Preface

The International Symposium on Numeric and Symbolic Algorithms for Scientific Computing, SYNASC, is an annual event in Timișoara, Romania. It has been organized by the West University of Timișoara in cooperation with the Research Institute for Symbolic Computation of the Johannes Kepler University of Linz, Austria and with the Institute e-Austria Timisoara. The eleventh occurrence was held at the West University of Timișoara from September 26th to 29th, 2009.

The aim of SYNASC has been to promote the dialogue between the symbolic and the numeric computing communities in order to advance the state of the art of mathematical computing and the range of its applicability.

While the SYNASC series has made its contribution to international scientific exchange in computer science, it has also contributed in a significant way to the promotion of scientific research in Romania. It has offered scientists, especially in the early difficult years, an international forum for presenting their research, as well as by facilitating contacts between scientists from Romania and abroad.

With this meeting, SYNASC now enters its second decade. The focus and spirit of the meeting remain the same, but it has matured. The practical aspects of running the meeting have become well practiced, and hence more systematic and effective, thanks to the hard work of many people. More importantly, the scientific level of the research contributions, while always respectable, has risen steadily and the symposium proceedings are now widely available.

The SYNASC symposia have always had its core set of represented areas. This year the program committee adopted a structure to support increased discussion among area specialists during the review process. The program was organized into six tracks, corresponding to research areas, with each track having its own subcommittee chaired by two area experts.

The symposium invited research submissions of two forms: full papers for formal presentation and extended abstracts for informal presentation. One hundred submissions were received and all were reviewed by the program committee members or by external referees. A total of 296 reports were received and every formal presentation had two to four referee reports. Each track produced its acceptance recommendations. These recommendations were then reviewed for consistency and combined in a meeting of the track chairs. In the end, 56 papers were selected for formal presentation and potential inclusion in these proceedings. An additional 11 papers were accepted for informal presentation at the symposium.

The highlights of the symposium were the plenary talks given by a distinguished set of international researchers: James Davenport, Tetsuo Ida, Lefteris Kirousis, Helmut Veith and Andrei Voronkov. Their thought-provoking talks were particularly appreciated by the symposium participants.
As in previous years, a number of workshops, tutorials, dissemination and training activities complemented the main symposium tracks.

The four workshops covered a range of related areas of interest to the symposium participants. These were:

- ACSys: the 6th Workshop on Agents for Complex Systems
- GlobalComp: the 2nd Workshop on Global Computing Models and Technologies
- NCA: Workshop on Natural Computing and Applications
- DMC: Workshop on Data Management and Control.

Each of these workshops handled its own invitations, submissions and review process.

The tutorials centered on the areas of software verification and theorem proving. The two-day program featured four well-attended tutorials:

- Automated Methods for Proving Program Termination and Liveness, Andrey Rybalchenko (Max Planck Institute for Software Systems, Germany)
- SMT Solvers for Testing, Program Analysis and Verification at Microsoft, Nikolaj Bjørner (Microsoft Research, USA)
- Automated Software Analysis, Helmut Veith (Technical University of Darmstadt, Germany)
- Satisfiability and Theories, Andrei Voronkov (University of Manchester, UK).

We express here our warm thanks to all the people who have contributed to this symposium, as authors, reviewers or presenters, either by initiative or by invitation. It is your contributions that give the symposium its life.

Stephen M. Watt  
Program Committee Chair

Viorel Negru  
General Chair

Tetsuo Ida, Tudor Jebelean, Dana Petcu, Daniela Zaharie  
Members of the Steering Committee
THE 11TH INTERNATIONAL SYMPOSIUM ON SYMBOLIC
AND NUMERICAL ALGORITHMS FOR SCIENTIFIC COMPUTING

September 26 - 29, 2009, Timişoara, Romania
http://synasc09.info.uvt.ro

Organized by:

Department of Computer Science, West University of Timişoara, Romania
Research Institute for Symbolic Computation, Johannes Kepler University, Linz, Austria
Institute e-Austria, Timişoara, Romania

Honorary Chairs:

Bruno Buchberger, Johannes Kepler University, Linz, Austria
Stefan Măruşter, West University of Timişoara, Romania

General Chair:

Viorel Negru, West University of Timişoara, Romania

Program Chair:

Stephen M. Watt, University of Western Ontario, Canada

Steering Committee:

Tudor Jebelean, Johannes Kepler University, Linz, Austria
Viorel Negru, West University of Timişoara, Romania
Tetsuo Ida, University of Tsukuba, Japan
Dana Petcu, West University of Timişoara, Romania
Stephen Watt, University of Western Ontario, Canada
Daniela Zaharie, West University of Timişoara, Romania

Tutorials Chair:

Laura Kovács, EPF Lausanne, Switzerland
Program Committee:

