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Preface

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This special issue of Annals of Mathematics and Artificial Intelligence is devoted to first-order theorem proving. The role of first-order theorem proving as a core domain of automated deduction has been recognized since the first automated procedures were developed in the late 1950s and early 1960s. Since then, first-order order theorem proving and closely related techniques have made considerable progress, not only in proving mathematical theorems such as, for example, the Robbins algebra conjecture, but also in various other disciplines of Artificial Intelligence, including knowledge representation, model-based diagnosis, planning, symbolic computation, and verification.

In 1997 the First-Order Theorem Proving Workshop Series was established in order to provide a forum for the presentation of new work in this area and the discussion of research in progress. The Sixth Workshop on First-Order Theorem Proving, FTP 2007, was held at the University of Liverpool, UK, in September 2007. The workshop was co-located with the Sixth International Symposium on Frontiers of Combining Systems, FroCoS'07. Following the workshop, this special issue has been put together. Submissions were not limited to papers presented at FTP 2007, but were selected from papers received in response to a general call for contributions on topics including theorem proving in first-order classical logic, many-valued logic, description logic, and modal logic, strategies and complexity of theorem proving procedures, decision procedures, and applications of first-order theorem proving. With the help of thirty-one peer reviewers, six submissions were selected for publication in this special issue.

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The contribution by Arnaud Fietzke and Christoph Weidenbach introduces a superposition calculus with explicit splitting and a new backtracking rule on the basis of labelled clauses. An experimental evaluation of an implementation of the new rule shows that it provides a considerable improvement over a previously known explicit splitting method.

The work by Peter Höfner, Georg Struth and Geoff Sutcliffe illustrates the use of state-of-the-art automated theorem proving (ATP) systems for the verification of refinement laws in demonic refinement algebras. In particular, it is shown that ATP systems are able to verify classical refinements laws, for example, a data refinement law and Back's atomicity refinement law, but also to discover new laws, for example, a refinement law for infinite loops.

Two papers are on work in the area of Satisfiability Modulo Theories (SMT). The contribution by Roberto Bruttomesso, Alessandro Cimatti, Anders Franzen, Alberto Griggio, and Roberto Sebastiani provides a comparative analysis of two different approaches that integrate SAT solvers with theory solvers in SMT systems, namely, Nelson and Oppen's combination method and the Delayed Theory Combination (DTC) method. The analysis highlights some important advantages of DTC in exploiting the power of modern lazy DPLL-based SAT solvers.

The paper by Yeting Ge, Clark Barret, and Cesare Tinelli describes a methodology for reasoning about quantifiers in SMT systems and present their methodology in the context of the Abstract DPLL Modulo Theories framework.

Fabrice Nahon, Claude Kirchner, Hélène Kirchner, and Paul Brauner present a novel narrowing-based proof search method for inductive theorems in equational rewrite theories. A major feature of the method is that it provides for each successful instance of the proof search procedure a constructive proof in deduction modulo.

The contribution by Renate A. Schmidt presents a new methodology for developing modal deduction methods, in particular, tableau systems, modal resolution systems and Rasiowa-Sikorski systems, by using standard principles and methods of first-order theorem proving. In addition to deriving proof methods, the approach allows such methods to be compared theoretically and empirically in a uniform framework.

The selected papers in this special issue reflect the diversity of research at the frontier of the field ranging from the development to the application of first-order theorem proving techniques and systems. We hope you will find the papers both interesting and stimulating.

We close by thanking everyone who made FTP 2007 and this special issue possible, including the authors for their high-quality contributions, the reviewers of this special issue, the members of the Steering Committee and Program Committee of the workshop. Finally, we thank Martin C. Golumbic, the editor-in-chief of Annals of Mathematics and Artificial Intelligence, for supporting the idea of this special issue.

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