

Lecture Notes in Computer Science  
Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

2552

**Springer**

*Berlin*

*Heidelberg*

*New York*

*Barcelona*

*Hong Kong*

*London*

*Milan*

*Paris*

*Tokyo*

Sartaj Sahni Viktor K. Prasanna  
Uday Shukla (Eds.)

# High Performance Computing – HiPC 2002

9th International Conference  
Bangalore, India, December 18-21, 2002  
Proceedings



Springer

Series Editors

Gerhard Goos, Karlsruhe University, Germany  
Juris Hartmanis, Cornell University, NY, USA  
Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Sartaj Sahni  
University of Florida, CISE Department  
Gainesville, FL 32611, USA  
E-mail: sahni@cise.ufl.edu

Viktor K. Prasanna  
University of Southern California, Department of Electrical Engineering, EEB 200C  
3740 McClintok Ave., Los Angeles, CA 90089-2562, USA  
E-mail: prasanna@usc.edu

Uday Shukla  
IBM Global Services India Exports, India Software Lab  
Golden Enclave, TISL Tower, Airport Road, Bangalore 560 017, India  
E-mail: ushukla@in.ibm.com

Cataloging-in-Publication Data applied for

A catalog record for this book is available from the Library of Congress

Bibliographic information published by Die Deutsche Bibliothek  
Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliographie;  
detailed bibliographic data is available in the Internet at <<http://dnb.ddb.de>>.

CR Subject Classification (1998): C.1-4, D.1-4, F.1-2, G.1-2

ISSN 0302-9743  
ISBN 3-540-00303-7 Springer-Verlag Berlin Heidelberg New York

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-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag Berlin Heidelberg New York  
a member of BertelsmannSpringer Science+Business Media GmbH

<http://www.springer.de>

© Springer-Verlag Berlin Heidelberg 2002  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by DA-TeX Gerd Blumenstein  
Printed on acid-free paper SPIN: 10871720 06/3142 5 4 3 2 1 0

## MESSAGE FROM THE PROGRAM CHAIR

Welcome to the 9th International Conference on High Performance Computing. The conference features 10 contributed paper sessions with 57 papers, 2 invited sessions with 9 papers, an industrial track session, a poster session, 5 keynote addresses, 10 tutorials, and 5 workshops. The 57 contributed papers are from 12 countries.

The 10 contributed paper sessions were put together by a distinguished and international program committee that comprised 56 committee members and 5 program vice-chairs: Oscar Ibarra (Algorithms), Vipin Kumar (Applications), Michel Cosnard (Architecture), Mani Srivastava (Communication Networks), and Francis Lau (Systems Software). Following a rigorous review process, the program committee selected 57 of the 145 papers that were submitted in response to the call for papers for presentation at the conference and inclusion in the conference proceedings. The 2 invited sessions were organized by Vijay Kumar (Biocomputation) and Viktor Prasanna (Embedded Systems), the industrial track by Sudheendra Hangal, the poster session by Paul Roe and Rajkumar Buyya, the keynote addresses by Cauligi Raghavendra, the tutorials by Srinivas Aluru, and the workshops by C.P. Ravikumar.

I wish to thank the entire program committee and especially the program vice-chairs for the excellent job they did in the review of the 145 submitted papers and subsequent selection of papers. Thanks also go to those who organized the remaining sessions, mentioned above, that make up the conference as well as to those who performed the administrative functions that are essential to the success of this conference. Finally, I thank Viktor Prasanna for giving me the opportunity to serve as program chair of this conference.

December 2002

Sartaj Sahni

## MESSAGE FROM THE GENERAL CO-CHAIRS

It is our pleasure to welcome you to the 9th International Conference on High Performance Computing and to Bangalore, the IT capital of India. This message pays tribute to many volunteers who made this meeting possible.

We are indebted to Prof. Sartaj Sahni for his superb efforts as program chair in organizing an excellent technical program. We would like to thank the vice-chairs, Michel Cosnard, Oscar Ibarra, Vipin Kumar, Francis Lau, and Mani Srivastava for their efforts in putting together a strong program committee, which in turn reviewed the submissions and composed an excellent technical program. We would like to thank Vijay Kumar for his efforts in organizing the invited session on Biocomputation. Cauligi S. Raghavendra assisted us in inviting the keynote speakers.

