Lecture Notes in Computer Science 4967

Commenced Publication in 1973
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Parallel Processing and Applied Mathematics

7th International Conference, PPAM 2007
Gdansk, Poland, September 9-12, 2007
Revised Selected Papers

Springer

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Library of Congress Control Number: 2008927189

CR Subject Classification (1998): D, F.2, G, B.2-3, C.2, J.2

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

ISSN 0302-9743
ISBN-10 3-540-68105-1 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-68105-2 Springer Berlin Heidelberg New York

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springer.com

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Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12270521 06/3180 5 4 3 2 1 0

Preface

This volume comprises the proceedings of the 7th International Conference on Parallel Processing and Applied Mathematics - PPAM 2007, which was held in Gdańsk, Poland, September 9–12, 2007. It was organized by the Department of Computer and Information Sciences of the Częstochowa University of Technology, with the help of the TASK Academic Computer Centre in Gdańsk. The main organizer was Roman Wyrzykowski.

PPAM is a biennial conference. Six previous events have been held in different places in Poland since 1994. The proceedings of the last three conferences have been published by Springer in the [illegible] series (Nałęczów, 2001, vol. 2328; Częstochowa, 2003, vol. 3019; Poznań, 2005, vol. 3911).

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 2007 was on software tools which facilitate efficient and convenient utilization of modern computing architectures, as well as grid computing, and large-scale applications.

This meeting gathered more than 230 participants from 35 countries. A strict refereeing process resulted in the acceptance of 141 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 and distributed non-numerical algorithms
- Environments and tools for parallel/distributed/grid computing
- Applications of parallel/distributed/grid computing
- Evolutionary computing, meta-heuristics and neural networks

The plenary and invited talks were presented by:

- David A. Bader from the Georgia Institute of Technology (USA)
- Ben Bennet from ClearSpeed Technology (UK)
- Ewa Deelman from the University of Southern California (USA)
- Jack Dongarra from the University of Tennessee and Oak Ridge National Laboratory (USA)
- Richard Dracott from Intel (USA)
- Erik Elmroth from the Umeå University (Sweden)
- Fabrizio Gagliardi from Microsoft (USA)
- Angel E. Garcia from the Rensselaer Polytechnic Institute (USA)
- Fred Gustavson from the IBM T.J. Watson Research Center (USA)
- Hans-Christian Hoppe from Intel (Germany)

- Vladik Kreinovich from the University of Texas at El Paso (USA)
- Jarek Nieplocha from the Pacific Northwest National Laboratory (USA)
- Jennifer Schopf from the Argonne National Laboratory (USA) and Science Institute (UK)
- Masha Sosonkina from the Ames Laboratory and Iowa State University (USA)
- Bolesław Szymański from the Rensselaer Polytechnic Institute (USA)
- Jerzy Waśniewski from the Technical University of Denmark (Denmark)

Workshops and Minisymposia

Important and integral parts of the PPAM 2007 conference were the workshops:

- The Second Minisymposium on Novel Data Formats and Algorithms for Dense Linear Algebra Computations organized by Fred Gustavson from the IBM T.J. Watson Research Center (USA), and Jerzy Waśniewski from the Technical University of Denmark (Denmark)
- Combinatorial Tools for Parallel Sparse Matrix Computations Workshop organized by Laura Grigori from INRIA (France), and Masha Sosonkina from the Ames Laboratory and Iowa State University (USA)
- The Third Grid Application and Middleware Workshop - GAMW '07 organized by Ewa Deelman from the USC Information Sciences Institute (USA), and Norbert Meyer from the Poznań Supercomputing and Networking Center (Poland)
- The Third Workshop on Large Scale Computations on Grids - LaSCoG'07 organized by Marcin Paprzycki from SWPS in Warsaw (Poland), Dana Petcu from the Western University of Timisoara (Romania), and Przemyslaw Stpiczyński from Marie Curie-Skłodowska University in Lublin (Poland)
- Workshop on Models, Algorithms and Methodologies for Grid-Enabled Computing Environments organized by Giovanni Aloisio from the University of Lecce (Italy), and Giuliano Laccetti from the University of Naples Federico II (Italy)
- Workshop on Scheduling for Parallel Computing - SPC'07 organized by Maciej Drozdowski from the Poznań University of Technology (Poland)
- The Second Workshop on Language-Based Parallel Programming Models - WLPP'07 organized by Ami Marowka from the Shenkar College of Engineering and Design in Ramat-Gan (Israel)
- Workshop on Performance Evaluation of Parallel Applications on Large-Scale Systems organized by Jan Kwiatkowski, Dariusz Konieczny and Marcin Pawlik from the Wrocław University of Technology (Poland)
- Workshop on Parallel Computational Biology - PBC'2007 organized by David A. Bader from the Georgia Institute of Technology in Atlanta (USA), Denis Trystram from ID-IMAG in Grenoble (France), and Jaroslaw Zola from the Iowa State University (USA)
- Workshop on High Performance Computing for Engineering Applications organized by Piotr Doerffer from the Institute of Fluid Machinery in Gdańsk (Poland), and Jacek Rokicki from the Warsaw University of Technology (Poland)

