

Lecture Notes in Artificial Intelligence

1617

Subseries of Lecture Notes in Computer Science

Edited by J. G. Carbonell and J. Siekmann

Lecture Notes in Computer Science

Edited by G. Goos, J. Hartmanis and J. van Leeuwen

Springer

Berlin

Heidelberg

New York

Barcelona

Hong Kong

London

Milan

Paris

Singapore

Tokyo

Neil V. Murray (Ed.)

Automated Reasoning with Analytic Tableaux and Related Methods

International Conference, TABLEAUX'99
Saratoga Springs, NY, USA, June 7-11, 1999
Proceedings



Springer

Series Editors

Jaime G. Carbonell, Carnegie Mellon University, Pittsburgh, PA, USA

Jörg Siekmann, University of Saarland, Saarbrücken, Germany

Volume Editor

Neil V. Murray

University at Albany - SUNY

Department of Computer Science, Institute for Programming and Logics

Albany, NY 12222, USA

E-mail: nvm@cs.albany.edu

Cataloging-in-Publication data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Automated reasoning with analytic tableaux and related methods : international conference, tableaux '99, Saratoga Springs, NY, USA, June 7 - 11, 1999 ; proceedings / Neil V. Murray (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ; Paris ; Singapore ; Tokyo : Springer, 1999

(Lecture notes in computer science ; Vol. 1617 : Lecture notes in artificial intelligence)

ISBN 3-540-66086-0

CR Subject Classification (1998): F.4.1, I.2.3

ISBN 3-540-66086-0 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1999

Printed in Germany

Typesetting: Camera-ready by author

SPIN 10705220

06/3142 - 5 4 3 2 1 0

Printed on acid-free paper

Position Papers

The regular conference program included the presentation of nine (of eleven accepted) position papers. Informal proceedings containing these papers appeared as the internal scientific report “Position Papers, TABLEAUX’99”, TR 99-1, Department of Computer Science, University at Albany - SUNY, Albany, NY, U.S.A.

Sequent Decomposition: A Sequent Calculus as Efficient as Resolution.

Noriko H. Arai, Shinji Inoue, and Ryuji Masukawa

Tactics for Translation of Tableau in Natural Deduction.

Alessandro Avellone, Marco Benini, and Ugo Moscato

Depth-First Proof Search without Backtracking for Free Variable Semantic Tableaux.

Bernhard Beckert

Gentzen-Like Methods in Quantum Logic.

Uwe Egly and Hans Tompits

Unification-Based Proof Method for Modal Logic with Well-Founded Frames.

Shigeki Hagihara and Naoki Yonezaki

Model Generation for Natural-Language Semantic Analysis.

Karsten Konrad

A Proof of Completeness for Non-Horn Magic Sets and Its Application to Proof Condensation.

Miyuki Koshimura and Ryuzo Hasegawa

An Application of Labelled Tableaux to Parsing.

Karl-Michael Schneider

COLOSSEUM An Automated Theorem Prover for Intuitionistic Predicate Logic Based on Dialogue Games.

Claus Zinn

Goal Lift-Up: A Technique for Improving Proof Search in Connection Tableau Calculi.

Dirk Fuchs and Marc Fuchs

Simultaneous Sorted Unification for Free Variable Tableaux: An Elegant Calculus.

Pedro J. Martín de la Calle and Antonio Gavilanes Franco

Previous Tableaux Workshops/Conferences

1992	Lautenbach, Germany	1993	Marseille, France
1994	Abingdon, England	1995	St. Goar, Germany
1996	Terrasini, Italy	1997	Pont-à-Mousson, France
1998	Oisterwijk, The Netherlands		

Invited speakers

Randal Bryant	Carnegie Mellon Univ., Pittsburgh, U.S.A.
David S. Warren	Univ. at Stony Brook – SUNY, Stony Brook, U.S.A.