Many volunteers contributed their efforts in organizing the meeting: Manish Parashar handled publicity, José Nelson Amaral interfaced with the authors and Springer-Verlag, with assistance from Angela French, to bring out these proceedings. David Bader acted as vice general chair, Paul Roe and Raj Buyya handled the poster/presentation session, Srinivas Aluru put together the tutorials, S.V. Sankaran assisted us with accommodation for student scholars, Ajay Gupta did a fine job in handling international financial matters, Dheeraj Sanghi administered scholarships for students from Indian academia, Sudheendra Hangal acted as industry liaison, Vinod Sanjay, though not listed in the announcements, assisted with publicity within India.

Continuing the tradition set at last year's meeting, several workshops were organized by volunteers. We would like to thank Srinivas Aluru, Rajendra Bera, Suthikshan Kumar, G. Manimaran, C.P. Ravikumar, C. Siva Ram Murthy, V. Sridhar, S.H. Srinivasan, and M. Vidyasagar for their efforts in putting together the workshop programs. These workshops were coordinated by C.P. Ravikumar.

We would like to thank all of them for their time and efforts.

Our special thanks go to A.K.P. Nambiar for his continued efforts in handling financial matters as well as coordinating the activities within India.

Major financial support for the meeting was provided by several leading IT companies. We would like to thank the following individuals for their support:

N.R. Narayana Murthy, Infosys,  
Karthik Ramarao, Hewlett-Packard,  
Kalyan Rao, Satyam,  
Shubhra Roy, Intel India, and  
M. Vidyasagar, TCS.

We would like to thank Kemal Ebcioglu for his efforts in obtaining sponsorship from the IFIP Working Group on Concurrent Systems.

Continued sponsorship of the meeting by the IEEE Computer Society, ACM, and the European Association for Theoretical Computer Science are much appreciated. Finally, we would like to thank Henryk Chrostek and Sumit Mohanty of USC and the Banquet staff at the Taj Residency, Bangalore for their assistance over the past year and Albee Jhoney, Nirmala Patel, and O. Pramod for their assistance with local arrangements.

December 2002

Viktor K. Prasanna  
Uday Shukla

## MESSAGE FROM THE VICE GENERAL CHAIR

It was a pleasure to welcome attendees to Bangalore and the 9th International Conference on High Performance Computing. It was an honor and a pleasure to be able to serve the international community by bringing together researchers, scientists, and students, from academia and industry, to this meeting in the technology capital of India.

First let me recognize **Manish Parashar** for his help publicizing this conference, and **José Nelson Amaral** for serving as the proceedings chair. **Srinivas Aluru** did an excellent job organizing tutorials presented by leading experts. HiPC 2002 includes 10 tutorials in areas likely to be at the forefront of high-performance computing in the next decade, such as computational biology, wireless networking, quantum computing, and pervasive computing.

I wish to thank all of the conference organizers and volunteers for their contributions to making HiPC 2002 a great success. I would especially like to thank the general co-chairs, **Viktor K. Prasanna** and **Uday Shukla**, for their enormous contributions steering and organizing this meeting. Their leadership and dedication is remarkable. It is to their credit that this meeting has become the premier international conference for high-performance computing. Special thanks are also due to the program chair, **Sartaj Sahni**, for his hard work assembling a high-quality technical program that includes contributed and invited papers, an industrial track, keynote addresses, tutorials, and several workshops.

December 2002

David A. Bader



# CONFERENCE ORGANIZATION

**General Co-chairs**

Viktor K. Prasanna, University of Southern California  
Uday Shukla, IBM Global Services India Pvt. Limited

**Vice General Chair**

David A. Bader, University of New Mexico

**Program Chair**

Sartaj Sahni, University of Florida

**Program Vice-chairs**

Algorithms

Oscar Ibarra, University of California, Santa Barbara

Applications

Vipin Kumar, AHPARC-University of Minnesota

Architecture

Michel Cosnard, INRIA, France

Communication Networks

Mani Srivastava, University of California, Los Angeles

Systems Software

Francis Lau, Hong Kong University

**Keynote Chair**

Cauligi S. Raghavendra, University of Southern California

**Poster / Presentation Co-chairs**

Paul Roe, Queensland University of Technology

Rajkumar Buyya, University of Melbourne

**Tutorials Chair**

Srinivas Aluru, Iowa State University

**Workshops Chair**

C.P. Ravikumar, Texas Instruments India

**Scholarships Chair**

Dheeraj Sanghi, Indian Institute of Technology, Kanpur

**Awards Chair**

Arvind, MIT

**Finance Co-chairs**

A.K.P. Nambiar, Software Technology Park, Bangalore  
Ajay Gupta, Western Michigan University

