

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Germany

Madhu Sudan

Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbruecken, Germany

Roman Wyrzykowski Jack Dongarra
Konrad Karczewski Jerzy Waśniewski (Eds.)

Parallel Processing and Applied Mathematics

9th International Conference, PPAM 2011
Torun, Poland, September 11-14, 2011
Revised Selected Papers, Part II

Volume Editors

Roman Wyrzykowski
Czestochowa University of Technology, Poland
E-mail: roman@icis.pcz.pl

Jack Dongarra
University of Tennessee, Knoxville, TN, USA
E-mail: dongarra@cs.utk.edu

Konrad Karczewski
Czestochowa University of Technology, Poland
E-mail: xeno@icis.pcz.pl

Jerzy Waśniewski
Technical University, Kongens Lyngby, Denmark
E-mail: jw@imm.dtu.dk

ISSN 0302-9743
ISBN 978-3-642-31499-5
DOI 10.1007/978-3-642-31500-8
Springer Heidelberg Dordrecht London New York

e-ISSN 1611-3349
e-ISBN 978-3-642-31500-8

Library of Congress Control Number: 2012941360

CR Subject Classification (1998): D.2, H.4, D.4, C.2.4, D.1.3, H.3, F.2

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

© Springer-Verlag Berlin Heidelberg 2012

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

This volume comprises the proceedings of the 9th International Conference on Parallel Processing and Applied Mathematics – PPAM 2011, which was held in Toruń, Poland, September 11–14, 2011. It was organized by the Department of Computer and Information Science of the Częstochowa University of Technology, with the help of the Nicolaus Copernicus University in Toruń, Faculty of Mathematics and Computer Science. The main organizer was Roman Wyrzykowski.

PPAM is a biennial conference. Eight previous events have been held in different places in Poland since 1994. The proceedings of the last five conferences have been published by Springer in the *Lecture Notes in Computer Science* series (Naęczów, 2001, vol. 2328; Częstochowa, 2003, vol. 3019; Poznań, 2005, vol. 3911; Gdańsk, 2007, vol. 4967; Wrocław, 2009, vols. 6067 and 6068).

The PPAM conferences have become an international forum for exchanging ideas between researchers involved in scientific and parallel computing, including theory and applications, as well as applied and computational mathematics. The focus of PPAM 2011 was on models, algorithms, and software tools which facilitate efficient and convenient utilization of modern parallel and distributed computing architectures, as well as on large-scale applications, and cloud computing.

This meeting gathered more than 200 participants from 33 countries. A strict refereeing process resulted in acceptance of 130 contributed presentations, while approximately 45% of the submissions were rejected. Regular tracks of the conference covered such important fields of parallel/distributed/grid computing and applied mathematics as:

- Parallel/distributed architectures and mobile computing
- Numerical algorithms and parallel numerics
- Parallel non-numerical algorithms
- Tools and environments for parallel/distributed/grid computing
- Applications of parallel/distributed computing
- Applied mathematics, neural networks and evolutionary computing
- History of computing

The plenary and invited talks were presented by:

- David A. Bader from the Georgia Institute of Technology (USA)
- Paolo Bientinesi from the RWTH Aachen (Germany)
- Christopher Carothers from the Rensselaer Polytechnic Institute (USA)
- Ewa Deelman from the University of Southern California (USA)
- Jack Dongarra from the University of Tennessee and Oak Ridge National Laboratory (USA)
- Geoffrey Ch. Fox from the Indiana University (USA)
- Fred Gustavson from the Umeå University (Sweden) and emeritus from the IBM T.J. Watson Research Center (USA)

- Tony Hey from the Microsoft Research
- Bo Kågström from the Umeå University (Sweden)
- Jakub Kurzak from the University of Tennessee (USA)
- Jarek Nabrzyski from the University of Notre Dame (USA)
- Raymond Namyst from the University of Bordeaux & INRIA (France)
- Victor Pankratius from the University of Karlsruhe (Germany)
- Markus Pueschel from the ETH Zurich (Switzerland)
- Eugen Schenfeld from the IBM T.J. Watson Research Center (USA)
- Robert Strzodka from the Max Planck Institut für Informatik (Germany)
- Bolesław Szymański from the Rensselaer Polytechnic Institute (USA)
- Richard W. Vuduc from the Georgia Institute of Technology (USA)
- Jerzy Waśniewski from the Technical University of Denmark (Denmark)

Important and integral parts of the PPAM 2011 conference were the workshops:

- Minisymposium on GPU Computing organized by José R. Herrero from the Universitat Politècnica de Catalunya (Spain), Enrique S. Quintana-Ortí from the Universitat Jaume I (Spain), and Robert Strzodka from the Max Planck Institut für Informatik (Germany)
- Minisymposium on Autotuning organized by Richard W. Vuduc from the Georgia Institute of Technology (USA) and Roman Wyrzykowski from the Częstochowa University of Technology (Poland)
- Workshop on Memory and Data Parallelism on Multi- and Manycore Platforms organized by Michael Bader from the University of Stuttgart (Germany), Carsten Trinitis, and Josef Weidendorfer from the TU München (Germany)
- Workshop on Models, Algorithms and Methodologies for Hierarchical Parallelism in New HPC Systems organized by Giulliano Laccetti and Marco Lapegna from the University of Naples Federico II (Italy) and Raffaele Montella from the University of Naples “Parthenope” (Italy)
- Workshop on Scheduling for Parallel Computing—SPC 2011—organized by Maciej Drozdowski from the Poznań University of Technology (Poland)
- The 4th Workshop on Language-Based Parallel Programming Models—WLPP 2011—organized by Ami Marowka from the Bar-Ilan University (Israel)
- The Second Workshop on Scalable Computing in Distributed Systems and the 7th Workshop on Large-Scale Computations on Grids—ScoDiS-LaSCoG 2011—organized by Dana Petcu from the West University of Timisoara (Romania) and Marcin Paprzycki from WSM and the Systems Research Institute of the Polish Academy of Sciences (Poland)
- The Third Workshop on Performance Evaluation of Parallel Applications on Large-Scale Systems organized by Jan Kwiatkowski from the Wrocław University of Technology (Poland)
- Workshop on Parallel Computational Biology—PBC 2011—organized by David A. Bader from the Georgia Institute of Technology (USA), Jarosław Żola from the Iowa State University (USA), and Scott Emrich from the University of Notre Dame (USA)

