issues which serve as a useful foundation to the topic. The educational flavor of the book makes it a necessary resource for researchers, engineers and students wanting to be familiarized with the potential offered by the application of parallel processing to robotic problems, and its current issues and trends.

Focusing on algorithms for distributed-memory parallel architectures, *Parallel Algorithms* presents a rigorous yet accessible treatment of theoretical models of parallel computation, parallel algorithm design for homogeneous and heterogeneous platforms, complexity and performance analysis, and essential notions of scheduling. The book extract

ICA3PP 2000 was an important conference that brought together researchers and practitioners from academia, industry and governments to advance the knowledge of parallel and distributed computing. The proceedings constitute a well-defined set of innovative research papers in two broad areas of parallel and distributed computing: (1) architectures, algorithms and networks; (2) systems and applications.

Contents: Cluster Computing Interconnection Networks and Routing Parallel Architecture & Parallel I/O Systems Parallel and Distributed Databases Parallel Algorithms ITools and Environments for Parallel and Distributed Software Development Parallel Algorithms II Parallel Processing on Web-Based Systems and Applications Distributed and Parallel Operating Systems and Middleware High-Performance Scientific Computing Parallel and Distributed Processing Fault-Tolerant Computing High-Performance Data Management Readership: Researchers, graduate students, academics and practitioners in computing.

Keywords:

This book constitutes the refereed proceedings of the 9th International Conference on Algorithms and Architectures for Parallel Processing, ICA3PP 2009, held in Taipei, Taiwan, in June 2009. The 80 revised full papers were carefully reviewed and selected from 243 submissions. The papers are organized in topical sections on bioinformatics in parallel computing; cluster, grid and fault-tolerant computing; cluster distributed parallel operating systems; dependability issues in computer networks and communications; dependability issues in distributed and parallel systems; distributed scheduling and load balancing, industrial applications; information security internet; multi-core programming software tools; multimedia in parallel computing; parallel distributed databases; parallel algorithms; parallel architectures; parallel IO systems and storage systems; performance of parallel distributed computing systems; scientific applications; self-healing, self-protecting and fault-tolerant systems; tools and environments for parallel and distributed software development; and Web service.

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