Program Chair

Neil V. Murray
University at Albany - SUNY

Local Arrangements

Joan Nellhaus
Inst. for Programming & Logics (SUNY)

Program Committee

P. Baumgartner	University of Koblenz, Germany
B. Beckert	University of Karlsruhe, Germany
K. Broda	Imperial College, London, U.K.
R. Dyckhoff	St. Andrews University, U.K.
A. Felty	Bell Labs, U.S.A.
C. Fermueller	TU Wien, Austria
M. Fitting	CUNY, New York City, U.S.A.
U. Furbach	University of Koblenz, Germany
D. Galmiche	LORIA, Nancy, France
R. Goré	Australian National University, Australia
J. Goubault-Larrecq	GIE Dyade, France
R. Hähnle	University of Karlsruhe, Germany
J. Hodas	Harvey Mudd College, California, U.S.A.
C. Kreitz	Cornell University, U.S.A.
R. Letz	Technical University of Munich, Germany
D. Miller	Pennsylvania State University, U.S.A.
U. Moscato	University of Milan, Italy
N. Murray	University at Albany - SUNY, U.S.A.
N. Olivetti	Torino University, Italy
J. Pitt	Imperial College, London, U.K.
E. Rosenthal	University of New Haven, U.S.A.
P. Schmitt	University of Karlsruhe, Germany
H. de Swart	Tilburg University, The Netherlands

Referees

Each submitted paper was refereed by three members of the program committee. In some cases, they consulted specialists who were not on the committee. We gratefully mention their names.

Wolfgang Ahrendt	D. Larchey-Wendling
Alessandro Avellone	Alexander Leitsch
Matthias Baaz	Donald Loveland
Matteo Baldoni	James Lu
Felice Cardone	Ornaghi Mario
A. Cichon	Fabio Massacci
Ingo Dahn	Georg Moser
C. Faggian	Christian Pape
Mauro Ferrari	Uwe Petermann
Camillo Fiorentini	Torsten Schaub
Andreas Goerd	Gernot Stenz
Guido Governatori	Mark Stickel
M. Kuehn	L. Vigneron

Sponsors

University at Albany

Research Council
 College of Arts and Sciences
 Department of Computer Science
 Institute for Programming & Logics

Foreword

This volume contains a selection of papers presented at the International Conference on Analytic Tableaux and Related Methods (TABLEAUX'99) held on June 7-11, 1999 at the Inn at Saratoga, Saratoga Springs, NY, USA. This conference was the continuation of international meetings on Theorem Proving with Analytic Tableaux and Related Methods held in Lautenbach near Karlsruhe (1992), Marseille (1993), Abingdon near Oxford (1994), St. Goar near Koblenz (1995), Terrasini near Palermo (1996), Pont-à-Mousson near Nancy (1997), and Oisterwijk near Tilburg (1998). TABLEAUX'99 marks the first time the conference has been held in North America.

Tableau and related methods have been found to be convenient and effective for automating deduction in various non-standard logics as well as in classical logic. Examples taken from this meeting alone include temporal, description, tense, quantum, modal, projective, hybrid, intuitionistic, and linear logics. Areas of application include verification of software and computer systems, deductive databases, knowledge representation and its required inference engines, and system diagnosis. The conference brought together researchers interested in all aspects – theoretical foundations, implementation techniques, systems development and applications – of the mechanization of reasoning with tableaux and related methods.

The members of the program committee worked diligently in selecting the presented papers. Each research paper was given a formal evaluation by three referees – to whom we are indeed grateful. From the 41 submissions received, 18 original *research papers* and 3 original *system descriptions* were chosen by the program committee for presentation at the conference and for inclusion in these proceedings, together with the invited lectures. Also included are the abstracts of 2 *tutorials*, a summary of the non classical systems comparison conducted for TABLEAUX'99, descriptions of the comparison entries, and the titles and authors of *position papers*, which were also presented at the conference.

Acknowledgements First, I would like to thank the local arrangements chair, Joan Nellhaus, who helped with virtually all aspects of organizing the conference. I also thank Fabio Massacci, who organized the comparison. Ron Goebel put much time and effort into installing the web software that facilitated secure discussions amongst program committee members.