– Minisymposium on Interval Analysis organized by Vladik Kreinovich from the University of Texas at El Paso (USA), Paweł Sewastjanow from the Częstochowa University of Technology, Bartłomiej J. Kubica from the Warsaw University of Technology (Poland), and Jerzy Waśniewski from the Technical University of Denmark (Denmark)

Tutorials

The PPAM 2007 meeting began with four half-day tutorials:

– Globus: fundamental tools for building your Grid, by Jennifer Schopf from the Argonne National Laboratory (USA) and eScience Institute (UK)
– Intel tools for grid programming, by Ralf Ratering from Intel (Germany)
– New data structures for the Cell processor, by Fred Gustavson from the the IBM T.J. Watson Research Center (USA), and Jerzy Waśniewski from the Technical University of Denmark (Denmark)
– Grid computing with GridWay on Globus infrastructures: porting applications using the DRMAA standard, by GridWay Team (Spain)

The New Topics at PPAM 2007

[illegible][1] Power consumption, heat dissipation and other physical limitations are pushing the microprocessor industry towards multicore design patterns. Most of the processor manufacturers, such as Intel and AMD, are following more conventional approaches, which consist of homogeneous, symmetric multicores where execution units are replicated on the same die; multiple execution units share some cache level (generally L2 and L3) and the bus to memory. Other manufacturers proposed still homogeneous approaches but with a stronger emphasis on parallelism and hyperthreading. Yet other chip manufacturers started exploring heterogeneous designs where cores have different architectural features. One such example is the Cell Broadband Engine (see[2],[3], and[4]) developed by STI, a consortium formed by Sony, Toshiba and IBM. The Cell BE has outstanding floating-point computational power, which makes it a considerable candidate for high performance computing systems. IBM shipped the first Cell-based system, the BladeCenter QS20, on September 12th 2006.

[1] Taken from the Introduction of the LAPACK Working Note Number 185 of Alfredo Buttari, Jack Dongarra, and Jakub Kurzak; Limitations of the Play Station 3 for High Performance Cluster Computing, UT-CS-07-597, May 2007; "http://www.netlib.org/lapack/lawnspdf/lawn185.pdf".

[2] H.P. Hofstee. Power efficient processor architecture and the Cell process or. In Proceedings of the 11th Intel Symposium on High-Performance Computer Architecture, 2005.

[3] J.A. Kahle, M.N. Day, H.P. Hofstee, C.R. Johns, T.R. Maeurer, and D. Shippy. Introduction to the Cell multiprocessor. IBM J. Res. & Dev., 49(4/5):589-604, 2005.

[4] IBM. Cell Broadband Engine Architecture, Version 1.0, August 2005.

This blade was equipped with two Cell processors with a 512 MB memory each and connected in a NUMA configuration; the external connectivity was achieved through a Gigabit and an InfiniBand network interface. Now QS20 blade is replaced with a new QS21 Blade Center with larger memory. Its impressive computational power, coupled with high speed network interfaces, makes it a good candidate for high performance cluster computing. At almost the same period (November 11th 2006), Sony released the Play Station 3 (PS3) gaming console. Even if this console is not meant for high performance computing, it is still equipped with a (stripped down) Cell processor and its price ($500) definitely makes it an attractive solution for building a Cell-based cluster.

