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# Parallel Processing and Applied Mathematics

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

## 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

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# 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 (Nałęczów, 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 Giuliano 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. Łuszczek)

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  
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