**Publicity Chair**

Manish Parashar, Rutgers, State University of New Jersey

**Local Arrangements Chair**

Rajendra K. Bera, IBM Global Services India Pvt. Limited

**Industry Liaison Chair**

Sudheendra Hangal, Sun Microsystems

**Publications Chair**

José Nelson Amaral, University of Alberta

**Steering Chair**

Viktor K. Prasanna, University of Southern California

**Steering Committee**

Jose Duato, Universidad Politecnica de Valencia  
Viktor K. Prasanna, Chair, University of Southern California  
N. Radhakrishnan, US Army Research Lab  
Sartaj Sahni, University of Florida  
Assaf Schuster, Technion-Israel Institute of Technology

## PROGRAM COMMITTEE

**Algorithms**

Cevdet Aykanat, Bilkent University  
Yookun Cho, Seoul National University  
Omer Egecioglu, University of California, Santa Barbara  
Tsan-sheng Hsu, Academia Sinica  
Myung Kim, Ewha Womans University  
Koji Nakano, Japan Advanced Institute of Science and Technology  
Sandeep Sen, Indian Institute of Technology, Delhi  
Bhabani Sinha, Indian Statistical Institute  
Meera Sitharam, University of Florida  
Hal Sudborough, University of Texas at Dallas  
Albert Zomaya, University of Western Australia

**Applications**

Rupak Biswas, NASA Ames Research Center  
Amitava Datta, University of Western Australia  
Timothy Davis, University of Florida  
Ratan Ghosh, Indian Institute of Technology, Kanpur  
Anshul Gupta, IBM T.J. Watson Research Center  
Hillol Kargupta, University of Maryland at Baltimore County  
Piyush Mehrotra, NASA Ames Research Center  
Raju Namburu, Army Research Laboratory, Maryland  
D.K. Panda, Ohio State University  
Srinivasan Parthasarathy, Ohio State University  
P. Sadayappan, Ohio State University  
Vivek Sarin, Texas A&M University  
Jon Weissman, University of Minnesota

**Architecture**

Makoto Amamiya, Kyushu University  
Franck Cappello, Paris-Sud XI University  
Kemal Ebcioglu, IBM T.J. Watson Research Center  
Michael Frank, University of Florida  
Tony Hey, Engineering & Physical Sciences Research Council  
Nectarios Koziris, National Technical University of Athens  
David Nassimi, New Jersey Institute of Technology  
Siva Ram Murthy, Indian Institute of Technology, Madras  
Mateo Valero, Universidad Politecnica de Catalunya  
Xiaodong Zhang, National Science Foundation

**Communication Networks**

Prathima Agrawal, Telcordia Technologies  
B.R. Badrinath, Rutgers University  
Sajal Das, University of Texas at Arlington  
Ramesh Govindan, ICSI/ACIRI Berkeley  
Sumi Helal, University of Florida  
Abhay Karandikar, Indian Institute of Technology, Bombay  
Steve Olariu, Old Dominion University  
Michael Palis, Rutgers University at Camden  
Parmesh Ramanathan, University of Wisconsin, Madison  
Ramesh Rao, University of California, San Diego  
Krishna Sivalingam, Washington State University

**Systems Software**

Ishfaq Ahmad, Hong Kong University of Science and Technology  
Hamid Arabnia, University of Georgia  
Jiannong Cao, Hong Kong Polytechnic University  
Elizier Dekel, IBM Research Laboratory, Haifa

XII Conference Organization

R. Govindarajan, Indian Institute of Science  
Weijia Jia, City University of Hong Kong  
Rajib Mall, Indian Institute of Technology, Kharagpur  
Kihong Park, Purdue University  
Krithi Ramamritham, Indian Institute of Technology, Bombay  
Yu-chee Tseng, National Chiao Tung University  
Cheng-zhong Xu, Wayne State University

