# Lecture Notes in Computer Science

1125

J. von Wright J. Grundy J. Harrison (Eds.)

## Theorem Proving in Higher Order Logics

9th International Conference, TPHOLs'96 Turku, Finland, August 1996 Proceedings



### Lecture Notes in Computer Science Edited by G. Goos, J. Hartmanis and J. van Leeuwen

1125

Advisory Board: W. Brauer D. Gries J. Stoer

## Springer Berlin

Berlin
Heidelberg
New York
Barcelona
Budapest
Hong Kong
London
Milan
Paris
Santa Clara
Singapore
Tokyo

J. von Wright J. Grundy J. Harrison (Eds.)

## Theorem Proving in Higher Order Logics

9th International Conference, TPHOLs'96 Turku, Finland, August 26-30, 1996 Proceedings



Series Editors

Gerhard Goos, Karlsruhe University, Germany
Juris Hartmanis, Cornell University, NY, USA
Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Joakim von Wright
Jim Grundy
John Harrison
Åbo Akademi University, Department of Computer Science
Lemminkäinengatan 14A, 20520 Turku, Finland

Cataloging-in-Publication data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Theorem proving in higher order logics: 9th international conference; proceedings / TPHOL '96, Turku, Finland, August 26 - 30, 1996 / J. von Wright ... (ed.). - Berlin; Heidelberg; New York; Barcelona; Budapest; Hong Kong; London; Milan; Paris; Santa Clara; Singapore; Tokyo: Springer, 1996 (Lecture notes in computer science; Vol. 1125) ISBN 3-540-61587-3
NE: Wright, Joakim von [Hrsg.]; TPHOL <9, 1996, Turku>; GT

CR Subject Classification (1991): B.6.3, D.2.4, F.3.1, F.4.1, I.2.3

ISSN 0302-9743 ISBN 3-540-61587-3 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 SpringerVerlag. Violations are liable for prosecution under the German Copyright Law

© Springer-Verlag Berlin Heidelberg 1996 Printed in Germany

Typesetting: Camera-ready by author SPIN 10513526 06/3142 - 5 4 3 2 1 0 Printed on acid-free paper

### Preface

This volume contains the proceedings of the *The 9th International Conference on Theorem Proving in Higher Order Logics* (TPHOLs'96). The previous meetings in the series were known initially as HOL Users Meetings, and later as Workshops on Higher Order Logic Theorem Proving and its Applications. The new name for the series reflects a broadening in scope of the conferences, which now encompass work related to all aspects of theorem proving in higher order logics, particularly when based on a secure mechanization of logic. As a sign of the broad scope of the conference, these proceedings contain papers describing work using the Alf, Coq, HOL, Isabelle, LAMBDA, LEGO, NuPrl, and PVS theorem provers.

The forty-six papers submitted to TPHOLs'96 were generally of high standard. All submissions were fully refereed, each paper being read by at least three reviewers appointed by the programme committee. Twenty-seven papers were selected for presentation as full research contributions. These are the papers contained in this volume. The conference also continued the tradition of its predecessors of providing an open venue for the discussion and sharing of preliminary results. Thus the programme included an informal poster session where twenty researchers were invited to present their work. The poster papers are available in a supplementary proceedings produced as a General Publication of the Turku Centre for Computer Science (TUCS).

The organizers are pleased that Mike Gordon and Andrzej Trybulec accepted invitations to be guest speakers at the conference. In addition to the two invited lectures, the conference also included two tutorials, by Paul Jackson and Christine Paulin-Mohring.

The conference was sponsored by the Turku Centre for Computer Science, the Research Institute of the Foundation of Åbo Akademi, and the Academy of Finland. Their financial support is gratefully acknowledged. We also want to thank Christel Engblom, Sirpa Nummila, and Gundel Westerholm who assisted in matters of local organization.

August 1996

Joakim von Wright Jim Grundy John Harrison

### **Conference Organization**

#### Conference Chair:

Joakim von Wright (Åbo Akademi)

#### **Programme Committee:**

Flemming Andersen (Tele Danmark)
Albert Camilleri (Hewlett-Packard)
Tony Cant (DSTO)
Elsa Gunter (AT&T)
Joshua Guttman (MITRE)
John Herbert (SRI)
Paul Jackson (U. Edinburgh)
Ramayya Kumar (FZI Karlsruhe)

Tim Leonard (DEC)

Paul Loewenstein (Sun)
Tom Melham (U. Glasgow)
Tobias Nipkow (TU München)
Christine Paulin (ENS Lyon)
Larry Paulson (U. Cambridge)
Tom Schubert (Portland State U.)
David Shepherd (SGS-THOMSON)
Phil Windley (PVII)

Phil Windley (BYU)

Joakim von Wright (Åbo Akademi)

#### Organizing Committee:

Jim Grundy (Åbo Akademi) John Harrison (Åbo Akademi) Joakim von Wright (Åbo Akademi)

#### Invited Speakers:

Mike Gordon (U. Cambridge) Andrzej Trybulec (U. Warsaw, Białystok)

#### Tutorial Speakers:

Paul Jackson (U. Edinburgh) Christine Paulin (ENS Lyon)

#### Additional Referees:

David Basin
Paul E. Black
Rosina Bignall
Christian Blumenröhr
Annette Bunker
Roy L. Crole
Anthony Dekker
Katherine Eastaughffe
Dirk Eisenbiegler
Jens Chr. Godskesen

Andrew Gordon
Jim Grundy
Kelly Hall
John Harrison
Michael Jones
Trent Larson
Thomas Långbacka
Brendan Mahony
Michael Norrish

Chris Owens
Maris Ozols
Kim Dam Petersen
Jimmi S. Pettersson
Christian Prehofer
Emil Sekerinski
Kaisa Sere
Donald Syme
Marina Waldén

## Contents

Translating Specifications in VDM-SL to PVS
A Comparison of HOL and ALF Formalizations of a  Categorical Coherence Theorem
Modeling a Hardware Synthesis Methodology in Isabelle
Inference Rules for Programming Languages with Side Effects in Expressions
Deciding Cryptographic Protocol Adequacy with HOL: The Implementation
Proving Liveness of Fair Transition Systems
Program Derivation Using the Refinement Calculator93  M. Butler, T. Långbacka
A Proof Tool for Reasoning About Functional Programs
Coq and Hardware Verification: A Case Study
Elements of Mathematical Analysis in PVS
Implementation Issues About the Embedding of Existing High Level Synthesis Algorithms in HOL
Five Axioms of Alpha-Conversion
Set Theory, Higher Order Logic or Both?
A Mizar Mode for HOL

Stålmarck's Algorithm as a HOL Derived Rule
Towards Applying the Composition Principle to Verify a Microkernel Operating System
A Modular Coding of Unity in Coq
Importing Mathematics from HOL into Nuprl
A Structure Preserving Encoding of Z in Isabelle/HOL
Improving the Result of High-Level Synthesis Using Interactive Transformational Design
Using Lattice Theory in Higher Order Logic
Formal Verification of Algorithm $\mathcal{W}$ : The Monomorphic Case
Verification of Compiler Correctness for the WAM
Synthetic Domain Theory in Type Theory:  Another Logic of Computable Functions
Function Definition in Higher Order Logic
Higher Order Annotated Terms for Proof Search
A Comparison of MDG and HOL for Hardware Verification
A Mechanisation of Computability Theory in HOL
Author Index