- Minisymposium on Applications of Parallel Computations in Industry and Engineering organized by Raimondas Čiegis from the Vilnius Gediminas Technical University (Lithuania) and Julius Žilinskas from the Vilnius University (Lithuania)
- Minisymposium on High-Performance Computing Interval Methods organized by Bartłomiej J. Kubica from the Warsaw University of Technology (Poland)
- Workshop on Complex Colective Systems organized by Paweł Topa and Jarosław Waś from the AGH University of Science and Technology in Cracow (Poland)
- The First Workshop on Service-Oriented Architecture in Distributed Systems—SOADS 2011—organized by Jan Kwiatkowski from the Wrocław University of Technology (Poland) and Dariusz Wawrzyniak from the Poznań University of Technology (Poland)

The PPAM 2011 meeting began with five tutorials:

- Scientific Computing with GPUs, by Dominik Göddeke from the University of Dortmund (Germany), Jakub Kurzak from the University of Tennessee (USA), Jan-Philipp Weiss from the Karlsruhe Institute of Technology (Germany), as well as André Heidekrüger from AMD, and Tim Schröder from NVIDIA
- StarPU System for Heterogeneous Multicore Architectures, by Raymond Namyst from the University of Bordeaux and INRIA (France)
- Tutorial on the 100th Anniversary of Cholesky’s Algorithm, by Fred Gustavson from the Umeå University (Sweden) and emeritus from the IBM T.J. Watson Research Center (USA) and Jerzy Waśniewski from the Technical University of Denmark (Denmark)
- FutureGrid, by Geoffrey Ch. Fox from the Indiana University (USA)
- Best Practices to Run Applications in HPC Environments, by the POWIEW Project team (Poland)

The PPAM Best Poster Award is granted to the best poster on display at the PPAM conferences, and was established at PPAM 2009. This Award is bestowed by the Program Committee members to the presenting author(s) of the best poster. The selection criteria are based on the scientific content and on the quality of the poster presentation.

The PPAM 2011 winners were Damian Wóicik, Marcin Kurowski, Bogdan Rosa, and Michał Ziemiański from the Institute of Meteorology and Water Management in Warsaw, who presented the poster “A Study on Parallel Performance of the EULAG F90/95 Code.”

The Special Award was bestowed to Andrzej Jarynowski from the Jagiellonian University and Przemysław Gawroński, Krzysztof Kułakowski from the AGH University of Science and Technology in Kraków, who presented the poster “How the Competitive Altruism Leads to Bistable Homogeneous States of Cooperation or Defection.”

Automated Performance Tuning (“Autotuning”) of Software: The complexity of modern machines makes performance tuning a tedious and time-consuming task. The goal of *autotuning* techniques is to automate the process of selecting the highest-performing program implementation from among a space of candidates, guided by experiments. An experiment is the execution of a benchmark and observation of its performance; such experiments may be used directly to test a candidate implementation, or may be used to calibrate a model that is then used to select such an implementation. Roughly speaking, autotuning research considers questions of how to identify and generate the space of candidate program implementations as well as how to find (or search for) the best implementation given such a space. A system that implements an autotuning process is an *autotuner*. An autotuner may be a stand-alone code generation system or may be part of a compiler.

The Minisymposium on Autotuning featured a number of invited and contributed talks covering recent and diverse advances, including:

- A new high-level rewrite system for linear algebra computations, with applications to computational physics and biology (by P. Bientinesi)
- Novel uses of machine learning to facilitate searching (M. Püschel)
- The extension of autotuning ideas into general software engineering processes, such as tuning the software architecture (V. Pankratius)
- New code generation and search space pruning techniques for dense linear algebra targeted at GPU architectures (J. Kurzak and H.H.B. Sørensen)
- Reducing tuning time for high-performance LINPACK using novel performance models (P. Luszczek)

The organizers are indebted to the PPAM 2011 sponsors, whose support was vital to the success of the conference. The main sponsor was the Intel Corporation. The other sponsors were: IBM Corporation, Hewlett-Packard Company, Microsoft Corporation, and AMD. We thank all members of the International Program Committee and additional reviewers for their diligent work in refereeing the submitted papers. Finally, we thank all of the local organizers from the Częstochowa University of Technology, and the Nicolaus Copernicus University in Toruń, who helped us to run the event very smoothly. We are especially indebted to Grażyna Kołakowska, Urszula Kroczevska, Łukasz Kuczyński, and Marcin Woźniak from the Częstochowa University of Technology; and to Andrzej Rozkosz, and Piotr Bała from the Nicolaus Copernicus University.