Four speakers Alfredo Buttari, Jack Dongarra, Fred Gustavson and Adrianto Wirawan spoke, in their lectures, about the new Cell architecture. Also, there was a tutorial on New Data Structures and Cell related work by Jack Dongarra team, and a minisymposium on "Novel Data Formats and Algorithms for Dense Linear Algebra Computations" both organized by Fred Gustavson and Jerzy Waśniewski. This latter material partly featured the Cell architecture as an example of the new Multi-Core / Many Core environment and role that New Data Structures could play for Cell. Ben Bennett, Richard Dracott, and Jerzy Waśniewski were also discussing the new Multi-Core / Many Core environment in their lectures.

[illegible] Numerical methods – such as optimization methods, methods for solving systems of equations, etc. – usually produce approximate solutions. Often, there are no guaranteed bounds on the accuracy of these approximate solutions – or there are bounds but these bounds are too wide to be practically useful. In such situations, it is desirable to have verified numerical computations, i.e., computations that would produce verified (provable) accuracy.

When a (final or intermediate) approximate result $\widetilde{x}$ of the computation comes with a verified bound Δ, it means that the actual (unknown) value of the estimated quantity belongs to the interval $[\widetilde{x}-\Delta, \widetilde{x}+\Delta]$. In view of this fact, verified numerical computing is also known as [illegible].

To address these issues, a minisymposium on interval analysis method was organized by Vladik Kreinovich, Paweł Sewastjanow, Bartłomiej J. Kubica, and Jerzy Waśniewski. The intent was to present a state-of-the-art overview on the challenging and dynamic field of verified computing techniques and interval analysis for researchers, experts, and scientists who are current and future users of these techniques. This minisymposium included a tutorial on interval techniques and their application, and several research talks.

Some of these talks described new interval (verification) techniques in solving various numerical problems: computing the value of a given special function (Evgueni Petrov), estimating the sum of an infinite series (Boguslaw Bożek, Wieslaw Solak, and Zbigniew Szydełko), solving algebraic (Paweł Sevastjanov and Ludmiła Dymowa) and differential equations (Karol Gajda, Małgorzata Jankowska, Andrzej Marciniak, and Barbara Szyszka), and checking properties of the solutions – such as their monotonicity (Iwona Skalna). Two talks discussed decision making under interval uncertainty: Bartłomiej J. Kubica and

Adam Woźniak showed how to compute the Pareto set in a multi-criterial problem, and Van Nam Huynh, Vladik Kreinovich, Yoshiteru Nakamori, and Hung T. Nguyen showed how to efficiently predict human decisions under such uncertainty. Eva Dyllong, Cornelius Grimm, Jorge Flórez, Mateu Sbert, Miguel A. Sainz, and Josep Vehí applied interval techniques to problems of computer vision, computer graphics, and computer-aided design and manufacturing. Finally, Piotr Orantek and Antoni John used interval techniques in biomedical engineering: namely, in the analysis of the human pelvic bone.

Acknowledgements

The organizers are indebted to PPAM 2007 sponsors, whose support was vital to the success of the conference. The main sponsor was the Intel Corporation. The other sponsors were: Microsoft Corporation, IBM Corporation, Action S.A., and SIAM. We thank to all members of the International Program Committee and additional reviewers for their diligent work in refereeing the submitted papers. Finally, we thank to all of the local organizers from the Częstochowa University of Technology, TASK Academic Computer Centre in Gdańsk, and Academy of Music in Gdańsk, who helped us to run the event very smoothly. We are especially indebted to Grażyna Kołakowska, Urszula Kroczewska, Łukasz Kuczyński, and Marcin Woźniak from the Częstochowa University of Technology; to Mścisław Nakonieczny, Ewa Politowska and Rafał Tylman from the TASK Academic Computer Centre; and to Henryk Mączka from the Academy of Music in Gdańsk.

PPAM 2009

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 2009, which will be held in Wrocław (Poland), September 2009.

