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Foreword

ETAPS 2003 was the sixth instance of the European Joint Conferences on Theory and Practice of Software. ETAPS is an annual federated conference that was established in 1998 by combining a number of existing and new conferences. This year it comprised five conferences (FOSSACS, FASE, ESOP, CC, TACAS), 14 satellite workshops (AVIS, CMCS, COCV, FAMAS, Feyerabend, FICS, LDTA, RSKD, SC, TACoS, UniGra, USE, WITS and WOOD), eight invited lectures (not including those that are specific to the satellite events), and several tutorials. We received a record number of submissions to the five conferences this year: over 500, making acceptance rates fall below 30% for every one of them. Congratulations to all the authors who made it to the final program! I hope that all the other authors still found a way of participating in this exciting event and I hope you will continue submitting.

A special event was held to honour the 65th birthday of Prof. Wlad Turski, one of the pioneers of our young science. The deaths of some of our "fathers" in the summer of 2002 — Dahl, Dijkstra and Nygaard — reminded us that Software Science and Technology is, perhaps, no longer that young. Against this sobering background, it is a treat to celebrate one of our most prominent scientists and his lifetime of achievements. It gives me particular personal pleasure that we are able to do this for Wlad during my term as chairman of ETAPS.

The events that comprise ETAPS address various aspects of the system development process, including specification, design, implementation, analysis and improvement. The languages, methodologies and tools which support these activities are all well within its scope. Different blends of theory and practice are represented, with an inclination towards theory with a practical motivation on the one hand and soundly based practice on the other. Many of the issues involved in software design apply to systems in general, including hardware systems, and the emphasis on software is not intended to be exclusive.

ETAPS is a loose confederation in which each event retains its own identity, with a separate program committee and independent proceedings. Its format is open-ended, allowing it to grow and evolve as time goes by. Contributed talks and system demonstrations are in synchronized parallel sessions, with invited lectures in plenary sessions. Two of the invited lectures are reserved for "unifying" talks on topics of interest to the whole range of ETAPS attendees. The aim of cramming all this activity into a single one-week meeting is to create a strong magnet for academic and industrial researchers working on topics within its scope, giving them the opportunity to learn about research in related areas, and thereby to foster new and existing links between work in areas that were formerly addressed in separate meetings.

ETAPS 2003 was organized by Warsaw University, Institute of Informatics, in cooperation with the Foundation for Information Technology Development, as well as:

- European Association for Theoretical Computer Science (EATCS);
- European Association for Programming Languages and Systems (EAPLS);

- European Association of Software Science and Technology (EASST); and
- ACM SIGACT, SIGSOFT and SIGPLAN.

The organizing team comprised:

Mikołaj Bojańczyk, Jacek Chrząszcz, Piotr Chrząstowski-Wachtel, Grzegorz Grudziński, Kazimierz Grygiel, Piotr Hoffman, Janusz Jabłonowski, Mirosław Kowaluk, Marcin Kubica (publicity), Sławomir Leszczyński (www), Wojciech Moczydłowski, Damian Niwiński (satellite events), Aleksy Schubert, Hanna Sokołowska, Piotr Stańczyk, Krzysztof Szafran, Marcin Szczuka, Łukasz Sznuk, Andrzej Tarlecki (co-chair), Jerzy Tiuryn, Jerzy Tyszkiewicz (book exhibition), Paweł Urzyczyn (co-chair), Daria Walukiewicz-Chrząszcz, Artur Zawłocki.

ETAPS 2003 received support from:[1]

- Warsaw University
- European Commission, High-Level Scientific Conferences and Information Society Technologies
- US Navy Office of Naval Research International Field Office,
- European Office of Aerospace Research and Development, US Air Force
- Microsoft Research

Overall planning for ETAPS conferences is the responsibility of its Steering Committee, whose current membership is:

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I would like to express my sincere gratitude to all of these people and organizations, the program committee chairs and PC members of the ETAPS conferences, the organizers of the satellite events, the speakers themselves, and Springer-Verlag for agreeing to publish the ETAPS proceedings. The final votes of thanks must go, however, to Andrzej Tarlecki and Paweł Urzyczyn. They accepted the risk of organizing what is the first edition of ETAPS in Eastern Europe, at a time of economic uncertainty, but with great courage and determination. They deserve our greatest applause.

Leicester, January 2003

José Luiz Fiadeiro
ETAPS Steering Committee Chair

[1] The contents of this volume do not necessarily reflect the positions or the policies of these organizations and no official endorsement should be inferred.

Preface

The present volume contains the proceedings of the international conference *Foundations of Software Science and Computation Structures (FOSSACS) 2003*, held in Warsaw, Poland, April 7–9, 2003. FOSSACS is an event of the *Joint European Conferences on Theory and Practice of Software (ETAPS)*. The previous five FOSSACS conferences took place in Lisbon (1998), Amsterdam (1999), Berlin (2000), Genoa (2001), and Grenoble (2002).

FOSSACS presents original papers on foundational research with a clear significance to software science. The Program Committee invited papers on theories and methods to support the analysis, integration, synthesis, transformation, and verification of programs and software systems. We identified the following topics, in particular: algebraic models; automata and language theory; behavioural equivalences; categorical models; computation processes over discrete and continuous data; computation structures; logics of programs; modal, spatial, and temporal logics; models of concurrent, reactive, distributed, and mobile systems; process algebras and calculi; semantics of programming languages; software specification and refinement; transition systems; and type systems and type theory. We received 96 submissions, of which 2 were withdrawn.

This proceedings consists of 27 papers. The first—*A Game Semantics for Generic Polymorphism*—accompanies the invited lecture by Samson Abramsky, University of Oxford. The remaining 26 were selected for publication by the Program Committee during a week-long electronic discussion.

I sincerely thank all the authors of papers submitted to FOSSACS 2003; the number and the quality of papers were exceptionally high this year. Moreover, I would like to thank all the members of the Program Committee for the excellent job they did during a rather demanding selection process, and to thank all our subreferees for their invaluable contributions to this process.

To administer submission and evaluation of papers, we relied on a fine web-based tool provided by METAFrame Technologies, Dortmund; thanks to Martin Karusseit and Tiziana Margaria of METAFrame for their timely support. Finally, thanks are due to the ETAPS 2003 Organizing Committee chaired by Andrzej Tarlecki and Paweł Urzyczyn and to the ETAPS Steering Committee for their efficient coordination of all the activities leading up to FOSSACS 2003.

Cambridge, January 2003 Andrew D. Gordon

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