

Foreword

ETAPS 2005 was the eighth 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 (CC, ESOP, FASE, FOSSACS, TACAS), 17 satellite workshops (AVIS, BYTECODE, CEES, CLASE, CMSB, COCV, FAC, FESCA, FINCO, GCW-DSE, GPL, LDTA, QAPL, SC, SLAP, TGC, UITP), seven invited lectures (not including those that were specific to the satellite events), and several tutorials. We received over 550 submissions to the five conferences this year, giving acceptance rates below 30% for each one. Congratulations to all the authors who made it to the final programme! I hope that most of the other authors still found a way of participating in this exciting event and I hope you will continue submitting.

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 programme committee and proceedings. Its format is open-ended, allowing it to grow and evolve as time goes by. Contributed talks and system demonstrations are in synchronised 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 2005 was organized by the School of Informatics of the University of Edinburgh, in cooperation with

- European Association for Theoretical Computer Science (EATCS);
- European Association for Programming Languages and Systems (EAPLS);
- European Association of Software Science and Technology (EASST).

The organizing team comprised:

- Chair: Don Sannella
- Publicity: David Aspinall
- Satellite events: Massimo Felici
- Secretariat: Dyane Goodchild
- Local Arrangements: Monika-Jeannette Lekuse
- Tutorials: Alberto Momigliano

- Finances: Ian Stark
- Website: Jennifer Tenzer, Daniel Winterstein
- Fundraising: Phil Wadler

ETAPS 2005 received support from the University of Edinburgh.

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

Perdita Stevens (Edinburgh, Chair), Luca Aceto (Aalborg and Reykjavík), Rastislav Bodík (Berkeley), Maura Cerioli (Genova), Evelyn Duesterwald (IBM, USA), Hartmut Ehrig (Berlin), José Fiadeiro (Leicester), Marie-Claude Gaudel (Paris), Roberto Gorrieri (Bologna), Reiko Heckel (Paderborn), Holger Hermanns (Saarbrücken), Joost-Pieter Katoen (Aachen), Paul Klint (Amsterdam), Jens Knoop (Vienna), Kim Larsen (Aalborg), Tiziana Margaria (Dortmund), Ugo Montanari (Pisa), Hanne Riis Nielson (Copenhagen), Fernando Orejas (Barcelona), Mooly Sagiv (Tel-Aviv), Don Sannella (Edinburgh), Vladimiro Sassone (Sussex), Peter Sestoft (Copenhagen), Michel Wermelinger (Lisbon), Igor Walukiewicz (Bordeaux), Andreas Zeller (Saarbrücken), Lenore Zuck (Chicago).

I would like to express my sincere gratitude to all of these people and organizations, the programme committee chairs and PC members of the ETAPS conferences, the organizers of the satellite events, the speakers themselves, the many reviewers, and Springer-Verlag for agreeing to publish the ETAPS proceedings. Finally, I would like to thank the organizer of ETAPS 2005, Don Sannella. He has been instrumental in the development of ETAPS since its beginning; it is quite beyond the limits of what might be expected that in addition to all the work he has done as the original ETAPS Steering Committee Chairman and current ETAPS Treasurer, he has been prepared to take on the task of organizing this instance of ETAPS. It gives me particular pleasure to thank him for organizing ETAPS in this wonderful city of Edinburgh in this my first year as ETAPS Steering Committee Chair.

Edinburgh, January 2005

Perdita Stevens
ETAPS Steering Committee Chair

Preface

This volume collects the proceedings of “Foundations of Software Science and Computation Structures,” FOSSACS 2005. FOSSACS is a member conference of ETAPS, the “European Joint Conferences on Theory and Practice of Software,” dedicated to foundational research for software science. It invites submissions on theories and methods to underpin the analysis, integration, synthesis, transformation, and verification of programs and software systems. Topics covered usually include: 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; models of security and trust; language-based security; process algebras and calculi; semantics of programming languages; software specification and refinement; type systems and type theory.