We hope that this volume will be useful to you. We would like everyone who reads it to feel invited to the next conference, PPAM 2013, which will be held during September 8–11, 2013, in Warsaw, the capital of Poland.

February 2012

Roman Wyrzykowski
 Jack Dongarra
 Konrad Karczewski
 Jerzy Waśniewski

Organization

Program Committee

Węglarz, Jan	Poznań University of Technology, Poland Honorary Chair
Wyrzykowski, Roman	Częstochowa University of Technology, Poland Program Committee Chair
Szymański, Bolesław	Rensselaer Polytechnic Institute, USA Program Committee Vice-chair
Arbenz, Peter	ETH, Zurich, Switzerland
Bała, Piotr	Nicolaus Copernicus University, Poland
Bader, David A.	Georgia Institute of Technology, USA
Bader, Michael	University of Stuttgart, Germany
Blaheta, Radim	Institute of Geonics, Czech Academy of Sciences
Błażewicz, Jacek	Poznań University of Technology, Poland
Bokota, Adam	Częstochowa University of Technology, Poland
Bouvry, Pascal	University of Luxembourg
Burczyński, Tadeusz	Silesia University of Technology, Poland
Brzeziński, Jerzy	Poznań University of Technology, Poland
Bubak, Marian	Institute of Computer Science, AGH, Poland
Čiegis, Raimondas	Vilnius Gediminas Technical University, Lithuania
Clematis, Andrea	IMATI-CNR, Italy
Cunha, Jose	University New of Lisbon, Portugal
Czech, Zbigniew	Silesia University of Technology, Poland
Deelman, Ewa	University of Southern California, USA
Dongarra, Jack	University of Tennessee and ORNL, USA
Drozdowski, Maciej	Poznań University of Technology, Poland
Elmroth, Erik	Umea University, Sweden
Flasiński, Mariusz	Jagiellonian University, Poland
Ganzha, Maria	IBS PAN, Warsaw, Poland
Gepner, Pawel	Intel Corporation
Gondzio, Jacek	University of Edinburgh, Scotland, UK
Gościński, Andrzej	Deakin University, Australia
Grigori, Laura	INRIA, France
Grzech, Adam	Wroclaw University of Technology, Poland
Guinand, Frederic	Université du Havre, France
Herrero, José R.	Universitat Politècnica de Catalunya, Barcelona, Spain
Hluchy, Ladislav	Slovak Academy of Sciences, Bratislava

Jakl, Ondrej	Institute of Geonics, Czech Academy of Sciences
Janciak, Ivan	University of Vienna, Austria
Jeannot, Emmanuel	INRIA, France
Kalinov, Alexey	Cadence Design System, Russia
Kamieniarz, Grzegorz	A. Mickiewicz University, Poznań, Poland
Kiper, Ayse	Middle East Technical University, Turkey
Kitowski, Jacek	Institute of Computer Science, AGH, Poland
Korbicz, Józef	University of Zielona Góra, Poland
Kozielski, Stanislaw	Silesia University of Technology, Poland
Kranzlmuller, Dieter	Ludwig Maximilian University, Munich, and Leibniz Supercomputing Centre, Germany
Krawczyk, Henryk	Gdańsk University of Technology, Poland
Krzyżanowski, Piotr	University of Warsaw, Poland
Kwiatkowski, Jan	Wrocław University of Technology, Poland
Laccetti, Giulliano	University of Naples Federico II, Italy
Lapegna, Marco	University of Naples Federico II, Italy
Lastovetsky, Alexey	University College Dublin, Ireland
Maksimov, Vyacheslav I.	Ural Branch, Russian Academy of Sciences
Malyshev, Victor E.	Siberian Branch, Russian Academy of Sciences
Margalef, Tomas	Universitat Autònoma de Barcelona, Spain
Margenov, Svetozar	Bulgarian Academy of Sciences, Sofia
Marowka, Ami	Bar-Ilan University, Israel
Meyer, Norbert	PSNC, Poznań, Poland
Nabrzyski, Jarek	University of Notre Dame, USA
Oksa, Gabriel	Slovak Academy of Sciences, Bratislava
Olas, Tomasz	Czestochowa University of Technology, Poland
Paprzycki, Marcin	WSM & IBS PAN, Warsaw, Poland
Petcu, Dana	West University of Timisoara, Romania
Quintana-Ortí, Enrique S.	Universitat Jaume I, Spain
Robert, Yves	Ecole Normale Supérieure de Lyon, France
Rokicki, Jacek	Warsaw University of Technology, Poland
Rutkowski, Leszek	Czestochowa University of Technology, Poland
Seredyński, Franciszek	Polish Academy of Sciences and Polish-Japanese Institute of Information Technology, Warsaw, Poland
Schaefer, Robert	Institute of Computer Science, AGH, Poland
Silc, Jurij	Jozef Stefan Institute, Slovenia
Sloot, Peter M.A.	University of Amsterdam, The Netherlands
Sosonkina, Masha	Ames Laboratory and Iowa State University, USA
Sousa, Leonel	Technical University of Lisbon, Portugal
Stroiński, Maciej	PSNC, Poznań, Poland
Talia, Domenico	University of Calabria, Italy
Tchernykh, Andrei	CICESE, Ensenada, Mexico