NATIONAL ADVISORY COMMITTEE

R.K. Bagga, DRDL, Hyderabad  
N. Balakrishnan, SERC, Indian Institute of Science  
Ashok Desai, Silicon Graphics Systems (India) Pvt. Limited  
Kiran Deshpande, Mahindra British Telecom Limited  
H.K. Kaura, Bhabha Atomic Research Centre  
Hans H. Kraflka, Siemens Communication Software Limited  
Ashish Mahadwar, PlanetAsia Limited  
Susanta Misra, Motorola India Electronics Limited  
Som Mittal, Digital Equipment (India) Limited  
B.V. Naidu, Software Technology Park, Bangalore  
N.R. Narayana Murthy, Infosys Technologies Limited  
S.V. Raghavan, Indian Institute of Technology, Chennai  
V. Rajaraman, Jawaharlal Nehru Centre for Advanced Scientific Research  
S. Ramadorai, Tata Consultancy Services, Mumbai  
K. Ramani, Future Software Pvt. Limited  
S. Ramani, Hewlett-Packard Labs India  
Karthik Ramarao, Hewlett-Packard (India) Pvt. Limited  
Kalyan Rao, Satyam Computer Services Limited  
S.B. Rao, Indian Statistical Institute  
H. Ravindra, Cirrus Logic  
Uday S. Shukla, IBM Global Services India Pvt. Limited  
U.N. Sinha, National Aerospace Laboratories

## WORKSHOP ORGANIZERS

### **Workshop on Bioinformatics and Computational Biology**

Co-chairs

Srinivas Aluru, Iowa State University  
M. Vidyasagar, Tata Consultancy Services

### **Workshop on Soft Computing**

Chair

Suthikshan Kumar, Larsen and Toubro Infotech Limited

### **Trusted Internet Workshop**

Co-chairs

G. Manimaran, Iowa State University  
C. Siva Ram Murthy, Indian Institute of Technology, Madras

### **Workshop on Cutting-Edge Computing**

Co-chairs

Uday S. Shukla, IBM Global Services India Pvt. Limited  
Rajendra K. Bera, IBM Global Services India Pvt. Limited

### **Workshop on Storage Area Networks**

Co-chairs

V. Sridhar, Satyam Computer Services Limited  
C.P. Ravikumar, Texas Instruments India  
S.H. Srinivasan, Satyam Computer Services Limited

# Table of Contents

## Keynote Address

Info-Bio-Nano Interface: High-Performance Computing & Visualization .....3  
*Priya Vashishta, Rajiv K. Kalia, and Aiichiro Nakano*

## Session I – Algorithms I

Chair: *Bhabani Sinha*

2-D Wavelet Transform Enhancement  
on General-Purpose Microprocessors:  
Memory Hierarchy and SIMD Parallelism Exploitation .....9  
*Daniel Chaver, Christian Tenllado, Luis Piñuel, Manuel Prieto,  
and Francisco Tirado*

A General Data Layout for Distributed Consistency  
in Data Parallel Applications ..... 22  
*Roxana Diaconescu*

A Parallel DFA Minimization Algorithm .....34  
*Ambuj Tewari, Utkarsh Srivastava, and P. Gupta*

Accelerating the CKY Parsing Using FPGAs .....41  
*Jacir L. Bordim, Yasuaki Ito, and Koji Nakano*

Duplication-Based Scheduling Algorithm  
for Interconnection-Constrained Distributed Memory Machines .....52  
*Savina Bansal, Padam Kumar, and Kuldip Singh*

Evaluating Arithmetic Expressions Using Tree Contraction:  
A Fast and Scalable Parallel Implementation  
for Symmetric Multiprocessors (SMPs) .....63  
*David A. Bader, Sukanya Sreshta, and Nina R. Weisse-Bernstein*

## Session II – Architecture I

Chair: *Michel Cosnard*

Dead-Block Elimination in Cache: A Mechanism  
to Reduce I-cache Power Consumption  
in High Performance Microprocessors ..... 79  
*Mohan G. Kabadi, Natarajan Kannan, Palanidaran Chidambaram,  
Suriya Narayanan, M. Subramanian, and Ranjani Parthasarathi*

Exploiting Web Document Structure to Improve Storage Management  
in Proxy Caches ..... 89  
*Abdolreza Abhari, Sivarama P. Dandamudi, and Shikharesh Majumdar*

High Performance Multiprocessor Architecture Design Methodology  
for Application-Specific Embedded Systems ..... 102  
*Syed Saif Abrar*

