Preface

The volume comprises final versions of the papers presented at the 5th International Andrei Ershov Memorial Conference “Perspectives of System Informatics,” Akademgorodok (Novosibirsk, Russia), July 9–12, 2003. The main goal of the conference was to give an overview of research directions that are decisive for growth in the major areas of research activities in system informatics.

The conference was held to honor the 70th anniversary of Ershov’s closest colleague, the late Prof. Igor Pottosin (1933–2001), and his outstanding contribution towards advancing informatics. The first four Andrei Ershov conferences were held in May 1991, June 1996, July 1999, and July 2001, and they proved to be significant international events.

Andrei Ershov was one of the early Russian pioneers in the field of theoretical and systems programming, a founder of the Siberian School of Computer Science. His closest colleague, Igor Pottosin, worked for the Siberian Branch of the Russian Academy of Sciences from 1958, step by step filling positions from junior researcher to director of the A. P. Ershov Institute of Informatics Systems. In later years he headed the Laboratory of Systems Programming in this institute and the Department of Programming at Novosibirsk State University.

I. V. Pottosin took a leading position among Russian specialists in computer science. It is hardly possible to overestimate his contribution to the formation and development of this research direction in the country. He obtained fundamental results in the theory of program optimization, formulated main principles and typical schemes of optimizing compilers, and suggested efficient algorithms for optimizing program transformations. One of the world’s first optimizing compilers ALPHA, the ALPHA-6 programming system, and the multilanguage compiling system BETA were designed and developed on the basis of these results and with the direct participation of Igor Pottosin.

In later years he mainly concentrated on the problems of designing programming environments for efficient and reliable program construction, and headed the SOKRAT project aimed at producing software for embedded computers. Research in program analysis and programming methodology was essentially inspired and greatly influenced by his practical work. Prof. Pottosin was actively involved in the training of computer professionals, and there is a professor, 11 Ph.D. holders, and hundreds of graduates among his disciples.

The fifth conference followed the traditions of the previous ones and included many of their subjects, such as theoretical computer science, programming methodology, and new information technologies, which are the most important components of system informatics. The style of the previous conferences was preserved to a certain extent: a considerable number of invited papers in addition to contributed regular and short papers.

This time 110 papers (a record number!) were submitted to the conference by researchers from 28 countries. Each paper was reviewed by three experts, at
least two of them from the same, or from a closely related one discipline as the authors. The reviewers generally provided high-quality assessments of the papers and often gave extensive comments to the authors for possible improvements of the presentations. The Programme Committee selected 25 high-quality papers as regular talks and 27 papers as short talks. A broad range of hot topics in system informatics was covered by five invited talks given by prominent computer scientists from different countries.

We are glad to express our gratitude to all the persons and organizations who contributed to the conference: to the sponsors for their moral, financial and organizational support, to the members of the Programme Committee who did their best to select the worthiest papers, and to the members of the Local Organizing Committee for their efforts towards the success of this event. We are especially grateful to N. Cheremnykh for her selfless labor when preparing the conference.

July, 2003

M. Broy, A. Zamulin
Organization

Conference Chair
Alexander Marchuk (Novosibirsk, Russia)

Programme Committee Co-chairs
Manfred Broy (Munich, Germany)
Alexandre Zamulin (Novosibirsk, Russia)

Conference Secretary
Natalia Cheremnykh (Novosibirsk, Russia)

