

Preface

This volume comprises the proceedings of the 11th International Conference on Parallel Processing and Applied Mathematics – PPAM 2015, which was held in Krakow, Poland, September 6–9, 2015. It was organized by the Department of Computer and Information Science of the Czestochowa University of Technology together with with the AGH University of Science and Technology, under the patronage of the Committee of Informatics of the Polish Academy of Sciences, in cooperation with the ICT COST Action IC1305 “Network for Sustainable Ultrascale Computing (NESUS).” The main organizer was Roman Wyrzykowski.

PPAM is a biennial conference. Ten previous events have been held in different places in Poland since 1994. The proceedings of the last six conferences have been published by Springer in the *Lecture Notes in Computer Science* series (Nałęczów, 2001, vol. 2328; Czestochowa, 2003, vol. 3019; Poznań, 2005, vol. 3911; Gdańsk, 2007, vol. 4967; Wrocław, 2009, vols. 6067 and 6068; Toruń, 2011, vols. 7203 and 7204; Warsaw, 2013, vols. 8384 and 8385).

The PPAM conferences have become an international forum for exchanging ideas between researchers involved in parallel and distributed computing, including theory and applications, as well as applied and computational mathematics. The focus of PPAM 2015 was on models, algorithms, and software tools that facilitate efficient and convenient utilization of modern parallel and distributed computing architectures, as well as on large-scale applications, including big data problems.

This meeting gathered more than 190 participants from 33 countries. A strict refereeing process resulted in the acceptance of 111 contributed presentations, while approximately 43 % of the submissions were rejected. Regular tracks of the conference covered important fields of parallel/distributed/cloud computing and applied mathematics such as:

- Numerical algorithms and parallel scientific computing
- Parallel non-numerical algorithms
- Tools and environments for parallel/distributed/cloud computing
- Applications of parallel computing
- Applied mathematics, neural networks, evolutionary computing, and metaheuristics

The plenary and invited talks were presented by:

- David A. Bader from the Georgia Institute of Technology (USA)
- Costas Bekas from IBM Research — Zurich (Switzerland)
- Pete Beckman from the Argonne National Laboratory (USA)
- Christopher Carothers from the Rensselaer Polytechnic Institute (USA)
- Barbara Chapman from the University of Houston (USA)
- Willem Deconinck from the European Centre for Medium-Range Weather Forecast (UK)
- Geoffrey C. Fox from Indiana University (USA)

- Dieter Kranzmueller from the Ludwig-Maximilians-Universität München (Germany)
- Vladik Kreinovich from the University of Texas at El Paso (USA)
- Alexey Lastovetsky from the University College Dublin (Ireland)
- Carlos Osuna from ETH Zurich (Switzerland)
- Srinivasan Parthasarathy from the Ohio State University (USA)
- Enrique S. Quintana-Orti from the Universidad Jaime I (Spain)
- Thomas Rauber from the University of Bayreuth (Germany)
- Daniel Reed from the University of Iowa (USA)
- Rizos Sakellariou from the University of Manchester (UK)
- Boleslaw K. Szymanski from the Rensselaer Polytechnic Institute (USA)
- Manuel Ujaldon from Nvidia
- Jeffrey Vetter from the Oak Ridge National Laboratory and Georgia Institute of Technology (USA)
- Richard W. Vuduc from the Georgia Institute of Technology (USA)
- Torsten Wilde from the Leibnitz Supercomputing Centre (LRZ) (Germany)

Important and integral parts of the PPAM 2015 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 Universidad Jaime I (Spain), and Robert Strzodka from Heidelberg University (Germany).
- The Third 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 Power and Energy Aspects of Computation organized by Jee Choi from the IBM T.J. Watson Research Center (USA), Piotr Luszczek from the University of Tennessee (USA), Leonel Sousa from the Technical University of Lisbon (Portugal), and Richard W. Vuduc from the Georgia Institute of Technology (USA).
- Workshop on Scheduling for Parallel Computing — SPC 2015 organized by Maciej Drozdowski from the Poznań University of Technology (Poland).
- The 6th Workshop on Language-Based Parallel Programming Models — WLPP 2015 organized by Ami Marowka from the Bar-Ilan University (Israel).
- The 5th Workshop on Performance Evaluation of Parallel Applications on Large-Scale Systems organized by Jan Kwiątkowski from the Wrocław University of Technology (Poland).
- Workshop on Parallel Computational Biology — PBC 2015 organized by Bertil Schmidt from the University of Mainz (Germany) and Jarosław Żoła from the University at Buffalo (USA).
- Workshop 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 HPC Applications in Physical Sciences organized by Grzegorz Kamieniarz and Wojciech Florek from the A. Mickiewicz University in Poznań (Poland).
- The Second Workshop on Applied High-Performance Numerical Algorithms in PDEs organized by Piotr Krzyżanowski and Leszek Marcinkowski from Warsaw University (Poland) and Talal Rahman from Bergen University College (Norway).
- Minisymposium on High-Performance Computing Interval Methods organized by Bartłomiej J. Kubica from the Warsaw University of Technology (Poland).
- Workshop on Complex Collective Systems organized by Paweł Topa and Jarosław Wąs from the AGH University of Science and Technology (Poland).
- Special Session on Efficient Algorithms for Problems with Matrix and Tensor Decompositions organized by Marian Vajtersic from the University of Salzburg (Austria) and Gabriel Oksa from the Slovak Academy of Sciences.
- Special Session on Algorithms, Methodologies, and Frameworks for HPC in Geosciences and Weather Prediction organized by Zbigniew Piotrowski from the Institute of Meteorology and Water Management (Poland) and Krzysztof Rojek from the Częstochowa University of Technology (Poland).