FOSSACS 2005 consisted of one invited and 30 contributed papers, selected out of 108 submissions, yielding an acceptance rate of less than 28%. The quality of the manuscripts was very high indeed, and the Programme Committee had to reject several deserving ones. Besides making for a strong 2005 programme, this is an indication that FOSSACS is becoming an established point of reference in the international landscape of Theoretical Computer Science. This is a trend that I believe will continue in its forthcoming editions.

Besides Marcelo Fiore’s invited talk, the volume includes Ugo Montanari’s invited address as an ETAPS unifying speaker. Ugo’s ‘*Model Checking for Nominal Calculi*’ reflects broadly on topics in semantics, weaving together verification via semantic equivalences and model checking, web services, the π -calculus, and the derivation of bisimulation congruences over reactive systems. Marcelo’s contribution, ‘*Mathematical Models of Computational and Combinatorial Structures*,’ advocates a combinatorial approach to semantic models by introducing a calculus of *generalised species of structures* as a unification and generalisation of models arising in several distinct areas, including his previous work on denotational models of the π -calculus and of variable-binding operators. The conference programme was organised in nine sessions, each focusing on reflecting common research topics among the accepted papers. The order of presentation of the papers in this volume maintains the structure of these sessions.

I have a debt of gratitude to the Programme Committee for their scholarly effort during the discussion phase; to the referees, for carrying out the reviewing task with competence, care, and precision; to the invited speakers for their inspired work; and ultimately to the authors for submitting their best work to FOSSACS. Thanks to David Aspinall and Don Sannella for the local organisation, and to Martin Karusseit and Tiziana Margaria for their support with the conference electronic management system.

I hope you will enjoy the volume.

Sussex, January 2005

Vladimiro Sassone
Programme Chair
FOSSACS 2005

Program Committee

Luca Aceto (Aalborg, DK)	Michele Bugliesi (Venice, I)
Luís Caires (Lisbon, P)	Giuseppe Castagna (ENS Paris, F)
Witold Charatonik (Wroclaw, PL)	Vincent Danos (PPS Paris, F)
Robert Harper (CMU, USA)	Petr Jančar (Ostrava, CZ)
Naoki Kobayashi (Tokyo, JP)	Orna Kupferman (Jerusalem, IL)
Guy McCusker (Sussex, UK)	Ugo Montanari (Pisa, I)
Anca Muscholl (Liafa Paris, F)	Tobias Nipkow (Munich, D)
Andrew Pitts (Cambridge, UK)	Amir Pnueli (Weizmann, IL and New York, USA)
David Sands (Chalmers, S)	Andre Scedrov (UPenn, USA)
Vladimiro Sassone (Sussex, UK)	Wolfgang Thomas (Aachen, D)
Peter Selinger (Ottawa, CAN)	Nobuko Yoshida (Imperial, UK)
Glynn Winskel (Cambridge, UK)	

