

Lecture Notes in Computer Science

1292

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

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

Hugh Glaser Pieter Hartel
Herbert Kuchen (Eds.)

Programming Languages: Implementations, Logics, and Programs

9th International Symposium, PLILP'97
Including a Special Track on Declarative
Programming Languages in Education
Southampton, UK, September 3-5, 1997
Proceedings



Springer

Series Editors

Gerhard Goos, Karlsruhe University, Germany

Juris Hartmanis, Cornell University, NY, USA

Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Hugh Glaser

Pieter Hartel

University of Southampton, Department of Electronics and Computer Science
Southampton SO17 1BJ, UK

E-mail: (hg,phh)@ecs.soton.ac.uk

Herbert Kuchen

Westfälische Wilhelms-Universität Münster, Institut für Wirtschaftsinformatik
Greverer Str. 91, D-48149 Münster, Germany

E-mail: herbert@helios.uni-muenster.de

Cataloging-in-Publication data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

**Programming languages : implementations, logics and programs ;
9th international symposium ; proceedings / PLILP '97, Southampton,
UK, September 1 - 3, 1997 ; including a special track on declarative
programming languages in education / Hugh Glaser ... (ed.). - Berlin ;
Heidelberg ; New York ; Barcelona ; Budapest ; Hong Kong ;
London ; Milan ; Paris ; Santa Clara ; Singapore ; Tokyo : Springer,
1997**

(Lecture notes in computer science ; Vol. 1292)

ISBN 3-540-63398-7

CR Subject Classification (1991): D.1.1, D.1.6, D.3.1, D.3.4, F.3.1, F.3.3,
F.4.1-3, K.3.2, I.1.3, I.2.1

ISSN 0302-9743

ISBN 3-540-63398-7 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 1997

Printed in Germany

Typesetting: Camera-ready by author

SPIN 10546391 06/3142 - 5 4 3 2 1 0 Printed on acid-free paper

Preface

This volume contains the proceedings of the *Ninth International Symposium on Programming Languages, Implementations, Logics, and Programs*, PLILP'97. It was held in Southampton, UK, in conjunction with the *Sixth International Conference on Algebraic and Logic Programming*, ALP'97, and the *Third International Workshop on Higher-Order Algebra, Logic and Term Rewriting*, HOA'97. The previous PLILP meetings took place in Orléans, France (1988), Linköping, Sweden (1990), Passau, Germany (1991), Leuven, Belgium (1992), Tallinn, Estonia (1993), Madrid, Spain (1994), Utrecht, The Netherlands (1995), and Aachen, Germany (1996). All proceedings have been published by Springer-Verlag as Lecture Notes in Computer Science volumes 348, 456, 528, 631, 714, 844, 982 and 1140.

The PLILP symposium aims at stimulating research on declarative *p*rogramming languages, and seeks to disseminate insights in the relation between implementation techniques, the *logics* of those languages, and the use of these languages in constructing real *p*rograms. Topics of interest include implementation of declarative concepts, integration of paradigms, compiler specification and construction, program analysis and transformation, programming environments, executable specifications, reasoning about language constructs, experiences in constructing applications, and typing and structuring systems.

The cooperation with ALP and HOA, together with a special track on declarative programming languages in education, has strengthened the attractiveness of the overall event and – as a consequence – the quality of the presentations. The quality and number of submitted papers serves as an indication of the success of this approach. Out of 68 submissions, 25 papers (37%) were selected, as well as some poster and system demonstrations. In addition to the selected contributions, invited talks were given by Neil Jones and Guy Cousineau.

The special track on declarative programming languages in education represents the state of the art in teaching methods using functional and logic languages. It followed the successful Symposium on *Functional Programming Languages in Education*, held in Nijmegen, The Netherlands, in 1995, and which appeared as Springer-Verlag LNCS volume 1022. These papers on education were selected by a separate programme committee chaired by Krzysztof Apt, Paul Klint, and Pieter Hartel.

All communication in organising the symposium was done electronically: submitting papers, distributing papers to reviewers, transmitting and discussing reviews among the program committee members, and giving feedback to the authors. This helped both to reduce the cost of organising the symposium and to keep the time between the deadline for submissions and the conference short.

On behalf of the two programme committees we thank all those who submitted papers. We thank the referees for their careful work in the reviewing and selection process.