The PPAM 2015 meeting began with four tutorials:

- Scientific Computing with GPUs, by Dominik Göddeke from the University of Stuttgart (Germany), Robert Strzodka from Heidelberg University (Germany), and Manuel Ujaldon from the University of Malaga (Spain) and Nvidia.
- Advanced Scientific Visualization with VisNow, by Krzysztof Nowiński, Bartosz Borucki, Kerstin Kantiem, and Szymon Jaranowski from the University of Warsaw (Poland).
- Parallel Computing in Java, by Piotr Bała from the Warsaw University of Technology (Poland) and Marek Nowicki, Łukasz Górski, Magdalena Ryczkowska from the Nicolaus Copernicus University (Poland).
- Introduction to Programming with Intel Xeon Phi, by Krzysztof Rojek and Łukasz Szustak from the Częstochowa University of Technology (Poland).

An integral part of the GPU Tutorial was the CUDA quiz with participants challenged to maximize the performance on a common GPU model. The winner was Miłosz Ciżnicki from the Poznan Supercomputing and Networking Center. The winner received the prize of a Tesla K40 GPU generously donated by Nvidia for the conference given its role of PPAM sponsor. The second and third prizes were granted, respectively, to Michał Antkowiak and Łukasz Kucharski, both from the A. Mickiewicz University in Poznań.

Nvidia also donated another prize, GeForce GTX480 GPU, for the authors of the best paper presented at the Minisymposium on GPU Computing. This prize was awarded to Jan Gmys, Mohand Mezma, Nouredine Melab, and Daniel Tuytens from the University of Mons, who presented the paper “IVM-Based Work Stealing for Parallel Branch-and-Bound on GPU.”

Special Session on Algorithms, Methodologies, and Frameworks for HPC in Geosciences and Weather Prediction: Contemporary and future applications of numerical

weather prediction, climate research, and studies in geosciences demand multidisciplinary advancements in computing methodologies, including the use of multi-/manycore processors and accelerators, scalable and energy-efficient frameworks, and big data strategies, as well as new or improved numerical algorithms. This includes, for example, development of scalable, high-resolution methods for integration of fluid PDEs and efficient iterative solvers, highly optimized ports to modern hardware (CPU, GPU, Xeon Phi), code development and portability strategies, and libraries for handling geophysical datasets.

The special session served as a multidisciplinary forum for the discussion of state-of-the-art research and development toward the next-generation geophysical fluid solvers and weather/climate prediction applications.

The special session featured a number of invited and contributed talks, covering recent advances in numerical algorithms, accelerator methodologies, energy-efficient computing, and large dataset managements, including:

- Algorithms and tools for the extreme-scale numerical weather prediction (invited plenary talk by Willem Deconinck et al.)
- Adaptation of COSMO Consortium weather and climate numerical models to hybrid architectures (invited plenary talk by Carlos Osuna et al.)
- Highly efficient port of the GCR solver using high-level stencil framework on multi- and many-core architectures (by M. Ciżnicki et al.)
- Autotuned scheduler for time/energy optimization for a fully three-dimensional MPDATA advection scheme on the hybrid CPU-GPU clusters (by K. Rojek et al.)
- Parallel alternating direction implicit preconditioners for all-scale atmospheric models (by Z. Piotrowski et al.)

The organizers are indebted to the PPAM 2015 sponsors, whose support was vital to the success of the conference. The main sponsor was Intel Corporation and the other sponsors were: Nvidia, Action S.A., and Gambit. We thank all the members of the international Program Committee and additional reviewers for their diligent work in reviewing the submitted papers. Finally, we thank all of the local organizers from the Częstochowa University of Technology and the AGH University of Science and Technology, who helped us run the event very smoothly. We are especially indebted to Grażyna Kołakowska, Urszula Kroczevska, Łukasz Kuczyński, Adam Tomasz, and Marcin Woźniak from the Częstochowa University of Technology; and to Krzysztof Zieliński, Kazimierz Wiatr, and Jacek Kitowski from the AGH University of Science and Technology.

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 2017, which will be held during September 10–13, 2017, in Lublin, the largest Polish city east of the Vistula River.

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