LLM: A Low Latency Messaging Infrastructure for Linux Clusters ..... 112  
*R. K. Shyamasundar, Basant Rajan, Manish Prasad, and Amit Jain*

Low-Power High-Performance Adaptive Computing Architectures  
for Multimedia Processing ..... 124  
*Rama Sangireddy, Huesung Kim, and Arun K. Somani*

**Keynote Address**

Field Programmable Systems ..... 137  
*Patrick Lysaght*

**Session III – Systems Software I**

Chair: *Rajib Mall*

CORBA-as-Needed:  
A Technique to Construct High Performance CORBA Applications ..... 141  
*Hui Dai, Shivakant Mishra, and Matti A. Hiltunen*

Automatic Search for Performance Problems in Parallel  
and Distributed Programs by Using Multi-experiment Analysis ..... 151  
*Thomas Fahringer and Clovis Seragiotto, Jr.*

An Adaptive Value-Based Scheduler and Its RT-Linux Implementation .... 163  
*S. Swaminathan and G. Manimaran*

Effective Selection of Partition Sizes for Moldable Scheduling  
of Parallel Jobs ..... 174  
*S. Srinivasan, V. Subramani, R. Kettimuthu, P. Holenarsipur,  
and P. Sadayappan*

Runtime Support for Multigrain and Multiparadigm Parallelism ..... 184  
*Panagiotis E. Hadjidoukas, Eleftherios D. Polychronopoulos,  
and Theodore S. Papatheodorou*

A Fully Compliant OpenMP Implementation  
on Software Distributed Shared Memory ..... 195  
*Sven Karlsson, Sung-Woo Lee, and Mats Brorsson*

**Session IV – Networks**

Chair: *Abhay Karandikar*

A Fast Connection-Time Redirection Mechanism  
for Internet Application Scalability ..... 209  
*Michael Haungs, Raju Pandey, Earl Barr, and J. Fritz Barnes*

|   |     |
|---|-----|
| Algorithms for Switch-Scheduling in the Multimedia Router for LANs . . . . .                                  | 219 |
| <i>Indrani Paul, Sudhakar Yalamanchili, and Jose Duato</i>  |     |
| An Efficient Resource Sharing Scheme<br>for Dependable Real-Time Communication in Multihop Networks . . . . . | 232 |
| <i>Ranjith G and C. Siva Ram Murthy</i>   |     |
| Improving Web Server Performance<br>by Network Aware Data Buffering and Caching . . . . .                     | 242 |
| <i>S. Sen and Y. Narahari</i>   |     |
| WRAPS Scheduling and Its Efficient Implementation<br>on Network Processors . . . . .                          | 252 |
| <i>Xiaotong Zhuang and Jian Liu</i>   |     |
| Performance Comparison of Pipelined Hash Joins<br>on Workstation Clusters . . . . .                           | 264 |
| <i>Kenji Imasaki, Hong Nguyen, and Sivarama P. Dandamudi</i>  |     |

### Keynote Address

|   |     |
|---|-----|
| Computational Science and Engineering – Past, Present, and Future . . . . . | 279 |
| <i>N. Radhakrishnan</i>   |     |

### Session V – Algorithms II

Chair: *Rajendra Bera*

|  |     |
|--|-----|
| Iterative Algorithms on Heterogeneous Network Computing:<br>Parallel Polynomial Root Extracting . . . . .                    | 283 |
| <i>Raphaël Couturier, Philippe Canalda, and François Spies</i>   |     |
| Efficient Tree-Based Multicast in Wormhole-Routed Networks . . . . .   | 292 |
| <i>Jianping Song, Zifeng Hou, and Yadong Qu</i>  |     |
| Parallel Algorithms for Identification of Basis Polygons in an Image . . . . .   | 302 |
| <i>Arijit Laha, Amitava Sen, and Bhabani P. Sinha</i>  |     |
| Range Image Segmentation on a Cluster . . . . .  | 313 |
| <i>Mary Ellen Bock and Concettina Guerra</i>   |     |
| Detection of Orthogonal Interval Relations . . . . .   | 323 |
| <i>Punit Chandra and Ajay D. Kshemkalyani</i>  |     |
| An Efficient Parallel Algorithm for Computing Bicompatible Elimination<br>Ordering (BCO) of Proper Interval Graphs . . . . . | 334 |
| <i>B.S. Panda and S. K. Das</i>  |     |



