

# Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

300

---

H. Ganzinger (Ed.)

**ESOP '88**

2nd European Symposium on Programming  
Nancy, France, March 21–24, 1988  
Proceedings

---



**Springer-Verlag**

Berlin Heidelberg New York London Paris Tokyo

**Editorial Board**

D. Barstow W. Brauer P. Brinch Hansen D. Gries D. Luckham  
C. Moler A. Pnueli G. Seegmüller J. Stoer N. Wirth

**Editor**

Harald Ganzinger  
Fachbereich Informatik, Universität Dortmund  
Postfach 50 05 00, D-4600 Dortmund 50

CR Subject Classification (1987): D.1.1–3, D.2–3, F.3

ISBN 3-540-19027-9 Springer-Verlag Berlin Heidelberg New York  
ISBN 0-387-19027-9 Springer-Verlag New York Berlin Heidelberg

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 other ways, and storage in data banks. Duplication of this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its version of June 24, 1985, and a copyright fee must always be paid. Violations fall under the prosecution act of the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1988  
Printed in Germany

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.  
2145/3140-543210

## Preface

This volume contains the papers selected for presentation at the 2nd European Symposium on Programming, Nancy, March 21-24, 1988. The first conference in this series was held at Saarbrücken in March 1986 (see LNCS 213) as a successor to the "Colloque sur la Programmation" and the GI Conference on "Programmiersprachen und Programmentwicklung". ESOP '88 has been held in conjunction with CAAP '88.

The theme of the ESOP conference is the design, specification and implementation of programming languages and systems. Emphasis is on work in which an implemented system embodies an important concept or formal model of programming in such a way that its usefulness is demonstrated. It was therefore decided that the conference be accompanied by an exhibition of software systems in the area. This volume also contains a short description of some of the systems that have been demonstrated. The program committee has selected 23 papers out of a total of 75 submitted papers. In addition, the volume contains a paper from one of the two invited speakers.

The program committee has consisted of the following persons:

S. Abramsky, London	G. Kahn, Sophia-Antipolis
E. Astesiano, Genova	P. Klint, Amsterdam
M. Bruynooghe, Leuven	P. Lescanne, Nancy
G. Cousineau, Paris	T. Reps, Madison, WI
H. Ganzinger, Dortmund (chairman)	B. Robinet, Paris
J. Hughes, Glasgow	M. Sintzoff, Louvain-la-Neuve
Th. Johnsson, Gøteborg	R. Wilhelm, Saarbrücken
N. Jones, København	M. Wirsing, Passau

The following people have served as additional referees:

J.A.S. Alegria, L. Augustsson, D. Bert, A. Callebaut, L. F. del Cerro, A. Ciepielewski, D. Clement, G. Costa, J. Crammond, P.-L. Curien, O. Danvy, J. O'Donnell, D. Galmiche, R. Giegerich, C. V. Hall, M. Hanus, L. Hascoet, R. Heckmann, P. van Hentonyck, R. Hennicker, N. Hermann, K. Holm, P. Jacquet, R. Jacquier, J. Jaray, K. Karlsson, A. van Lamsweerde, J. Maluszynski, D. Maurer, D. Mery, T. Mogensen, A. Pettorossi, L. Pierron, A. Poigné, A. Quere, Th. Rauber, H. P. Sander, D. de Schreye, T. Streicher, A. Suarez, P. Wadler, A. Waern and P. Wolper.

I would like to express my sincere gratitude to all the members of the program committee, as well as to the many other referees listed above for their care and advice.

Moreover, I am grateful to Astrid Baumgart at Dortmund and to Jean-Luc Rémy, Corinne Hally and all the other people of the Local Arrangement Committee at Nancy who have helped in preparing and organizing this conference.

Dortmund, March 1988

H. Ganzinger

## Table of Contents

### 1. Invited Speakers

*G. Huet*: The Constructive Engine \*

*T. Reps and S. Horwitz*: Semantics-Based Program Integration 1

### 2. Program Development and Verification

*G. D. Gough and H. Barringer*: A Semantics Driven Temporal Verification System 21

*B. Krieg-Brückner*: Algebraic Formalisation of Program Development by Transformation 34

*Y. Takayama*: QPC: QJ-based Proof Compiler  
- Simple Examples and Analysis - 49

### 3. Algebraic Specification and Type Concepts

*N. W. P. van Diepen*: Implementation of Modular Algebraic Specifications 64

*R. Dietrich and F. Hagl*: A Polymorphic Type System with Subtypes for Prolog 79

*Y.-C. Fuh and P. Mishra*: Type Inference with Subtypes 94

*M. C. Gaudel and Th. Moineau*: A Theory of Software Reusability 115

*S. Kaes*: Parametric Overloading in Polymorphic Programming Languages 131

*M. Parigot*: Programming with Proofs: A Second-Order Type Theory 145

### 4. Language Concepts

*M. Bretz and J. Ebert*: An Exception Handling Construct for Functional Languages 160

*R. Heckmann*: A Functional Language for the Specification of Complex Tree Transformations 175

*S. M. Kaplan*: Garp: Graph Abstractions for Concurrent Programming 191

*R. Legrand*: Extending Functional Programming Towards Relations 206

---

\* Manuscript not received in time for publication

<b>5. Implementation of Programming Languages</b>	
<i>A. Aiken and A. Nicolau: Perfect Pipelining: A New Loop Parallelization Technique</i>	221
<i>C. Consel: New Insights into Partial Evaluation: The SCHISM Experiment</i>	236
<i>R. Giegerich and K. Schmal: Code Selection Techniques: Pattern Matching, Tree Parsing, and Inversion of Derivors</i>	247
<i>S. Horwitz: Adding Relational Query Facilities to Software Development Environments</i>	269
<i>D. Jacobs and A. Langen: Compilation of Logic Programs for Restricted And-Parallelism</i>	284
<i>A. Laville: Implementation of Lazy Pattern Matching Algorithms</i>	298
<i>A. Martelli and G. F. Rossi: Enhancing Prolog to Support Prolog Programming Environments</i>	317
<i>F. Nielson and H. R. Nielson: 2-Level-<math>\lambda</math>-Lifting</i>	328
<i>Ph. Wadler: Deforestation: Transforming Programs to Eliminate Trees</i>	344
<i>P. Weemeeuw, M. Bruynooghe and M. De Hondt: On Implementing Logic Programming Languages on a Dataflow Architecture</i>	359
 <b>6. Systems Exhibition</b>	 373
 <b>Author Index</b>	 381