Trinitis, Carsten	TU München, Germany
Trobec, Roman	Jozef Stefan Institute, Slovenia
Trystram, Denis	ID-IMAG, Grenoble, France
Tudruj, Marek	Polish Academy of Sciences and Polish-Japanese Institute of Information Technology, Warsaw, Poland
Tvrdik, Pavel	Czech Technical University, Prague
Vajtersic, Marian	Salzburg University, Austria
Volkert, Jens	Johannes Kepler University, Linz, Austria
Waśniewski, Jerzy	Technical University of Denmark
Wiszniewski, Bogdan	Gdańsk University of Technology, Poland
Yahyapour, Ramin	University of Dortmund, Germany
Zhu, Jianping	University of Texas at Arlington, USA

Table of Contents – Part II

Workshop on Scheduling for Parallel Computing (SPC 2011)

Parallel Cost Function Determination on GPU for the Job Shop Scheduling Problem	1
<i>Wojciech Bożejko, Mariusz Uchroński, and Mieczysław Wodecki</i>	
Partitioning and Scheduling Workflows across Multiple Sites with Storage Constraints	11
<i>Weiwei Chen and Ewa Deelman</i>	
Grid Branch-and-Bound for Permutation Flowshop	21
<i>Maciej Drozdowski, Paweł Marciniak, Grzegorz Pawlak, and Maciej Płaza</i>	
An Experimental Comparison of Load Balancing Strategies in a Web Computing Environment	31
<i>Joachim Gehweiler, Peter Kling, and Friedhelm Meyer auf der Heide</i>	
A Grid Scheduling Based on Generalized Extremal Optimization for Parallel Job Model	41
<i>Piotr Switalski and Franciszek Seredynski</i>	
Scheduling Parallel Programs Based on Architecture-Supported Regions	51
<i>Marek Tudruj and Łukasz Maśko</i>	
Genetic Algorithm Calibration for Two Objective Scheduling Parallel Jobs on Hierarchical Grids	61
<i>Victor Hugo Yaurima-Basaldua, Andrei Tchernykh, Yair Castro-Garcia, Victor Manuel Villagomez-Ramos, and Larisa Burtseva</i>	

The 4th Workshop on Language-Based Parallel Programming Models (WLPP 2011)

Expression Templates and OpenCL	71
<i>Uwe Bawidamann and Marco Nehmeier</i>	
Portable Explicit Threading and Concurrent Programming for MPI Applications	81
<i>Tobias Berka, Helge Hagenauer, and Marian Vajteršić</i>	

Verification of a Heat Diffusion Simulation Written with Orléans Skeleton Library	91
<i>Noman Javed and Frédéric Loulergue</i>	
Parallelization of an XML Data Compressor on Multi-cores	101
<i>Tomasz Müldner, Christopher Fry, Tyler Corbin, and Jan Krzysztof Miziołek</i>	
Comparing CUDA, OpenCL and OpenGL Implementations of the Cardiac Monodomain Equations	111
<i>Rafael Sachetto Oliveira, Bernardo Martins Rocha, Ronan Mendonça Amorim, Fernando Otaviano Campos, Wagner Meira Jr., Elson Magalhães Toledo, and Rodrigo Weber dos Santos</i>	
Fine Grained Parallelism in Recursive Function Calls	121
<i>Dimitris Saouglkos, Aristeidis Mastoras, and George Manis</i>	
The Second Workshop on Scalable Computing in Distributed Systems and the 7th Workshop on Large Scale Computations on Grids (ScoDiS-LaSCoG 2011)	
On-Line Grid Monitoring Based on Distributed Query Processing	131
<i>Bartosz Balis, Grzegorz Dyk, and Marian Bubak</i>	
Distributed Memory Virtualization with the Use of SDDSfL	141
<i>Arkadiusz Chrobot, Maciej Lasota, Grzegorz Lukawski, and Krzysztof Sapiecha</i>	
Dynamic Compatibility Matching of Services for Distributed Workflow Execution	151
<i>Paweł Czarnul and Michał Wójcik</i>	
Cyberinfrastructure Support for Engineering Virtual Organization for CyberDesign	161
<i>Tomasz Haupt, Nitin Sukhija, and Mark F. Horstemeyer</i>	
Dynamic Business Metrics-driven Resource Provisioning in Cloud Environments	171
<i>Paweł Koperek and Włodzimierz Funika</i>	
Stochastic Control of the Scalable High Performance Distributed Computations	181
<i>Zdzisław Onderka</i>	
Distributed Collaborative Visualization on Mobile Devices Using Interactive Video Streaming Techniques	191
<i>Maciej Panka, Michał Chlebiej, Krzysztof Benedyczak, and Piotr Bała</i>	

P2P Approach to Knowledge-Based Dynamic Virtual Organizations Inception and Management	201
<i>Marcin Stelmach, Bartosz Kryza, and Jacek Kitowski</i>	

The Third Workshop on Performance Evaluation of Parallel Applications on Large-Scale Systems

Balancing the Communications and Computations in Parallel FEM Simulations on Unstructured Grids	211
<i>Nikola Kosturski, Svetozar Margenov, and Yavor Vutov</i>	
Scalable Quasineutral Solver for Gyrokinetic Simulation	221
<i>Guillaume Latu, Virginie Grandgirard, Nicolas Crouseilles, and Guilhem Dif-Pradalier</i>	
Semantic-Based SLA Monitoring of Storage Resources	232
<i>Renata Słota, Darin Nikolow, Paweł Młoczek, and Jacek Kitowski</i>	
The Generalization of AQM Algorithms for Queueing Systems with Bounded Capacity	242
<i>Oleg Tikhonenko and Wojciech M. Kempa</i>	
Parallel Implementation and Scalability of Cloud Resolving EULAG Model	252
<i>Andrzej A. Wyszogrodzki, Zbigniew P. Piotrowski, and Wojciech W. Grabowski</i>	