Programme Committee

Hugh Glaser (Chair)	University of Southampton, UK
Herbert Kuchen (Chair)	Westfälische Wilhelms-Universität Münster, Germany
María Alpuente	Universitat Politècnica de Valencia, Spain
Lex Augusteijn	Philips Research Laboratories, The Netherlands
Francisco Bueno Carrillo	Univ. Politècnica, Madrid, Spain
Maurizio Gabbrielli	Università di Pisa, Italy
Yike Guo	Imperial College London, UK
Fritz Henglein	University of Copenhagen, Denmark
Pascal van Hentenryck	Brown University, USA
Tetsuo Ida	University of Tsukuba, Japan
Gerda Janssens	Katholieke Universiteit Leuven, Belgium
Mark Jones	University of Nottingham, UK
Peter Kacsuk	KFKI, Budapest, Hungary
Daniel Le Métayer	IRISA, Rennes, France
John Lloyd	University of Bristol, UK
Francisco Lopez Fraguas	Universidad Complutense de Madrid, Spain
Dale Miller	University of Pennsylvania, USA
Masaki Murakami	Okayama University, Japan
Jukka Paakki	University of Helsinki, Finland
Christian Queinnec	Université Paris 6 & INRIA-Rocquencourt, France
Gert Smolka	DFKI Saarbrücken, Germany
Zoltan Somogy	University of Melbourne, Australia
Peter Thiemann	Universität Tübingen, Germany

Programme Committee of the Special Track on Education

Krzysztof Apt (Chair)	CWI, Amsterdam, The Netherlands
Pieter Hartel (Chair)	University of Southampton, UK
Paul Klint (Chair)	CWI, Amsterdam, The Netherlands
Maurice Bruynooghe	Katholieke Universiteit Leuven, Belgium
Pierre Deransart	INRIA, Rocquencourt, France
Matthias Felleisen	Rice University, USA
Alfons Geser	Universität Tübingen, Germany
Bob Harper	Carnegie Mellon University, USA
Pascal van Hentenryck	Brown University, USA
Manuel Hermenegildo	Univ. Politècnica, Madrid, Spain
Paul Hudak	Yale University, USA
John Hughes	Chalmers University, Sweden
Jacques Loeckx	Universität Saarbrücken, Germany
Rita Loogen	Universität Marburg, Germany
John O'Donnell	University of Glasgow, UK
Rinus Plasmeijer	University of Nijmegen, The Netherlands
David S. Warren	Stony Brook University, USA

Referees

B. Aarts, Lex Augusteijn, Maria Garcia de la Banda, Frank van den Beuken, Paul Blampied, George Horatiu Botorog, Francisco Bueno Carrillo, Manuel Chakravarty, Olaf Chitil, Justin Cormack, Agostino Cortesi, M. Danelutto, Anthony Daniels, Bart Demoen, Thierry Despeyroux, Roberto Di Cosmo, Remi Douence, Dirk Dussart, Moreno Falaschi, Pascal Fradet, Maurizio Gabbrielli, Benedict R. Gaster, Roberto Giacobazzi, Ana Gil-Luezas, Hugh Glaser, J.C. Gonzalez-Moreno, P. Gorissen, Steve Gregory, Yike Guo, John Hannan, Fritz Henglein, Pascal Van Hentenryck, Graham Hutton, Tetsuo Ida, Suresh Jagannathan, Paul Jansen, Gerda Janssens, David Jeffery, Thomas Jensen, Mark P. Jones, Peter Kacsuk, Andy King, F.E.J. Kruseman Aretz, Herbert Kuchen, Konstantin Laufer, Julia Lawall, Daniel Le Métayer, Javier Leach, Martin Leucker, John Lloyd, Rita Loogen, Francisco Lopez Fraguas, Salvador Lucas, Andrew Macdonald, Dale Miller, M. Mohnen, Juan José Moreno-Navarro, Angelo Montanari, Luc Moreau, Martin Müller, Tobias Müller, Peter Moller Neergaard, Zsolt Nemeth, Joachim Niehren, Hanne Riis Nielson, Susana Nieva., Henning Niss, Javier Oliver, Wouter van Oortmerssen, Jukka Paakki, Norbert Podhorszki, German Puebla, Zsolt Puskas, Christian Queinnec, Mario Rodriguez-Artalejo, Mads Rosendahl, Konstantinos Sagonas, Vladimiro Sassone, Mitsuhisa Sato, Christian Schulte, Jens Peter Secher, Kish Shen, Etsuya Shibayama, Yuka Shimajiri, Gert Smolka, Zoltan Somogyi, Harald Sondergaard, Morten Heine Sorensen, Michael Sperber, Paul Steckler, Mario Suedholt, Taro Suzuki, Kazuko Takahashi, Yukihide Takayama, Jorma Tarhio, Colin J. Taylor, Peter Thiemann, Germán Vidal, Hing Wing To, Jörg Würtz