XVIII Table of Contents

**Session VI – Mobile Computing and Databases**

Chair: *Nalini Venkatasubramanian*

|  |     |
|--|-----|
| Router Handoff: An Approach for Preemptive Route Repair<br>in Mobile Ad Hoc Networks .....             | 347 |
| <i>P. Abhilash, S. Perur, and S. Iyer</i>  |     |
| A 2-D Random Walk Based Mobility Model for Location Tracking .....                                     | 357 |
| <i>Srabani Mukhopadhyaya and Krishnendu Mukhopadhyaya</i>  |     |
| Data Placement in Intermittently Available Environments .....  | 367 |
| <i>Yun Huang and Nalini Venkatasubramanian</i>   |     |
| RT-MuPAC: Multi-power Architecture for Voice Cellular Networks .....                                   | 377 |
| <i>K. Jayanth Kumar, B.S. Manoj, and C. Siva Ram Murthy</i>  |     |
| Asynchronous Transaction Processing for Updates by Client:<br>With Elimination of Wait-for State ..... | 388 |
| <i>Subhash Bhalla</i>  |     |
| Active File Systems for Data Mining and Multimedia .....   | 398 |
| <i>S.H. Srinivasan and P. Singh</i>  |     |

**Session VII – Applications**

Chair: *Shahrouz Aliabadi*

|  |     |
|--|-----|
| Simulating DNA Computing .....   | 411 |
| <i>Sanjeev Baskiyar</i>  |     |
| Parallel Syntenic Alignments .....   | 420 |
| <i>Natsuhiko Futamura, Srinivas Aluru, and Xiaoqiu Huang</i>   |     |
| XS-systems: eXtended S-Systems and Algebraic Differential Automata<br>for Modeling Cellular Behavior .....                         | 431 |
| <i>Marco Antoniotti, Alberto Policriti, Nadia Ugel, and Bud Mishra</i>   |     |
| A High Performance Scheme for EEG Compression<br>Using a Multichannel Model .....  | 443 |
| <i>D. Gopikrishna and Anamitra Makur</i>   |     |
| Scalability and Performance of Multi-threaded Algorithms<br>for International Fare Construction on High-Performance Machines ..... | 452 |
| <i>Chandra N. Sekharan, Krishnan Saranathan, Raj Sivakumar,<br/>and Zia Taherbhai</i>  |     |

**Session VIII – Systems Software II**

Chair: *P. Sadayappan*

|   |     |
|---|-----|
| A Resource Brokering Infrastructure for Computational Grids ..... | 463 |
| <i>Ahmed Al-Theneyan, Piyush Mehrotra, and Mohammad Zubair</i>    |     |

|   |     |
|---|-----|
| On Improving Thread Migration: Safety and Performance .....                       | 474 |
| <i>Hai Jiang and Vipin Chaudhary</i>  |     |
| Improved Preprocessing Methods for Modulo Scheduling Algorithms .....             | 485 |
| <i>D.V. Ravindra and Y.N. Srikant</i>   |     |
| Dynamic Path Profile Aided Recompilation<br>in a JAVA Just-In-Time Compiler ..... | 495 |
| <i>R. Vinodh Kumar, B. Lakshmi Narayanan, and R. Govindarajan</i>                 |     |
| Exploiting Data Value Prediction in Compiler Based Thread Formation ...           | 506 |
| <i>Anasua Bhowmik and Manoj Franklin</i>  |     |

### Session IX – Scientific Computation

Chair: *R.K. Shyamasundar*

|  |     |
|--|-----|
| High Performance Computing of Fluid-Structure Interactions<br>in Hydrodynamics Applications Using Unstructured Meshes<br>with More than One Billion Elements ..... | 519 |
| <i>S. Aliabadi, A. Johnson, J. Abedi, and B. Zellars</i>   |     |
| An Efficient and Exponentially Accurate Parallel<br>$h$ - $p$ Spectral Element Method for Elliptic Problems<br>on Polygonal Domains – The Dirichlet Case .....     | 534 |
| <i>S.K. Tomar, P. Dutt, and B.V. Rathish Kumar</i>   |     |
| Fast Stable Solver<br>for Sequentially Semi-separable Linear Systems of Equations .....  | 545 |
| <i>S. Chandrasekaran, P. Dewilde, M. Gu, T. Pals,<br/>and A.-J. van der Veen</i>   |     |
| Dynamic Network Information Collection<br>for Distributed Scientific Application Adaptation .....  | 555 |
| <i>Devdatta Kulkarni and Masha Sosonkina</i>   |     |
| Adaptive Runtime Management of SAMR Applications .....   | 564 |
| <i>Sumir Chandra, Shweta Sinha, Manish Parashar, Yeliang Zhang,<br/>Jingmei Yang, and Salim Hariri</i>   |     |
| Mobile Agents – The Right Vehicle<br>for Distributed Sequential Computing .....  | 575 |
| <i>Lei Pan, Lubomir F. Bic, Michael B. Dillencourt, and Ming Kin Lai</i>   |     |