February 2008

Roman Wyrzykowski
Jack Dongarra
Konrad Karczewski
Jerzy Waśniewski

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Table of Contents

Parallel/Distributed Architectures and Mobile Computing

Safety of a Session Guarantees Protocol Using Plausible Clocks 1

On Checkpoint Overhead in Distributed Systems Providing Session Guarantees 11

Performance Evolution and Power Benefits of Cluster System Utilizing Quad-Core and Dual-Core Intel Xeon Processors 20

Skip Ring Topology in FAST Failure Detection Service 29

Inter-processor Communication Optimization in Dynamically Reconfigurable Embedded Parallel Systems 39

An Algorithm to Improve Parallelism in Distributed Systems Using Asynchronous Calls 49

IEBS Ticketing Protocol as Answer to Synchronization Issue 59

Analysis of Distributed Packet Forwarding Strategies in Ad Hoc Networks 68

Implementation and Optimization of Dense LU Decomposition on the Stream Processor 78

Numerical Algorithms and Parallel Numerics

An Adaptive Interface for the Efficient Computation of the Discrete Sine Transform 89

Incomplete WZ Factorization as an Alternative Method of Preconditioning for Solving Markov Chains 99

A Block-Based Parallel Adaptive Scheme for Solving the 4D Vlasov Equation 108

On Optimal Strategies of Russia's Behavior on the International Market for Emissions Permits 118

Message-Passing Two Steps Least Square Algorithms for Simultaneous Equations Models 127

Parallel Implementation of Cholesky $\mathbf{LL^T}$-Algorithm in FPGA-Based Processor 137

Dimensional Analysis Applied to a Parallel QR Algorithm 148

Sparse Matrix-Vector Multiplication - Final Solution? 156

Parallel and Distributed Non-numerical Algorithms

Petascale Computing for Large-Scale Graph Problems 166

The Buffered Work-Pool Approach for Search-Tree Based Optimization Algorithms 170

Parallel Scatter Search Algorithm for the Flow Shop Sequencing Problem 180

Theoretical and Practical Issues of Parallel Simulated Annealing 189

Modified R-MVB Tree and BTV Algorithm Used in a Distributed Spatio-temporal Data Warehouse 199

Towards Stream Data Parallel Processing in Spatial Aggregating Index . . . 209

On Parallel Generation of Partial Derangements, Derangements and Permutations . . . 219

Parallel Simulated Annealing Algorithm for Graph Coloring Problem . . . 229

Parallel Algorithm to Find Minimum Vertex Guard Set in a Triangulated Irregular Network . . . 239

JaCk-SAT: A New Parallel Scheme to Solve the Satisfiability Problem (SAT) Based on Join-and-Check . . . 249

Environments and Tools for Parallel/Distributed/Grid Computing

Designing Service-Based Resource Management Tools for a Healthy Grid Ecosystem . . . 259

BC-MPI: Running an MPI Application on Multiple Clusters with BeesyCluster Connectivity . . . 271

Managing Distributed Architecture with Extended WS-CDL . . . 281

REVENTS: Facilitating Event-Driven Distributed HPC Applications . . . 291

Empowering Automatic Semantic Annotation in Grid . . . 302

Fault Tolerant Record Placement for Decentralized SDDS LH* . . . 312

Grid Services for HSM Systems Monitoring . . . 321

The Vine Toolkit: A Java Framework for Developing Grid Applications 331

Enhancing Productivity in High Performance Computing through Systematic Conditioning 341

A Formal Model of Multi-agent Computations 351

An Approach to Distributed Fault Injection Experiments 361

Applications of Parallel/Distributed/Grid Computing

Parallel Solution of Nonlinear Parabolic Problems on Logically Rectangular Grids 371

Provenance Tracking in the ViroLab Virtual Laboratory 381

Efficiency of Interactive Terrain Visualization with a PC-Cluster 391

Implementing Commodity Flow in an Agent-Based Model E-Commerce System 400

MPI and OpenMP Computations for Nuclear Waste Deposition Models 409

A Pipelined Parallel Algorithm for OSIC Decoding 419

A Self-scheduling Scheme for Parallel Processing in Heterogeneous Environment: Simulations of the Monte Carlo Type 429

Asynchronous Parallel Molecular Dynamics Simulations 439

Parallel Computing of GRAPES 3D-Variational Data Assimilation System 447

Evolutionary Computing, Meta-Heuristics and Neural Networks

The Effects of Heterogeneity on Asynchronous Panmictic Genetic Search 457

A Parallel Sensor Selection Technique for Identification of Distributed Parameter Systems Subject to Correlated Observations 469

Distributed Segregative Genetic Algorithm for Solving Fuzzy Equations 479

Solving Channel Borrowing Problem with Coevolutionary Genetic Algorithms 489

Balancedness in Binary Sequences with Cryptographic Applications 499

A Cost-Benefit-Based Adaptation Scheme for Multimeme Algorithms . . . 509

Optimizing the Shape of an Impeller Using the Differential Ant-Stigmergy Algorithm 520