Programme Committee

Egidio Astesiano (Italy)  Valery Nepomniaschy (Russia)
Janis Barzdins (Latvia)  Peter Pepper (Germany)
Frédéric Benhamou (France)  Francesco Parisi-Presicce (Italy)
Nieves Brisaboa (Spain)  Jaan Penjam (Estonia)
Mikhail Bulyonkov (Russia)  Alexander Petrenko (Russia)
Albertas Čaplinskas (Lithuania)  Jaroslav Pokorny (Czech Republic)
Gabriel Ciobanu (Romania)  Wolfgang Reisig (Germany)
Alexander Dikovskiy (France)  Fuji Ren (Japan)
Alexander Gelbukh (Mexico)  Viktor Sabelfeld (Germany)
Jan Friso Groote (The Netherlands)  Don Sannella (UK)
Victor Ivanikov (Russia)  Vladimir Sazonov (UK)
Victor Kasyanov (Russia)  Timos Sellis (Greece)
Alexander Kleschev (Russia)  Alexander Semenov (Russia)
Gregory Kucherov (France)  Klaus-Dieter Schewe (New Zealand)
Reino Kurki-Suonio (Finland)  David Schmidt (USA)
Sergei Kuznetsov (Russia)  Sibylle Schupp (USA)
Giorgio Levi (Italy)  Lothar Thiele (Switzerland)
Dominique Méry (France)  Alexander Tomilin (Russia)
Ruslan Mîtkov (UK)  Enn Tyugu (Estonia)
Bernhard Möller (Germany)  Frits Vaandrager (The Netherlands)
Hanspeter Mössenböck (Austria)  Karin Verspoor (USA)
Peter Mosses (Denmark)  Andrei Voronkov (UK)
J. Strother Moore (USA)  Tatyana Yakhno (Turkey)
Ron Morrison (UK)  Wang Yi (Sweden)
Additional Referees

H. Anderson  J. Iyoda  A. Sabelfeld
Th. Baar  Ch. Jermann  A. Sage
R. Bagnara  A. Kalnins  Th. Santen
V. Barichard  K. Kapp  B. Schätz
M. Bellia  R. Kaschek  K. Schneider
J. Bézivin  Yu. Khan  N. Shilov
L. Bordeaux  M. Kirchberg  D. Shkurko
M. Cebulla  L. Kof  A. Sinyakov
M.V. Cengarle  J. Küster Filipe  S. Skiadopoulos
A. Cisternino  J. Lawall  J. Souqueres
Th. Dalamagas  Le An Ha  K. Spies
O. Danvy  S. Link  A. Stasenko
M. Dekhtyar  R. Loukanova  A. Stefan
F. Dinenberg  P. Machado  Gh. Stefanescu
Th. Ehnh  S. Merz  G. Struth
A. El-Sayed  A. Metzner  M. Südholt
P. Emelianov  B. Meyer  M. Sustik
J. Engblom  K. Michen  M. Syrjakow
J. Erickson  T. Mossakowski  P.S. Thiagarajan
R. Evans  S. Norcross  M. Tombak
M. Falaschi  M.E. Occhiuto  B. Trançon y Widemann
F.A. Ferrarotti  C. Orasan  A. Tretiakov
S. Frank  A. Pavlov  A. Tsois
P. Geibel  T. Pedersen  T. Uustalu
R. Glück  M. R. Penabad  M. K. Valiev
M. Glukhankov  P. Pettersson  S. Van Groningen
J. Golden  M. Pister  P. Vassiliadiis
D. Gurov  M. Pizka  L. Vigneron
G. Hains  K. Podnieks  A. Vilbig
S. Hartmann  S. Ray  I. Virbitskaite
M. Henz  E. Rebeer  M. Voorhoeve
D. Hofbauer  G. Reggio  W. Wesselink
P. Hofstedt  W.P. de Roever  J. Wieland
R.R. Hoogerwoord  J. Romberg  T. Willemse
F. Huber  A. Roychoudhury

Sponsors

Support from the following institutions is gratefully acknowledged:

- Microsoft Research Ltd., UK
- US Air Force European Office of Aerospace Research and Development
- US Navy Office of Naval Research, International Field Office
- US Army Research Laboratory, European Research Office
- US Army Communications-Electronics Command (CECOM)
# Table of Contents

## Programming Issues

- **The Verifying Compiler: A Grand Challenge for Computing Research**
  
  *Tony Hoare*
  
  Page: 1

- **Linear Types for Cashflow Reengineering**
  
  *Torben Æ. Mogensen*
  
  Page: 13

- **Storing Properties in Grouped Tagged Tuples**
  
  *Roland Weiss, Volker Simonis*
  
  Page: 22

- **A Polymorphic Radix-\(n\) Framework for Fast Fourier Transforms**
  
  *Marcin Zalewski, Sibylle Schupp*
  
  Page: 30

- **Intersecting Classes and Prototypes**
  
  *Wolfgang De Meuter, Theo D’Hondt, Jessie Dedecker*
  
  Page: 37

## Software Engineering

- **Bending without Breaking: Making Software More Flexible**
  
  *Kim B. Bruce*
  
  Page: 46

- **Program Construction in the Context of Evolutionary Computation**
  
  *Jelena Sanko, Jaan Penjam*
  
  Page: 50

- **A Layered Architecture Sustaining Model-Driven and Event-Driven Software Development**
  