Workshop on Parallel Computational Biology (PBC 2011)

Highly Efficient Parallel Approach to the Next-Generation DNA Sequencing	262
<i>Jacek Blazewicz, Bartosz Bosak, Piotr Gawron, Marta Kasprzak, Krzysztof Kurowski, Tomasz Piontek, and Aleksandra Swiercz</i>	
Parallel and Memory-Efficient Reads Indexing for Genome Assembly . . .	272
<i>Guillaume Chapuis, Rayan Chikhi, and Dominique Lavenier</i>	
Parallel Software Architecture for Experimental Workflows in Computational Biology on Clouds	281
<i>Luqman Hodgkinson, Javier Rosa, and Eric A. Brewer</i>	
Bit-Parallel Multiple Pattern Matching	292
<i>Tuan Tu Tran, Mathieu Giraud, and Jean-Stéphane Varré</i>	

Minisymposium on Applications of Parallel Computation in Industry and Engineering

A Parallel Space-Time Finite Difference Solver for Periodic Solutions of the Shallow-Water Equation	302
<i>Peter Arbenz, Andreas Hildebrand, and Dominik Obrist</i>	
A Parallel 3D Unstructured Implicit RANS Solver for Compressible and Incompressible CFD Simulations	313
<i>Aldo Bonfiglioli, Sergio Campobasso, Bruno Carpentieri, and Matthias Bollhöfer</i>	
Parallelization of the Discrete Chaotic Block Encryption Algorithm	323
<i>Dariusz Burak and Michał Chudzik</i>	
Parallel Algorithms for Parabolic Problems on Graphs	333
<i>Raimondas Čiegis and Natalija Tumanova</i>	
Efficient Isosurface Extraction Using Marching Tetrahedra and Histogram Pyramids on Multiple GPUs	343
<i>Miłosz Ciżnicki, Michał Kierzynka, Krzysztof Kurowski, Bogdan Ludwiczak, Krystyna Napierała, and Jarosław Palczyński</i>	
Parallel Implementation of Stochastic Inversion of Seismic Tomography Data	353
<i>Maciej Dwornik and Anna Pięta</i>	
Parallel Coarse-Grid Treatment in AMG for Coupled Systems	361
<i>Maximilian Emans</i>	
Approaches to Parallelize Pareto Ranking in NSGA-II Algorithm	371
<i>Algirdas Lančinskas and Julius Žilinskas</i>	
OpenCL Implementation of Cellular Automata Finite Element (CAFE) Method	381
<i>Lukasz Rauch, Krzysztof Bzowski, and Artur Rodzaj</i>	
Parallelization of EULAG Model on Multicore Architectures with GPU Accelerators	391
<i>Krzysztof Rojek and Lukasz Szustak</i>	
High-Resolution Simulation of Turbulent Collision of Cloud Droplets . . .	401
<i>Bogdan Rosa, Hossein Parishani, Orlando Ayala, Lian-Ping Wang, and Wojciech W. Grabowski</i>	
Parallelization of the Seismic Ray Trace Algorithm	411
<i>Kamil Szostek and Andrzej Leśniak</i>	

A Study on Parallel Performance of the EULAG F90/95 Code	419
<i>Damian K. Wójcik, Marcin J. Kurowski, Bogdan Rosa, and Michał Z. Ziemiański</i>	

Minisymposium on High Performance Computing Interval Methods

Parallel Execution in Metaheuristics for the Problem of Solving Parametric Interval Linear Systems	429
<i>Jerzy Duda and Iwona Skalna</i>	
Organizing Calculations in Algorithms for Solving Systems of Interval Linear Equations Using the “Interval Extended Zero” Method	439
<i>Ludmila Dymova and Mariusz Pilarek</i>	
An Interval Backward Finite Difference Method for Solving the Diffusion Equation with the Position Dependent Diffusion Coefficient . . .	447
<i>Malgorzata A. Jankowska</i>	
Arbitrary Precision Complex Interval Computations in C-XSC	457
<i>Walter Krämer and Frithjof Blomquist</i>	
Tuning the Multithreaded Interval Method for Solving Underdetermined Systems of Nonlinear Equations	467
<i>Bartłomiej Jacek Kubica</i>	
Applying an Interval Method for a Four Agent Economy Analysis	477
<i>Bartłomiej Jacek Kubica and Adam Woźniak</i>	
An Axiomatic Approach to Computer Arithmetic with an Appendix on Interval Hardware	484
<i>Ulrich Kulisch</i>	
A Method for Comparing Intervals with Interval Bounds	496
<i>Pavel Sevastjanov, Pavel Bartosiewicz, and Kamil Tkacz</i>	
Direct Interval Extension of TOPSIS Method	504
<i>Pavel Sevastjanov and Anna Tikhonenko</i>	
Enclosure for the Solution Set of Parametric Linear Systems with Non-affine Dependencies	513
<i>Iwona Skalna</i>	
The Central Difference Interval Method for Solving the Wave Equation	523
<i>Barbara Szyszka</i>	