I also thank the authors of all submissions, the speakers, the tutorial organizers, the comparison entrants, program committee members, and, last but not least, the sponsors, who made it possible to organize this conference in Saratoga Springs, NY.

Table of Contents

Extended Abstracts of Invited Lectures

Microprocessor Verification Using Efficient Decision Procedures for a Logic of Equality with Uninterpreted Functions.....	1
<i>Randal E. Bryant (with Steven German and Miroslav N. Velev)</i>	

Comparison

Design and Results of the Tableaux-99 Non-classical (Modal) Systems Comparison	14
<i>Fabio Massacci</i>	
DLP and FaCT.....	19
<i>Peter F. Patel-Schneider and Ian Horrocks</i>	
Applying an \mathcal{ALC} ABox Consistency Tester to Modal Logic SAT Problems..	24
<i>Volker Haarslev and Ralf Möller</i>	
KtSeqC: System Description.	29
<i>Vijay Boyapati and Rajeev Goré</i>	

Abstracts of Tutorials

Automated Reasoning and the Verification of Security Protocols.	32
<i>Fabio Massacci</i>	
Proof Confluent Tableau Calculi.	34
<i>Reiner Hähnle and Bernhard Beckert</i>	

Contributed Research Papers

Analytic Calculi for Projective Logics.	36
<i>Matthias Baaz and Christian G. Fermüller</i>	
Merge Path Improvements for Minimal Model Hyper Tableaux.....	51
<i>Peter Baumgartner, J.D. Horton and Bruce Spencer</i>	
CLDS for Propositional Intuitionistic Logic.	66
<i>Krysia Broda and Dov Gabbay</i>	
Intuitionistic Tableau Extracted.....	82
<i>James Caldwell</i>	
A Tableau-Based Decision Procedure for a Fragment of Set Theory Involving a Restricted Form of Quantification.....	97
<i>Domenico Cantone and Calogero G. Zarba</i>	

Bounded Contraction in Systems with Linearity.....	113
<i>Agata Ciabattoni</i>	
The Non-associative Lambek Calculus with Product in Polynomial Time...	128
<i>Philippe de Groote</i>	
Sequent Calculi for Nominal Tense Logics: A Step Towards Mechanization?	140
<i>Stéphane Demri</i>	
Cut-Free Display Calculi for Nominal Tense Logics.....	155
<i>Stéphane Demri and Rajeev Goré</i>	
Hilbert's Epsilon-Terms in Automated Theorem Proving.....	171
<i>Martin Giese and Wolfgang Ahrendt</i>	
Partial Functions in an Impredicative Simple Theory of Types.....	186
<i>Paul C. Gilmore</i>	
A Simple Sequent System for First-Order Logic with Free Constructors. ...	202
<i>Jean Goubault-Larrecq</i>	
linTAP: A Tableau Prover for Linear Logic.....	217
<i>Heiko Mantel and Jens Otten</i>	
A Tableau Calculus for a Temporal Logic with Temporal Connectives.....	232
<i>Wolfgang May</i>	
A Tableaux Calculus for Pronoun Resolution.....	247
<i>Christof Monz and Maarten de Rijke</i>	
Generating Minimal Herbrand Models Step by Step.....	263
<i>Heribert Schütz</i>	
Tableau Calculi for Hybrid Logics.....	278
<i>Miroslava Tzakova</i>	
Full First-Order Free Variable Sequents and Tableaux in Implicit Induction.....	293
<i>Claus-Peter Wirth</i>	

Contributed System Descriptions

An Interactive Theorem Proving Assistant.....	308
<i>Ulrich Endriss</i>	
A Time Efficient KE Based Theorem Prover.....	313
<i>Ulrich Endriss</i>	
Strategy Parallel Use of Model Elimination with Lemmata - System Abstract -.....	319
<i>Andreas Wolf and Joachim Draeger</i>	
Author Index	325