Foundations of Software Science and Computational Structures: Selected papers from FOSSACS 2005

Preface

This issue of Theoretical Computer Science contains six of the best contributions to the 8th edition of "*Foundations of Software Science and Computation Structures*", FOSSACS 2005, held in Edinburgh, Scotland on 2–4 April 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, in its ten years of existence FOSSACS has experienced a continued and tremendous growth both in quantity of submissions and quality of programmes, and is now a firmly-established point of reference for the Theoretical Computer Science research community. FOSSACS invites submissions on theories and methods to underpin the analysis, integration, synthesis, transformation, and verification of programs and software systems. Typical topics 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 very high-quality submissions. The proceedings have appeared in Springer LNCS, Lecture Notes in Computer Science, vol. 3441. This volume bears a debt of gratitude to the FOSSACS 2005's referees and Programme Committee, for their scholarly work drove me in the selection of the papers for the special issue. I wish of course to thank very warmly the *referees* of the full articles as they appear in this volume, who have contributed a very substantial and valuable effort. They are: Marco Bernardo, Thomas Brihaye, Vincent Danos, Daniel Hirschkoff, Petr Jancar, Bartek Klin, Jim Laird, Rupak Majumdar, Guy McCusker, Eugenio Moggi, Dirk Pattinson, Eijiro Sumi, and Daniele Varacca.

I hope you will enjoy the volume.

Southampton, August 2007

An invitation to read

This collection of selected papers provides an excellent sample of the gamut of research topics FOSSACS has to offer. I will give below a brief synopsis of each of them, as an invitation to the casual reader to read on.

TRUE-CONCURRENCY PROBABILISTIC MODELS: MARKOV NETS AND A LAW OF LARGE NUMBERS
Samy Abbes and Albert Benveniste

This paper introduces a new stochastic model based on Petri nets, the Markov nets. The key to assigning meaningful probabilities to execution sequences is a sophisticated notion of *branching cell* which identifies 'minimal' choice points in the net, building on a similar concept for probabilistic event structures. The result in the paper is a *Law of Large Numbers* which enables a quantitative analysis of the asymptotic behaviour of Markov nets.

Full Abstraction for Polymorphic Pi-Calculus
Alan Jeffrey and Julian Rathke

The authors establish a fully-abstract model for an asynchronous polymorphic π-calculus, the first such model ever for a concurrent, polymorphic calculus. The key differences with respect to previous attempts are the ability to assign *multiple* types to names and the inclusion of an essentially 'untyped' *name matching* construct, which raises the expressiveness of the calculus and so makes its semantics 'finer.'

Optimal Reachability for Multi-Priced Timed Automata
Kim Guldstrand Larsen and Jacob Illum Rasmussen

The paper is concerned with *priced* timed automata, which are hybrid automata with time and cost parameters that measure the price of waiting in a state while traversing the automaton. The typical problem on priced timed automata is the reachability of a given state at a minimal cost. The authors here study time automata with *multiple* cost variables for the first time, and prove the decidability of generalised reachability questions — such as optimal reachability and optimal *conditional* reachability — that is, reachability at a minimal primary cost while keeping secondary cost variables within given bounds.

Third-Order Idealized Algol with Iteration is Decidable, *Andrzej S. Murawski and Igor Walukiewicz*

This paper merges techniques from *automata* theory and results from *game semantics* to formulate algorithms for contextual equivalence and approximation of programs in the third-order fragment of Idealized Algol with iteration. Indeed, by representing game semantics strategies as pushdown automata with PTIME equivalence and inclusion problems, the authors prove that contextual equivalence and approximation for the chosen language are EXPTIME-*hard*.

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

Modal logic is increasingly presented as the natural logic for coalgebras, as while the latter are a unifying semantic framework for reactive systems and bisimulation, the former are often invariant under behavioural equivalence. That is, *behaviourally* indistinguishable states are also *logically* equivalent. This paper presents an easy criterion for a modal logic to be *expressive*, i.e. such that logically indistinguishable states are also behavioural equivalent. In addition, the author shows that every accessible functor admits an expressive *polyadic* modal logic, that is, a logic with multi-argument modalities.

Free-Algebra Models for the π-Calculus
Ian Stark

The author provides an novel characterisation of the well-known functor-category fully-abstract model of the finite π-calculus. This in fact yields an algebraic description of π-models based on intuitive operations and equations over categories of *name-indexed* sets, the fully abstract model being the *initial algebra*. Besides the specific results, the algebraic theories introduced in the paper are of independent value and possibly of further consequence.

FOSSACS 2005 Program Committee.

Luca Aceto, Michele Bugliesi, Luís Caires, Giuseppe Castagna, Witold Charatonik, Vincent Danos, Robert Harper, Petr Jančar, Naoki Kobayashi, Orna Kupferman, Guy McCusker, Ugo Montanari, Anca Muscholl, Tobias Nipkow, Andrew Pitts, Amir Pnueli, David Sands, Vladimiro Sassone, Andre Scedrov, Peter Selinger, Wolfgang Thomas, Glynn Winskel, Nobuko Yoshida.

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