Workshop on Complex Collective Systems

Meta-model Assisted Evolutionary Optimization of Cellular Automata: An Application to the SCIARA Model	533
<i>Donato D'Ambrosio, Rocco Rongo, William Spataro, and Giuseppe A. Trunfio</i>	
How the Competitive Altruism Leads to Bistable Homogeneous States of Cooperation or Defection	543
<i>Andrzej Jarynowski, Przemysław Gawroński, and Krzysztof Kulakowski</i>	
Towards Multi-Agent Simulation of the Dynamic Vehicle Routing Problem in MATSim	551
<i>Michał Maciejewski and Kai Nagel</i>	
The Application of Cellular Automata to Simulate Drug Release from Heterogeneous Systems	561
<i>Agnieszka Mietła, Iwona Wanat, and Jarosław Wąs</i>	
Model of Skyscraper Evacuation with the Use of Space Symmetry and Fluid Dynamic Approximation	570
<i>Wiesława Sikora, Janusz Malinowski, and Arkadiusz Kupczak</i>	
Graph of Cellular Automata as a Metaphor of Fusarium Graminearum Growth Implemented in GPGPU CUDA Computational Environment	578
<i>Paweł Topa, Maciej Kuźniar, and Witold Dzwiniel</i>	
DPD Model of Foraminiferal Chamber Formation: Simulation of Actin Meshwork – Plasma Membrane Interactions	588
<i>Paweł Topa, Jarosław Tyszka, Samuel S. Bowser, and Jeffrey L. Travis</i>	
A Discrete Simulation Model for Traffic Including Bicycles on Urban Networks, Applied to Intersection of Two One-Way Streets	598
<i>Jelena Vasić and Heather J. Ruskin</i>	

The First Workshop on Service Oriented Architecture in Distributed Systems (SOADS 2011)

Lightweight Information Flow Control for Web Services	608
<i>Bartosz Brodecki, Michał Kalewski, Piotr Sasak, and Michał Szychowiak</i>	
Failure Detection in a RESTful Way	618
<i>Dariusz Dwornikowski, Anna Kobusińska, and Jacek Kobusiński</i>	

Compensability of Business Processes	628
<i>Hubert Gęzikiewicz, Krzysztof Jankiewicz, and Tadeusz Morzy</i>	
A Developer’s View of Application Servers Interoperability	638
<i>Paweł Lech Kaczmarek and Michał Nowakowski</i>	
Traffic Pattern Analysis for Distributed Anomaly Detection	648
<i>Grzegorz Kolaczek and Krzysztof Juszczyszyn</i>	
Author Index	659

Table of Contents – Part I

A Look Back: 57 Years of Scientific Computing	1
<i>Jerzy Waśniewski</i>	

Parallel/Distributed Architectures and Mobile Computing

Modeling a Leadership-Scale Storage System	10
<i>Ning Liu, Christopher Carothers, Jason Cope, Philip Carns, Robert Ross, Adam Crume, and Carlos Maltzahn</i>	

Combining Optimistic and Pessimistic Replication	20
<i>Marcin Bazydło, Szymon Francuzik, Cezary Sobaniec, and Dariusz Wawrzyniak</i>	

K-Resilient Session Guarantees Synchronization Protocol for Mobile Ad-Hoc Networks	30
<i>Jerzy Brzeziński, Dariusz Dwornikowski, Lukasz Piątkowski, and Grzegorz Sobański</i>	

On Time Constraints of Reliable Broadcast Protocols for Ad Hoc Networks with the Liveness Property	40
<i>Jerzy Brzeziński, Michał Kalewski, and Dariusz Wawrzyniak</i>	

Data Transfers on the Fly for Hierarchical Systems of Chip Multi-Processors	50
<i>Marek Tudruj and Lukasz Maśko</i>	

Numerical Algorithms

New Level-3 BLAS Kernels for Cholesky Factorization	60
<i>Fred G. Gustavson, Jerzy Waśniewski, and José R. Herrero</i>	

Parallel Preconditioner for Nonconforming Adini Discretization of a Plate Problem on Nonconforming Meshes	70
<i>Leszek Marcinkowski</i>	

Incomplete Cyclic Reduction of Banded and Strictly Diagonally Dominant Linear Systems	80
<i>Carl Christian Kjølgaard Mikkelsen and Bo Kågström</i>	

Fast and Small Nonlinear Pseudorandom Number Generators for Computer Simulation	92
<i>Samuel Neves and Filipe Araujo</i>	
Parallel Quantum Algorithm for Finding the Consistency of Saaty’s Matrices	102
<i>Henryk Piech and Olga Siedlecka-Lamch</i>	
A Numerical Approach to the Determination of 3D Stokes Flow in Polygonal Domains Using PIES	112
<i>Eugeniusz Ziemiuk, Krzysztof Szerszen, and Marta Kapturczak</i>	
Parallel Numerics	
Cache Blocking for Linear Algebra Algorithms	122
<i>Fred G. Gustavson</i>	
Reducing the Amount of Pivoting in Symmetric Indefinite Systems	133
<i>Dulcinea Becker, Marc Baboulin, and Jack Dongarra</i>	
A High Performance Dual Revised Simplex Solver	143
<i>Julian Hall and Qi Huangfu</i>	
TFETI Coarse Space Projectors Parallelization Strategies	152
<i>Vaclav Hapla and David Horak</i>	
FFTs and Multiple Collective Communication on Multiprocessor-Node Architectures	163
<i>Andreas Jocksch</i>	
Performance Analysis of Parallel Alternating Directions Algorithm for Time Dependent Problems	173
<i>Ivan Lirkov, Marcin Paprzycki, and Maria Ganzha</i>	
A Novel Parallel Algorithm for Gaussian Elimination of Sparse Unsymmetric Matrices	183
<i>Riccardo Murri</i>	
Parallel FEM Adaptation on Hierarchical Architectures	194
<i>Tomasz Olas, Roman Wyrzykowski, and Pawel Gepner</i>	
Solving Systems of Interval Linear Equations in Parallel Using Multithreaded Model and “Interval Extended Zero” Method	206
<i>Mariusz Pilarek and Roman Wyrzykowski</i>	
GPU-Based Parallel Algorithms for Transformations of Quantum States Expressed as Vectors and Density Matrices	215
<i>Marek Sawerwain</i>	