  *Cindy Michiels, Monique Snoeck, Wilfried Lemahieu, Frank Goethals, Guido Dedene*
  
  Page: 58

## Software Education

- **The Outside-In Method of Teaching Introductory Programming**
  
  *Bertrand Meyer*
  
  Page: 66

## Program Synthesis, Transformation, and Semantics

- **Numeric Types in Formal Synthesis**
  
  *Viktor Sabelfeld, Kai Kapp*
  
  Page: 79

- **On the Possibility of Provably Secure Obfuscating Programs**
  
  *Nikolay P. Varnovsky, Vladimir A. Zakharov*
  
  Page: 91
Verification-Oriented Language C-Light and Its Structural Operational Semantics ............................................ 103
Valery A. Nepomniashchy, Igor S. Anureev, Alexey V. Promsky

Proofs-as-Imperative-Programs: Application to Synthesis of Contracts ........................................................ 112
Iman Poernomo

Graphical Interfaces

On the Visualization and Aesthetics of Large Graphs ......................... 120
David Harel

Data Mappings in the Model-View-Controller Pattern ....................... 121
Martin Rammerstorfer, Hanspeter Mössenböck

Partial Evaluation and Supercompilation

The Translation Power of the Futamura Projections ....................... 133
Robert Glück

A Compiler Generator for Constraint Logic Programs ..................... 148
Stephen-John Craig, Michael Leuschel

The Supercompiler SCP4: General Structure ................................ 162
Andrei P. Nemytykh

Partial Evaluation for Common Intermediate Language .................... 171
Andrei M. Chepovsky, Andrei V. Klimov, Arkady V. Klimov,
Yuri A. Klimov, Andrei S. Mishchenko, Sergei A. Romanenko,
Sergei Y. Skorobogatov

Verification

Timed Verification with $\mu$CRL ...................................... 178
Stefan Blom, Natalia Ioustinova, Natalia Sidorova

Verification of Distributed Dataspase Architectures ....................... 192
Simona Orzan, Jaco van de Pol

Using SPIN and STeP to Verify Business Processes Specifications ...... 207
Juan C. Augusto, Michael Butler, Carla Ferreira,
Stephen-John Craig

Integrating Tools for Automatic Program Verification .................... 214
Engelbert Hubbers
# Logic and Types

A Logical Reconstruction of Reachability ........................................ 222  
*Tatiana Rybina, Andrei Voronkov*

Recent Advances in \( \Sigma \)-Definability over Continuous Data Types ........ 238  
*Margarita Korovina*

## Concurrent and Distributed Systems

Open Maps and Trace Semantics for Timed Partial Order Models .......... 248  
*Irina B. Virbitskaite, Nataly S. Gribovskaja*

Confidentiality for Multithreaded Programs via Bisimulation ............. 260  
*Andrei Sabelfeld*

Dynamic Modification of System Structures Using LLPNs ............... 274  
*Berndt Farwer, Kundan Misra*

## Concurrent and Reactive Systems

Principles for Entity Authentication .............................................. 294  
*Michele Bugliesi, Riccardo Focardi, Matteo Maffei*

Causality and Replication in Concurrent Processes .......................... 307  
*Pierpaolo Degano, Fabio Gadducci, Corrado Priami*

Event-Driven Traversal of Logic Circuits for Re-evaluation of Boolean Functions in Reactive Systems .............................................. 319  
*Valeriy Vyatkin*

Teams of Pushdown Automata .......................................................... 329  
*Maurice H. ter Beek, Erzsébet Csuhaí-Varjú, Victor Mitrana*

## Program Specification

Algebraic State Machines: Concepts and Applications to Security ......... 338  
*Jan Jürjens*

Combining Aspects of Reactive Systems ........................................ 344  
*Leonid Kof, Bernhard Schätz*

OCL Extended with Temporal Logic .............................................. 351  
*Paul Ziemann, Martin Gogolla*

The Definition of Transitive Closure with OCL – Limitations and Applications – ................................................................. 358  
*Thomas Baar*
Verification and Model Checking