Referees

Reynald Affeldt	Michael Butler	Neil Ghani
Jonathan Aldrich	Marco Carbone	Rob van Glabbeek
Jan Altenbernd	Josep Carmona	Daniele Gorla
Torben Amtoft	Alberto Casagrande	Eric Goubault
Eugene Asarin	Ilaria Castellani	Jean Goubault-Larrecq
David Aspinall	Amine Chaieb	Susanne Graf
Franz Baader	Stefano Chessa	Erich Grädel
Christel Baier	Corina Cîrstea	S. Gutierrez-Nolasco
Patrick Baillot	Giovanni Conforti	Joshua Guttman
Sebastian Bala	Thierry Coquand	Peter Habermehl
Paolo Baldan	Silvia Crafa	Masahito Hasegawa
Richard Banach	Karl Crary	Ichiro Hasuo
Nicolas Baudru	Federico Cazzolara	Thomas Hildebrandt
Gerd Behrmann	Pedro D'Argenio	Daniel Hirschkoff
Martin Berger	Jim Davies	Kohei Honda
Ulrich Berger	Josée Desharnais	Haruo Hosoya
Gerd Berhmann	Pietro Di Gianantonio	Jesse Hughes
Marco Bernardo	Ernst-Erich Doberkat	Michael Huth
Alexis Bes	Marie Duflot	Atsushi Igarashi
Stephen Bloom	Martín Escardó	Florent Jacquemard
Richard Blute	Alessandro Fantechi	Radha Jagadeesan
Viviana Bono	Marcelo Fiore	Alan Jeffrey
Ana Bove	Riccardo Focardi	Ole Jensen
Tomas Brázdil	Alain Frisch	Gabriel Juhas
Thomas Brihaye	Fabio Gadducci	Tomasz Jurdzinski
Stephen Brookes	Philippe Gaucher	Joost-Pieter Katoen
Franck van Breugel	Simon Gay	Emanuel Kieronski
Marzia Buscemi	Blaise Genest	Bartek Klin

Teodor Knapik
Martin Kot
Pavel Krčál
Neel Krishnaswami
Jean Krivine
Jim Laird
Martin Lange
Diego Latella
Francesca Levi
Paul Blain Levy
Christof Löding
Etienne Lozes
Christoph Lüth
Zhaohui Luo
Yoad Lustig
Bas Luttik
Damiano Macedonio
Matteo Maffei
Sergio Maffei
Jean Mairesse
Rupak Majumdar
Jean-Yves Marion
Keye Martin
Luis Mateu
Paul-André Mellèès
Robin Milner
Faron Moller
Luis Monteiro
Carroll Morgan
Rémi Morin
Madhavan Mukund
Markus Müller-Olm
Sumit Nain
Aleks Nanevski
Francesco Zappa Nardelli
Peter Niebert
Damian Niwinski
Gethin Norman
Karol Ostrovsky
Sam Owre
Prakash Panangaden
George Pappas
Matthew Parkinson
Doron Peled
Frank Pfenning
Iain Philipp
Andrew Phillips
Carla Piazza
Brigitte Pientka
Benjamin Pierce
Jean-Eric Pin
Lucia Pomello
K.V.S. Prasad
Sanjiva Prasad
Francesco Ranzato
Julian Rathke
Arend Rensink
James Riely
Philipp Rohde
Bill Roscoe
Sabina Rossi
Pawel Rychlikowski
Zdeněk Sawa
Norbert Schirmer
Alan Schmitt
Lutz Schröder
Robert Seely
Roberto Segala
Olivier Serre
Peter Sewell
Janos Simon
Alex Simpson
Christian Skalka
Paweł Sobociński
Jiří Srba
Ian Stark
Colin Stirling
Mariëlle Stoelinga
Kristian Stovring Sorensen
Oldrich Stražovský
Eijiro Sumii
Vasco T. Vasconcelos
Gabriele Taentzer
Jean-Marc Talbot
Kazushige Terui
Stavros Tripakis
Tomasz Truderung
Emilio Tuosto
Irek Ulidowski
Christian Urban
Tarmo Uustalu
Franck Van Breugel
Daniele Varacca
Maria Grazia Vigliotti
David Walker
Nico Wallmeier
Igor Walukiewicz
Volker Weber
Carsten Weise
Joe Wells
Benjamin Werner
Piotr Wieczorek
Stefan Wöhrle
Burkhart Wolff
James Worrell
Kwangkeun Yi
Shoji Yuen
Marc Zeitoun

Table of Contents

Invited Talks

Model Checking for Nominal Calculi	1
<i>Gian Luigi Ferrari, Ugo Montanari, and Emilio Tuosto</i>	

Mathematical Models of Computational and Combinatorial Structures	25
<i>Marcelo P. Fiore</i>	