### Session X – Architecture II

Chair: *Siva Ram Murthy*

|   |     |
|---|-----|
| Using Dataflow Based Context for Accurate Branch Prediction ..... | 587 |
| <i>Renju Thomas and Manoj Franklin</i>                            |     |

|   |     |
|---|-----|
| Rehashable BTB: An Adaptive Branch Target Buffer<br>to Improve the Target Predictability of Java Code ..... | 597 |
| <i>Tao Li, Ravi Bhargava, and Lizy Kurian John</i>  |     |
| Return-Address Prediction in Speculative Multithreaded Environments ...                                     | 609 |
| <i>Mohamed Zahran and Manoj Franklin</i>  |     |
| HLSpower: Hybrid Statistical Modeling<br>of the Superscalar Power-Performance Design Space .....            | 620 |
| <i>Ravishankar Rao, Mark H. Oskin, and Frederic T. Chong</i>  |     |
| Efficient Decomposition Techniques for FPGAs .....  | 630 |
| <i>Seok-Bum Ko and Jien-Chung Lo</i>  |     |

### **Keynote Address**

|  |     |
|--|-----|
| Protocols for Bandwidth Management<br>in Third Generation Optical Networks ..... | 643 |
| <i>Imrich Chlamtac</i>   |     |

### **Invited Session I – Embedded Systems**

Chair: *Viktor K. Prasanna*

|  |     |
|--|-----|
| Memory Architectures for Embedded Systems-On-Chip .....                                | 647 |
| <i>Preeti Ranjan Panda and Nikil D. Dutt</i>   |     |
| Structured Component Composition Frameworks<br>for Embedded System Design .....        | 663 |
| <i>Sandeep K. Shukla, Frederic Doucet, and Rajesh K. Gupta</i>                         |     |
| Low Power Distributed Embedded Systems:<br>Dynamic Voltage Scaling and Synthesis ..... | 679 |
| <i>Jiong Luo and Niraj K. Jha</i>  |     |
| The Customization Landscape for Embedded Systems .....                                 | 693 |
| <i>Sudhakar Yalamanchili</i>   |     |

### **Keynote Address**

|  |     |
|--|-----|
| Parallel Computations of Electron-Molecule Collisions<br>in Processing Plasmas ..... | 697 |
| <i>B. Vincent McKoy and Carl Winstead</i>  |     |

**Invited Session II – Biocomputation**Chair: *Vijay Kumar*

|  |     |
|--|-----|
| Computing Challenges and Systems Biology .....   | 701 |
| <i>Srikanta P. Kumar, Jordan C. Feidler, and Henrietta Kulaga</i>  |     |
| Visual Programming for Modeling and Simulation<br>of Biomolecular Regulatory Networks .....                                      | 702 |
| <i>Rajeev Alur, Calin Belta, Franjo Ivančić, Vijay Kumar, Harvey Rubin,<br/>Jonathan Schug, Oleg Sokolsky, and Jonathan Webb</i> |     |
| Framework for Open Source Software Development<br>for Organ Simulation in the Digital Human .....                                | 713 |
| <i>M. Cenk Cavusoglu, Tolga Goktekin, Frank Tendick,<br/>and S. Shankar Sastry</i>   |     |
| Reachability Analysis of Delta-Notch Lateral Inhibition<br>Using Predicate Abstraction .....                                     | 715 |
| <i>Inseok Hwang, Hamsa Balakrishnan, Ronojoy Ghosh,<br/>and Claire Tomlin</i>  |     |
| A Symbolic Approach to Modeling Cellular Behavior .....  | 725 |
| <i>Bhubaneswar Mishra</i>  |     |
| <b>Author Index</b> .....  | 733 |