**Symbolic Computation Track**

Tetsuo Ida (co-chair), University of Tsukuba, Japan  
Dongming Wang (co-chair), Université Pierre et Marie Curie, France

James Davenport, UK  
Laureano González-Vega, Spain  
David Jeffrey, Canada  
Fairouz Kamareddine, UK  
Boris Konev, UK  
Mircea Marin, Japan  
Bazil Pârv, Romania  
Agnes Szánto, USA  
Ioan Tomescu, Romania

**Logic and Programming Track**

Tudor Jebelean (co-chair), Johannes Kepler University, Linz, Austria  
Jens Knoop (co-chair), Technical University of Vienna, Austria

Stefan Andrei, USA  
Gabriel Ciobanu, Romania  
Adrian Crăciun, Romania  
Boris Konev, UK  
Dorel Lucanu, Romania  
Madhav Marathe, USA  
Mircea Marin, Japan  
Markus Müller-Olm, Germany  
Daniel Pop, Romania  
Markus Schröder, Austria  
Sorin Stratulat, France  
Ferucio Tiplea, Romania  
Helmut Veith, Germany

**Numerical Computing Track**

Vasile Berinde (co-chair), North University of Baia Mare, Romania  
Stefan Murușter (co-chair), West University of Timișoara, Romania

Emil Catinaș, Romania  
Octavian Cîră, Romania  
Gheorghe Coman, Romania  
Patrick Combettes, France  
Hideaki Iiduka, Japan  
Constantin Ilioi, Romania  
Abdellatif Moudafi, France  
Laszlo Nyul, Hungary  
Kalman Palagyi, Hungary  
Ion Păvăloiu, Romania  
Adrian Petreșel, Romania  
Hong-Kun Xu, Taiwan  
Yonghong Yao, China

**Parallel Computing Track**

Dana Petcu (co-chair), West University of Timișoara, Romania  
Wolfgang Schreiner (co-chair), Research Institute for Symbolic Computation, Linz, Austria

Valentin Cristea, Romania  
Florin Fortiş, Romania  
Dorian Gorgan, Romania  
Laura Marușter, The Netherlands  
Jan Mendling, Germany  
John Morrison, Ireland  
Gabriel Neagu, Romania  
Florin Pop, Romania  
Jan Recker, Australia  
Todor Stoilov, Bulgaria  
Elisaveta Trichkova, Bulgaria  
Marek Tudruj, Poland
### Advances in the Theory of Computing Track

Gabriel Istrate (co-chair), Institute e-Austria, Timișoara, Romania  
Mihai Pătrașcu (co-chair), AT&T Bell Labs, USA

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexandru Andoni</td>
<td>USA</td>
</tr>
<tr>
<td>Gruia Călinescu</td>
<td>USA</td>
</tr>
<tr>
<td>Cristian Calude</td>
<td>New Zealand</td>
</tr>
<tr>
<td>Stephan Eidenbenz</td>
<td>USA</td>
</tr>
<tr>
<td>Lane Hemaspaandra</td>
<td>USA</td>
</tr>
<tr>
<td>Lefteris Krousis</td>
<td>Greece</td>
</tr>
<tr>
<td>Madhav Marathe</td>
<td>USA</td>
</tr>
<tr>
<td>Marius Minea</td>
<td>Romania</td>
</tr>
</tbody>
</table>

### Artificial Intelligence Track

Ajith Abraham (co-chair), NTNU, Trondheim, Norway  
Daniela Zaharie (co-chair), West University of Timișoara, Romania