Improving the Consistency Checking Process by Reusing Formal Verification Knowledge ............................................ 366
   Rebeca P. Díaz Redondo, José J. Pazos Arias, Ana Fernández Vilas, Jorge García Duque, Alberto Gil Solla

Complexity of Model Checking by Iterative Improvement:
The Pseudo-Boolean Framework ........................................ 381
   Henrik Björklund, Sven Sandberg, Sergei Vorobyov

Polynomial Approximations for Model Checking ......................... 395
   Nikolai V. Shilov, Natalya O. Garanina

Constraint Programming

Separating Search and Strategy in Solver Cooperations ............... 401
   Brice Pajot, Eric Monfroy

Industrial Application of External Black-Box Functions in Constraint Programming Solver ......................................... 415
   Vladimir Sidorov, Vitaly Telerman

LGS: Geometric Constraint Solver ........................................ 423
   Alexey Ershov, Ilia Ivanov, Serge Preis, Eugene Rukoleev, Dmitry Ushakov

On Strategies of the Narrowing Operator Selection in the Constraint Propagation Method .................................. 431
   Yuri G. Dolgov

Documentation and Testing

ProgDOC — A New Program Documentation System .................... 438
   Volker Simonis, Roland Weiss

Integration of Functional and Timed Testing of Real-Time and Concurrent Systems .............................................. 450
   Victor V. Kuliamin, Alexander K. Petrenko, Nick V. Pakoulin, Alexander S. Kossatchev, Igor B. Bourdonov

Test Case Generation for UML Statecharts ............................. 462
   Dirk Seifert, Steffen Helke, Thomas Santen

Databases

Conceptual Content Modeling and Management ......................... 469
   Joachim W. Schmidt, Hans-Werner Sehring
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Relational Algebra for Functional Logic Deductive Databases</td>
<td>494</td>
</tr>
<tr>
<td>Jesús Manuel Almendros-Jiménez, Antonio Becerra-Terón</td>
<td></td>
</tr>
<tr>
<td>Implication of Functional Dependencies for Recursive Queries</td>
<td>509</td>
</tr>
<tr>
<td>José R. Paramá, Nieves R. Brisaboa, Miguel R. Penabad, Ángeles S. Places</td>
<td></td>
</tr>
<tr>
<td>TeXOR: Temporal XML Database on an Object-Relational Database System</td>
<td>520</td>
</tr>
<tr>
<td>Kjetil Nørvåg, Marit Limstrand, Lene Myklebust</td>
<td></td>
</tr>
<tr>
<td>Functional Dependencies, from Relational to XML</td>
<td>531</td>
</tr>
<tr>
<td>Jixue Liu, Millist Vincent, Chengfei Liu</td>
<td></td>
</tr>
<tr>
<td>Data-Object Replication, Distribution, and Mobility in Network</td>
<td>539</td>
</tr>
<tr>
<td>Joaquín Pérez O., Rodolfo A. Pazos, René Santaolaya, Juan Frausto S., Guillermo Rodríguez O., Laura Cruz R., Maricela Bravo C.</td>
<td></td>
</tr>
<tr>
<td>Natural Language Processing</td>
<td></td>
</tr>
<tr>
<td>Multi-classification of Patent Applications with Winnow</td>
<td>546</td>
</tr>
<tr>
<td>Cornelis H.A. Koster, Marc Seutter, Jean Beney</td>
<td></td>
</tr>
<tr>
<td>Automatic Evaluation of Quality of an Explanatory Dictionary by</td>
<td>556</td>
</tr>
<tr>
<td>Comparison of Word Senses</td>
<td></td>
</tr>
<tr>
<td>Alexander Gelbukh, Grigori Sidorov, SangYong Han, Liliana Chanona-Hernandez</td>
<td></td>
</tr>
<tr>
<td>An Approach to Automatic Construction of a Hierarchical Subject</td>
<td>563</td>
</tr>
<tr>
<td>Domain for Question Answering Systems</td>
<td></td>
</tr>
<tr>
<td>Anna V. Zhdanova, Pavel V. Mankevich</td>
<td></td>
</tr>
<tr>
<td>Author Index</td>
<td>571</td>
</tr>
</tbody>
</table>