Referees for the Special Track on Education

Krzysztof Apt, Silvia Bretinger, Maurice Bruynooghe, Pierre Deransart, Marko van Eekelen, Matthias Felleisen, Daniel Friedman, Alfons Geser, Bob Harper, Pieter Hartel, Pascal van Hentenryck, Manuel Hermenegildo, Angel Herranz-Nieva, Paul Hudak, John Hughes, Juan José Moreno-Navarro, Paul Klint, Jacques Loeckx, Rita Loogen, Julio Mario, John O'Donnell, Rinus Plasmeijer, Jacques Riche, Karel de Vlaeminck, David Warren

The PLILP '97 conference was organised in cooperation with the British Computer Society, the Association of Logic Programming, the European Association for Programming Languages and Systems and Compulog Net (the ESPRIT Network of Excellence in Computational Logic).

Table of Contents

Paradigm Integration

Narrowing the Narrowing Space	1
<i>Sergio Antoy and Zena M. Ariola</i>	
An Object Calculus with Algebraic Rewriting	17
<i>Adriana Compagnoni and Maribel Fernández</i>	
Inheritance and Selective Method Dispatching in Concurrent Haskell	33
<i>José E. Gallardo, Francisco Gutiérrez and Blas C. Ruiz</i>	

Language Constructs

Overriding Operators in a Mixin-Based Framework	47
<i>Davide Ancona and Elena Zucca</i>	
Resolution for Logic Programming with Universal Quantifiers	63
<i>Antony F. Bowers, Patricia M. Hill and Francisco Ibañez</i>	
A Declarative Approach to Concurrent Programming	79
<i>Steve Gregory</i>	

Transformation

Transformation of Divide & Conquer to Nested Parallel Loops	95
<i>Christoph A. Herrmann and Christian Lengauer</i>	
Transforming Lazy Functions Using Compartment Properties	111
<i>Ross Paterson</i>	
Transformations for Efficient Evaluations in Functional Programming	127
<i>Salvador Lucas</i>	

Program Analysis

Inline Expansion: <i>When</i> and <i>How</i> ?	143
<i>Manuel Serrano</i>	
Higher-Order Value Flow Graphs	159
<i>Christian Mossin</i>	
Intuitionistic Implication in Abstract Interpretation	175
<i>Roberto Giacobazzi and Francesca Scozzari</i>	

Compilation

An Open-Ended Finite Domain Constraint Solver	191
<i>Mats Carlsson, Greger Ottosson, Björn Carlson</i>	
Semantics and Compilation of Recursive Sequential Streams in $\lambda_{1/2}$	207
<i>Jean-Louis Giavitto, Dominique De Vito and Olivier Michel</i>	
Implementation of Term Rewritings with the Evaluation Strategy	225
<i>Kazuhiro Ogata and Kokichi Futatsugi</i>	
Reflections on Reflections	241
<i>Gilles Barthe, John Hatchiff and Morten Heine Sørensen</i>	

Evaluation

Evaluation under Lambda Abstraction	259
<i>Hongwei Xi</i>	
Selective Recomputation for Handling Side-Effects in Parallel Logic Programs	275
<i>Zhiyi Huang, Chengzheng Sun and Abdul Sattar</i>	
Tracing Lazy Functional Computations Using Redex Trails	291
<i>Jan Sparud and Colin Runciman</i>	

Education: Invited Paper

Functional Programming and Geometry	309
<i>Guy Cousineau</i>	

Education: Methodologies

<i>Where do I begin?</i>	
A Problem Solving Approach in Teaching Functional Programming	323
<i>Simon Thompson</i>	
Teaching Functional and Logic Programming with a Single Computation Model	335
<i>Michael Hanus</i>	
Logic Implemented Functionally	351
<i>Norbert Eisinger, Tim Geisler and Sven Panne</i>	

Education: Tools and Themes

DrScheme: A Pedagogic Programming Environment for Scheme	369
<i>Robert Bruce Findler, Cormac Flanagan, Matthew Flatt, Shriram Krishnamurthi, and Matthias Felleisen</i>	
An Editor for Helping Novices to Learn Standard ML	389
<i>Jon Whittle, Alan Bundy, and Helen Lowe</i>	
Introducing the Declarative Dungeon	407
<i>David DeRoure</i>	

Poster Presentations

A Pragmatic Approach to Compilation of Erlang	419
<i>Erik Johansson, Christer Jonsson, Thomas Lindgren, Johan Bevemyr, and Håkan Millroth</i>	
Formal Translations Described by Translation Grammars with $LR(k)$ Input Grammars	421
<i>Jan Janoušek and Bořivoj Melichar</i>	
Automatic Run-Time Code Generation in Object-Oriented Languages	423
<i>Nobuhisa Fujinami</i>	

Author index	425
--------------------	-----