Generalizing Matrix Multiplication for Efficient Computations on Modern Computers	225
<i>Stanislav G. Sedukhin and Marcin Paprzycki</i>	
Distributed QR Factorization Based on Randomized Algorithms	235
<i>Hana Straková, Wilfried N. Gansterer, and Thomas Zemen</i>	
Static Load Balancing for Multi-level Monte Carlo Finite Volume Solvers	245
<i>Jonas Šukys, Siddhartha Mishra, and Christoph Schwab</i>	

Parallel Non-numerical Algorithms

A Parallel Algorithm for Minimizing the Number of Routes in the Vehicle Routing Problem with Time Windows	255
<i>Miroslaw Błocho and Zbigniew J. Czech</i>	
Towards Parallel Direct SAT-Based Cryptanalysis	266
<i>Paweł Dudek, Miroslaw Kurkowski, and Marian Srebrny</i>	
Parallel Version of Image Segmentation Algorithm Using Polygonal Markov Fields	276
<i>Rafał Kluszczyński and Piotr Bała</i>	
Parallel Community Detection for Massive Graphs	286
<i>E. Jason Riedy, Henning Meyerhenke, David Ediger, and David A. Bader</i>	
Is Your Permutation Algorithm Unbiased for $n \neq 2^m$?	297
<i>Michael Waechter, Kay Hamacher, Franziska Hoffgaard, Sven Widmer, and Michael Goesele</i>	

Tools and Environments for Parallel/Distributed/Grid Computing

Extracting Coarse-Grained Parallelism for Affine Perfectly Nested Quasi-uniform Loops	307
<i>Włodzimierz Bielecki and Krzysztof Kraska</i>	
Polish Computational Research Space for International Scientific Collaborations	317
<i>Jacek Kitowski, Michał Turała, Kazimierz Wiatr, Łukasz Dutka, Marian Bubak, Tomasz Szepieniec, Marcin Radecki, Mariusz Sterzel, Zofia Mosurska, Robert Pająk, Renata Słota, Krzysztof Kurowski, Bartek Palak, Bartłomiej Balcerak, Piotr Bała, Maciej Filocha, and Rafał Tylman</i>	

Request Distribution Toolkit for Virtual Resources Allocation 327
Jan Kwiatkowski and Mariusz Fras

Vitrall: Web-Based Distributed Visualization System for Creation of
 Collaborative Working Environments 337
*Piotr Śniegowski, Marek Błażewicz, Grzegorz Grzelachowski,
 Tomasz Kuczyński, Krzysztof Kurowski, and Bogdan Ludwiczak*

Applications of Parallel/Distributed Computing

CUDA Accelerated Blobby Molecular Surface Generation 347
*Daniele D’Agostino, Sergio Decherchi, Antonella Galizia,
 José Colmenares, Alfonso Quarati, Walter Rocchia, and
 Andrea Clematis*

GPU Accelerated Image Processing for Lip Segmentation 357
Lukasz Adrjanowicz, Mariusz Kubanek, and Adam Tomas

Material Parameter Identification with Parallel Processing and
 Geo-applications 366
*Radim Blaheta, Rostislav Hrtus, Roman Kohut, Owe Axlsson, and
 Ondřej Jakl*

Hierarchical Parallel Approach in Vascular Network Modeling – Hybrid
 MPI+OpenMP Implementation 376
Krzysztof Jurczuk, Marek Kretowski, and Johanne Bezy-Wendling

Runtime Optimisation Approaches for a Real-Time Evacuation
 Assistant 386
*Armel Ulrich Kemloh Wagoum, Bernhard Steffen, and
 Armin Seyfried*

A Parallel Genetic Algorithm Based on Global Program State
 Monitoring 396
Adam Smyk and Marek Tudruj

**Applied Mathematics, Neural Networks and
 Evolutionary Computing**

Parallel Approach to the Functional Decomposition of Logical Functions
 Using Developmental Genetic Programming 406
Stanislaw Deniziak and Karol Wiczorek

The Nine Neighbor Extrapolated Diffusion Method for Weighted Torus
 Graphs 416
Katerina A. Dimitrakopoulou and Michail N. Misyrlis

