Journal of Symbolic Computation 36 (2003) 1–3

Journal of Symbolic Computation

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Preface

Preface to First order theorem proving

First-order theorem proving (FTP) is among the most traditional disciplines in Artificial Intelligence. Its roots date back to the 1960s, which brought us milestones like the Davis–Putnam–Logemann–Loveland procedure for propositional logic and the resolution calculus for the first order logic. Since then, FTP has been an area of steady and active research. This is witnessed best by the existence of international conferences (CADE—the "Conference on Automated Deduction" being the most well-known) that have FTP as a core topic.

In the 1990s, the idea of a "Workshop on First-order Theorem Proving" was born as a (successful!) attempt to complement the international conferences by providing an informal forum for presentation of recent work and discussion of research in progress on FTP as a core theme of automated deduction. The call for papers mentions interest in first-order classical, many-valued and modal logics, resolution, equational reasoning, term-rewriting, model construction, constraint reasoning, unification, propositional logic, specialized decision procedures, strategies and complexity of theorem proving procedures, and applications of first-order theorem provers to problems in verification, artificial intelligence, and mathematics. (More information about the FTP workshop series is available from the web page http://www.logic.at/FTP/.)

FTP 2000, the third workshop in the series, was held in the autumn of 2000 in St Andrews, Scotland, in conjunction with Tableaux 2000, the major international conference for automated reasoning with analytic tableaux and related methods. Following the tradition established by the First Workshop on FTP, this special issue of the *Journal of Symbolic Computation* has been edited to commemorate the success of FTP 2000.

There is no reason to limit submissions to the special issue to those papers that had been presented at FTP 2000. From a wider call for submissions we received 16 submissions, each of which was thoroughly reviewed. For most papers we asked two or three experts from the submissions' subject areas for reviews. One submission received was very controversial, and we eventually arrived at five reviews. As the result of the reviewing process 11 submissions were accepted.

The papers of this special issue match very well the scope of FTP cited above. More concretely:

Resolution theorem proving. The four papers dedicated to resolution based theorem proving propose different ways for improvements: the two papers by Nicolas Peltier, *Model building with ordered resolution: extracting models from saturated clause sets* and *A calculus combining resolution and enumeration for building finite models* deal

doi:10.1016/S0747-7171(03)00022-1

with the complementary problem of "theorem proving", when no proof for a given clause set exists.

In the paper *Stratified resolution* by Anatoli Degtyarev, Robert Nieuwenhuis and Andrei Voronkov, techniques and notions from the logic programming world are brought to resolution.

The paper *Limited resource strategy in resolution theorem proving* by Alexandre Riazonov and Andrei Voronkov concerns very practical aspects: how to best spend resources available to a theorem prover under a given time limit.

Tableau and connection method theorem proving. The paper *Depth-first proof search without backtracking for free-variable clausal tableaux* by Bernhard Beckert attacks the basic problem of redundancy in proof search in free-variable clausal tableau calculi by means of a backtracking-free proof procedure.

Jens Otten and Wolfgang Bibel present and analyze in their paper *Lean CoP: lean connection-based theorem proving* a tricky implementation of a first-order proof procedure in the related framework of the connection method.

Modal logic. Many modal logics can be translated to classical first-order logic and thus are amenable to first-order logic methods. A new decision procedure for a sub-fragment of the related Guarded Fragment is obtained by Lila Georgieva, Ullrich Hustadt and Renate A. Schmidt in their paper *Hyperresolution for guarded formulae*.

Equational reasoning, simplification. The paper *Constraint contextual rewriting* by Alessandro Armando and Silvio Ranise deals with the integration of decision procedures within formula simplification. The motivation is given from the software verification context.

The same theme, in a different setting, is explored by Jürgen Avenhaus, Thomas Hillenbrand and Bernd Löchner in their paper *On using ground joinable equations in equational theorem proving*.

Equational reasoning, complexity. In the paper *On the complexity of equational problems in CNF*, Reinhard Pichler proves complexity results for testing the satisfiability of such formulas. Such satisfiability tests occur frequently in various application areas.

Application to set theory. In the paper *The unifying concept of subvariance*, Johan Belinfante described one part of a large, ongoing project to formalize set theory in a way that is practical for automated provers to prove theorems in set theory.

We believe that this volume collects some of the latest state-of-the-art achievements in the respective sub-areas of FTP.

To conclude this preface, we would like to thank Hoon Hong for his support in putting together this issue, the reviewers for their professional reviews, and, of course, the authors for considering the *Journal of Symbolic Computation* for publication.

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22 June 2002