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iyada Alshabani</td>
<td>France</td>
</tr>
<tr>
<td>Alexandru Cicortas</td>
<td>Romania</td>
</tr>
<tr>
<td>Kusum Deep</td>
<td>India</td>
</tr>
<tr>
<td>Christo Dichev</td>
<td>USA</td>
</tr>
<tr>
<td>Adina Magda Florea</td>
<td>Romania</td>
</tr>
<tr>
<td>Florin Fortiș</td>
<td>Romania</td>
</tr>
<tr>
<td>Maria Ganzha</td>
<td>Poland</td>
</tr>
<tr>
<td>Vladimir Gorodetsky</td>
<td>Russia</td>
</tr>
<tr>
<td>Gabriel Istrate</td>
<td>Romania</td>
</tr>
<tr>
<td>Bernadetta Kwintiana</td>
<td>Germany</td>
</tr>
<tr>
<td>Shiguo Lian</td>
<td>China</td>
</tr>
<tr>
<td>Dorel Lucanu</td>
<td>Romania</td>
</tr>
<tr>
<td>Laura Mărușter</td>
<td>The Netherlands</td>
</tr>
<tr>
<td>Guy Melançon</td>
<td>France</td>
</tr>
<tr>
<td>Viorel Negru</td>
<td>Romania</td>
</tr>
<tr>
<td>Laszlo Nyul</td>
<td>Hungary</td>
</tr>
<tr>
<td>Kalman Palagyi</td>
<td>Hungary</td>
</tr>
<tr>
<td>Bijaya Ketan Panigrahi</td>
<td>India</td>
</tr>
<tr>
<td>Marcin Paprzycki</td>
<td>Poland</td>
</tr>
<tr>
<td>Bazil Pârv</td>
<td>Romania</td>
</tr>
<tr>
<td>Daniel Pop</td>
<td>Romania</td>
</tr>
<tr>
<td>Florin Pop</td>
<td>Romania</td>
</tr>
<tr>
<td>Joel Quinqueton</td>
<td>France</td>
</tr>
<tr>
<td>Robert Reisz</td>
<td>Romania</td>
</tr>
<tr>
<td>Vasile Rus</td>
<td>USA</td>
</tr>
<tr>
<td>Gerald Schaefer</td>
<td>UK</td>
</tr>
<tr>
<td>Daniel Stamate</td>
<td>UK</td>
</tr>
<tr>
<td>Luminita State</td>
<td>Romania</td>
</tr>
<tr>
<td>Sorin Stratulat</td>
<td>France</td>
</tr>
<tr>
<td>Nick Szirbik</td>
<td>The Netherlands</td>
</tr>
<tr>
<td>Doina Tătar</td>
<td>Romania</td>
</tr>
<tr>
<td>Stefan Trăuşan-Matu</td>
<td>Romania</td>
</tr>
<tr>
<td>Dan Tufiş</td>
<td>Romania</td>
</tr>
<tr>
<td>Helmut Veith</td>
<td>Germany</td>
</tr>
</tbody>
</table>
Reviewers:

Ajith Abraham
Iyada Alshabani
Alexandru Andoni
Stefan Andrei
Costin Badica
Vasile Berinde
Costin Boldea
Cosmin Bonchis
Christopher Brown
Dragos Burileanu
Massimo Caboara
Gruia Calinescu
Cristian Calude
Emil Catinas
Alexandru Cicortas
Gabriel Ciobanu
Octavian Cira
Gheorghe Coman
Patrick Combettes
Adrian Craciun
Dan Cristea
Valentin Cristea
James Davenport
Kusum Deep
Christo Dickev
Christophe Doche
Dan Dumitrescu
Stephan Eidenbenz
Adina Magda Florea
Martin F"urer
Florin Fortis
Maria Ganzha
Laureano Gonzalez-Vega
Dorian Gorgan
Vladimir Gorodetsky
Hermann Gruber
Yo-Sub Han
Lane Hemaspaandra
Tetsuo Ida
Hideaki Iiduka
Constantin Ilioi
Gabriel Istrate
Tudor Jebelean
David Jeffrey
Ciprian Jichici
Meng Jin
Fairouz Kamareddine
Lefteris Kourousis
Jens Knoop
Boris Konev
Ilias Kotsireas
Simon Kramer
Bernadetta Kwintiana
Peter Lammich
Alexander Levin
Ziming Li
Shiguo Lian
Dorel Lucanu
Florin Manea
Madhav Marathe
Mircea Marin
Laura Maruster
Stefan Maruster
Guy Melancon
Jan Mendling
Jochen Messner
Marius Minea
Markus M"uller-Olm
Marc Moreno Maza
John Morrison
Abdellatif Moudafi
Gabriel Neagu
Viorel Negru
Laszlo Nyul
Richard Olejnik
Alexey Ovchinnikov
Vasile Palade
Kalman Palagyi
Silviu Panica
Bijaya Ketan Panigrahi
Marcin Paprzycki
Bazil Parv
Mihai Patrascu
Ion Pavaloiu
Dana Petcu
Adrian Petrusel
Daniel Pop
Florin Pop
Franz Puntigam
Joel Quinqueton
S. S. Ravi
Jan Recker
Robert Reisz
Vasile Rus
Calin Sandru
Gerald Schaefer
Markus Schordan
Dietmar Schreiner
Wolfgang Schreiner
Ekaterina Shemyakova
Christian Sommer
Daniel Stamate
Yannis Stamatiou
Luminita State
Gheorghe Stefanescu
Todor Stoilov
Sorin Stratulat
Agnes Szanto
Nick Szirbik
Doina Tatar
Ferucio Tiplea
Ioan Tomescu
Stefan Trausan-Matu
Elisaveta Trichkova
Marek Tudruj
Dan Tufis
Helmut Veith
Dongming Wang
Stephen Watt
Alexander Wenner
Hong-Kun Xu
Yonghong Yao
Kazuhiro Yokoyama
Daniela Zaharie