Parallel Algorithm for Simulation of Circuit and One-Way Quantum Computation Models 530

Modular Rough Neuro-fuzzy Systems for Classification 540

Tracing SQL Attacks Via Neural Networks 549

Optimization of Parallel FDTD Computations Using a Genetic Algorithm 559

Modular Type-2 Neuro-fuzzy Systems 570

Evolutionary Viral-type Algorithm for the Inverse Problem for Iterated Function Systems 579

Tackling the Grid Job Planning and Resource Allocation Problem Using a Hybrid Evolutionary Algorithm 589

Evolutionary Algorithm with Forced Variation in Multi-dimensional Non-stationary Environment 600

Hybrid Flowshop with Unrelated Machines, Sequence Dependent Setup Time and Availability Constraints: An Enhanced Crossover Operator for a Genetic Algorithm 608

The Second Minisymposium on Novel Data Formats and Algorithms for Dense Linear Algebra Computations

The Relevance of New Data Structure Approaches for Dense Linear Algebra in the New Multi-Core / Many Core Environments 618

Three Versions of a Minimal Storage Cholesky Algorithm Using New Data Structures Gives High Performance Speeds as Verified on Many Computers 622

Hardware-Oriented Implementation of Cache Oblivious Matrix Operations Based on Space-filling Curves 628

Parallel Tiled QR Factorization for Multicore Architectures 639

Application of Rectangular Full Packed and Blocked Hybrid Matrix Formats in Semidefinite Programming for Sensor Network Localization 649

New Data Structures for Matrices and Specialized Inner Kernels: Low Overhead for High Performance 659

The Implementation of BLAS for Band Matrices 668

Parallel Solution of Band Linear Systems in Model Reduction 678

Evaluating Linear Recursive Filters Using Novel Data Formats for Dense Matrices 688

Combinatorial Tools for Parallel Sparse Matrix Computations Workshop

Application of Fusion-Fission to the Multi-way Graph Partitioning Problem 698

A Parallel Approximation Algorithm for the Weighted Maximum Matching Problem 708

Heuristics for a Matrix Symmetrization Problem 718

A Supernodal Out-of-Core Sparse Gaussian-Elimination Method 728

The Third Grid Applications and Middleware Workshop (GAMW'07)

A Large-Scale Semantic Grid Repository 738

Scientific Workflow: A Survey and Research Directions 746

A Light-Weight Grid Workflow Execution Engine Enabling Client and Middleware Independence 754

Supporting NAMD Application on the Grid Using GPE 762

A Grid Advance Reservation Framework for Co-allocation and Co-reservation Across Heterogeneous Local Resource Management Systems 770

Using HLA and Grid for Distributed Multiscale Simulations 780

The OpenCF: An Open Source Computational Framework Based on Web Services Technologies 788

Service Level Agreement Metrics for Real-Time Application on the Grid 798

Dynamic Control of Grid Workflows through Activities Global State Monitoring 807

Transparent Access to Grid-Based Compute Utilities 817

Towards Secure Data Management System for Grid Environment Based on the Cell Broadband Engine 825

Ontology Alignment for Contract Based Virtual Organizations Negotiation and Operation 835

The Third Workshop on Large Scale Computations on Grids (LaSCoG'07)

On Service-Oriented Symbolic Computing 843

CPPC-G: Fault-Tolerant Applications on the Grid 852

Garbage Collection in Object Oriented Condensed Graphs 860

MASIPE: A Tool Based on Mobile Agents for Monitoring Parallel Environments 870

Geovisualisation Service for Grid-Based Assessment of Natural Disasters 880

Web Portal to Make Large-Scale Scientific Computations Based on Grid Computing and MPI 888

Workshop on Models, Algorithms and Methodologies for Grid-Enabled Computing Environments

The GSI Plug-In for gSOAP: Building Cross-Grid Interoperable Secure Grid Services 894

Implementing Effective Data Management Policies in Distributed and Grid Computing Environments 902

Data Mining on Desktop Grid Platforms 912

Distributed Resources Reservation Algorithm for GRID Networks 922

A PMI-Aware Extension for the SSH Service 932

An Integrated ClassAd-Latent Semantic Indexing Matchmaking Algorithm for Globus Toolkit Based Computing Grids 942