Rule Formats and Bisimulation

Congruence for Structural Congruences	48
<i>MohammadReza Mousavi and Michel Reniers</i>	

Probabilistic Congruence for Generative Semistochastic Processes	63
<i>Ruggero Lanotte and Simone Tini</i>	

Bisimulation on Speed: A Unified Approach	78
<i>Gerald Lüttgen and Walter Vogler</i>	

Probabilistic Models

Branching Cells as Local States for Event Structures and Nets: Probabilistic Applications	93
<i>Samy Abbes and Albert Benveniste</i>	

Axiomatizations for Probabilistic Finite-State Behaviors	108
<i>Yuxin Deng and Catuscia Palamidessi</i>	

Stochastic Transition Systems for Continuous State Spaces and Non-determinism	123
<i>Stefano Cattani, Roberto Segala, Marta Kwiatkowska, and Gethin Norman</i>	

Model Checking Durational Probabilistic Systems	138
<i>François Laroussinie and Jeremy Sproston</i>	

Algebraic Models

Free-Algebra Models for the Pi-Calculus	153
<i>Ian Stark</i>	

A Unifying Model of Variables and Names	168
<i>Marino Miculan and Kidane Yemane</i>	

A Category of Higher-Dimensional Automata	184
<i>Ulrich Fahrenberg</i>	

Games and Automata

Third-Order Idealized Algol with Iteration is Decidable	199
<i>Andrzej S. Murawski and Igor Walukiewicz</i>	
Fault Diagnosis using Timed Automata	215
<i>Patricia Bouyer, Fabrice Chevalier and Deepak D'Souza</i>	
Optimal Conditional Reachability for Multi-Priced Timed Automata	230
<i>Kim Guldstrand Larsen and Jacob Illum Rasmussen</i>	
Alternating Timed Automata	245
<i>Ślawomir Lasota and Igor Walukiewicz</i>	

Language Analysis

Full Abstraction for Polymorphic Pi-Calculus	261
<i>Alan Jeffrey and Julian Rathke</i>	
Foundations of Web Transactions	277
<i>Cosimo Laneve and Gianluigi Zavattaro</i>	
Bridging Language-Based and Process Calculi Security	294
<i>Riccardo Focardi, Sabina Rossi and Andrei Sabelfeld</i>	
History-based Access Control with Local Policies	311
<i>Massimo Bartoletti, Pierpaolo Degano and Gian Luigi Ferrari</i>	

Partial Order Models

Composition and Decomposition in True-Concurrency	327
<i>Sibylle Fröschle</i>	
Component Refinement and CSC Solving for STG Decomposition	342
<i>Mark Schäfer and Walter Vogler</i>	
The Complexity of Live Sequence Charts	357
<i>Yves Bontemps and Pierre-Yves Schobbens</i>	

Logics

A Simpler Proof Theory for Nominal Logic	372
<i>James Cheney</i>	
From Separation Logic to First-Order Logic	387
<i>Cristiano Calcagno, Philippa Gardner and Matthew Hague</i>	
Justifying Algorithms for $\beta\eta$ Conversion	402
<i>Healfdene Goguen</i>	

On Decidability within the Arithmetic of Addition and Divisibility 417
Marius Bozga and Radu Iosif

Coalgebraic Modal Logics

Expressivity of Coalgebraic Modal Logic: The Limits and Beyond 432
Lutz Schröder

Duality for Logics of Transition Systems 447
Marcello M. Bonsangue and Alexander Kurz

Computational Models

Confluence of Right Ground Term Rewriting Systems is Decidable 462
Lukasz Kaiser

Safety is not a Restriction at Level 2 for String Languages 477
Klaus Aehlig, Jolie G. de Miranda and C.-H. Luke Ong

A Computational Model for Multi-Variable Differential Calculus 492
Abbas Edalat, André Lieutier and Dirk Pattinson

Author Index 507