On the Weak Convergence of the Recursive Orthogonal Series-Type Kernel Probabilistic Neural Networks in a Time-Varying Environment	427
<i>Piotr Duda and Yoichi Hayashi</i>	
On the Cesaro Orthogonal Series-Type Kernel Probabilistic Neural Networks Handling Non-stationary Noise	435
<i>Piotr Duda and Jacek M. Zurada</i>	
On the Weak Convergence of the Orthogonal Series-Type Kernel Regression Neural Networks in a Non-stationary Environment	443
<i>Meng Joo Er and Piotr Duda</i>	
A Graph-Based Generation of Virtual Grids	451
<i>Ewa Grabska, Wojciech Palacz, Barbara Strug, and Grażyna Ślusarczyk</i>	
On General Regression Neural Network in a Nonstationary Environment	461
<i>Yoichi Hayashi and Lena Pietruczuk</i>	
Determination of the Heat Transfer Coefficient by Using the Ant Colony Optimization Algorithm	470
<i>Edyta Hetmaniok, Damian Słota, and Adam Zielonka</i>	
Learning in a Non-stationary Environment Using the Recursive Least Squares Method and Orthogonal-Series Type Regression Neural Network	480
<i>Maciej Jaworski and Meng Joo Er</i>	
On the Application of the Parzen-Type Kernel Probabilistic Neural Network and Recursive Least Squares Method for Learning in a Time-Varying Environment	490
<i>Maciej Jaworski and Yoichi Hayashi</i>	
Learning in Rough-Neuro-Fuzzy System for Data with Missing Values	501
<i>Bartosz A. Nowak and Robert K. Nowicki</i>	
Diameter of the Spike-Flow Graphs of Geometrical Neural Networks	511
<i>Jarosław Piersa</i>	
Weak Convergence of the Recursive Parzen-Type Probabilistic Neural Network in a Non-stationary Environment	521
<i>Lena Pietruczuk and Jacek M. Zurada</i>	
Strong Convergence of the Parzen-Type Probabilistic Neural Network in a Time-Varying Environment	530
<i>Lena Pietruczuk and Meng Joo Er</i>	

Learning in a Time-Varying Environment by Making Use of the Stochastic Approximation and Orthogonal Series-Type Kernel Probabilistic Neural Network	539
<i>Jacek M. Zurada and Maciej Jaworski</i>	

Minisymposium on GPU Computing

Accelerating BST Methods for Model Reduction with Graphics Processors	549
<i>Peter Benner, Pablo Ezzatti, Enrique S. Quintana-Ortí, and Alfredo Remón</i>	
Reducing Thread Divergence in GPU-Based B&B Applied to the Flow-Shop Problem	559
<i>Imen Chakroun, Ahcène Bendjoudi, and Nouredine Melab</i>	
A GPU-Based Approximate SVD Algorithm	569
<i>Blake Foster, Sridhar Mahadevan, and Rui Wang</i>	
Automatic CUDA Code Synthesis Framework for Multicore CPU and GPU Architectures	579
<i>Hanwoong Jung, Youngmin Yi, and Soonhoi Ha</i>	
Accelerating the Red/Black SOR Method Using GPUs with CUDA	589
<i>Elias Konstantinidis and Yiannis Cotronis</i>	
Dense Affinity Propagation on Clusters of GPUs	599
<i>Marcin Kurdziel and Krzysztof Boryczko</i>	
High-Performance Pseudo-Random Number Generation on Graphics Processing Units	609
<i>Nimalan Nandapalan, Richard P. Brent, Lawrence M. Murray, and Alistair P. Rendell</i>	
Auto-tuning Dense Vector and Matrix-Vector Operations for Fermi GPUs	619
<i>Hans Henrik Brandenburg Sørensen</i>	
GPGPU Implementation of Cellular Automata Model of Water Flow . . .	630
<i>Paweł Topa and Paweł Młoczek</i>	

Workshop on Memory and Data Parallelism on Multi- and Manycore Platforms

A Multi-GPU Implementation of a D2Q37 Lattice Boltzmann Code	640
<i>Luca Biferale, Filippo Mantovani, Marcello Pivanti, Fabio Pozzati, Mauro Sbragaglia, Andrea Scagliarini, Sebastiano Fabio Schifano, Federico Toschi, and Raffaele Tripiccion</i>	

Combining Smoother and Residual Calculation in v-cycle AMG for Symmetric Problems	651
<i>Maximilian Emans</i>	
Enhancing Parallelism of Tile Bidiagonal Transformation on Multicore Architectures Using Tree Reduction	661
<i>Hatem Ltaief, Piotr Luszczek, and Jack Dongarra</i>	
Autotuning of Adaptive Mesh Refinement PDE Solvers on Shared Memory Architectures	671
<i>Svetlana Nogina, Kristof Unterweger, and Tobias Weinzierl</i>	
GPU Acceleration of the Matrix-Free Interior Point Method	681
<i>Edmund Smith, Jacek Gondzio, and Julian Hall</i>	
Workshop on Models, Algorithms and Methodologies for Hierarchical Parallelism in New HPC Systems	
Deconvolution of 3D Fluorescence Microscopy Images Using Graphics Processing Units	690
<i>Luisa D'Amore, Livia Marcellino, Valeria Mele, and Diego Romano</i>	
HADAB: Enabling Fault Tolerance in Parallel Applications Running in Distributed Environments	700
<i>Vania Boccia, Luisa Carracciolo, Giuliano Laccetti, Marco Lapegna, and Valeria Mele</i>	
Increasing the Efficiency of the DaCS Programming Model for Heterogeneous Systems	710
<i>Maciej Cytowski and Marek Niezgódka</i>	
A Software Architecture for Parallel List Processing on Grids	720
<i>Apolo H. Hernández, Graciela Román-Alonso, Miguel A. Castro-García, Manuel Aguilar-Cornejo, Santiago Domínguez-Domínguez, and Jorge Buenabad-Chávez</i>	
Reducing the Time to Tune Parallel Dense Linear Algebra Routines with Partial Execution and Performance Modeling	730
<i>Piotr Luszczek and Jack Dongarra</i>	
A General-Purpose Virtualization Service for HPC on Cloud Computing: An Application to GPUs	740
<i>Raffaele Montella, Giuseppe Coviello, Giulio Giunta, Giuliano Laccetti, Florin Isaila, and Javier Garcia Blas</i>	
A Simulated Annealing Algorithm for GPU Clusters	750
<i>Maciej Zbierski</i>	
Author Index	761