A Grid Computing Based Virtual Laboratory for Environmental Simulations 951

Exploring the Behaviour of Fine-Grain Management for Virtual Resource Provisioning 961

Workshop on Scheduling for Parallel Computing (SPC'07)

Parallel Irregular Computations with Dynamic Load Balancing through Global Consistent State Monitoring 971

On-Line Partitioning for On-Line Scheduling with Resource Conflicts . . . 981

A Multiobjective Evolutionary Approach for Multisite Mapping on Grids 991

Scheduling with Precedence Constraints: Mixed Graph Coloring in Series-Parallel Graphs 1001

A New Model of Multi-installment Divisible Loads Processing in Systems with Limited Memory 1009

Scheduling DAGs on Grids with Copying and Migration 1019

Alea – Grid Scheduling Simulation Environment 1029

Cost Minimisation in Unbounded Multi-interface Networks 1039

Scheduling in Multi-organization Grids: Measuring the Inefficiency of Decentralization 1048

Tightness Results for Malleable Task Scheduling Algorithms 1059

The Second Workshop on Language-Based Parallel Programming Models (WLPP'07)

Universal Grid Client: Grid Operation Invoker 1068

Divide-and-Conquer Parallel Programming with Minimally Synchronous Parallel ML 1078

Cloth Simulation in the SILC Matrix Computation Framework: A Case Study 1086

Computing the Irregularity Strength of Connected Graphs by Parallel Constraint Solving in the Mozart System 1096

DPSKEL: A Skeleton Based Tool for Parallel Dynamic Programming . . . 1104

SkelJ: Skeletons for Object-Oriented Applications 1114

Formal Semantics of DRMA-Style Programming in BSPlib 1122

A Container-Iterator Parallel Programming Model 1130

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

Semantic-Oriented Approach to Performance Monitoring of Distributed Java Applications 1140

Using Experimental Data to Improve the Performance Modelling of Parallel Linear Algebra Routines 1150

Comparison of Execution Time Decomposition Methods for Performance Evaluation 1160

An Extensible Timing Infrastructure for Adaptive Large-Scale Applications 1170

End to End QoS Measurements of TCP Connections 1180

Performance Evaluation of Basic Linear Algebra Subroutines on a Matrix Co-processor 1190

Workshop on Parallel Computational Biology (PBC'2007)

High Throughput Comparison of Prokaryotic Genomes 1200

A Parallel Classification and Feature Reduction Method for Biomedical Applications 1210

Applying SIMD Approach to Whole Genome Comparison on Commodity Hardware 1220

Parallel Multiprocessor Approaches to the RNA Folding Problem 1230

Protein Similarity Search with Subset Seeds on a Dedicated Reconfigurable Hardware 1240

Parallel DNA Sequence Alignment on the Cell Broadband Engine 1249

Workshop on High Performance Computing for Engineering Applications

Scalability and Performance Analysis of a Probabilistic Domain Decomposition Method 1257

Scalability Analysis for a Multigrid Linear Equations Solver 1265

A Grid-Enabled Lattice-Boltzmann-Based Modelling System 1275

Parallel Bioinspired Algorithms in Optimization of Structures 1285

3D Global Flow Stability Analysis on Unstructured Grids 1293

Performance of Multi Level Parallel Direct Solver for *hp* Finite Element Method 1303

Graph Transformations for Modeling Parallel *hp*-Adaptive Finite Element Method 1313

Acceleration of Preconditioned Krylov Solvers for Bubbly Flow Problems 1323

Persistent Data Structures for Fast Point Location 1333

Minisymposium on Interval Analysis

A Reliable Extended Octree Representation of CSG Objects with an Adaptive Subdivision Depth 1341

Efficient Ray Tracing Using Interval Analysis 1351

A Survey of Interval Runge–Kutta and Multistep Methods for Solving the Initial Value Problem 1361

Towards Efficient Prediction of Decisions under Interval Uncertainty 1372

Interval Methods for Computing the Pareto-Front of a Multicriterial Problem 1382

Fuzzy Solution of Interval Linear Equations 1392

On Checking the Monotonicity of Parametric Interval Solution of Linear Structural Systems 1400

Author Index 1411