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# Mathematical Foundations of Programming Semantics

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## Preface

The Fifth International Conference on the Mathematical Foundations of Programming Semantics was held on the campus of Tulane University, New Orleans, Louisiana from March 29 to April 1, 1989. The major goal of this workshop-conference series is to bring together computer scientists who work in programming semantics and mathematicians who work in areas which might impact programming semantics so that they may share ideas and discuss problems of mutual interest. By letting mathematicians see applications of their work to programming semantics and by letting computer scientists see their ideas and intuitions expressed in pure mathematics, the organizers have sought to improve communication among the researchers in these areas and to establish ties between related areas of research. With these goals in mind, the invited speakers for the conference were:

Samson Abramsky, *Imperial College*
Luca Cardelli, *DEC Research*
Peter Johnstone, *University of Cambridge*
Robin Milner, *University of Edinburgh*
Peter Freyd, *University of Pennsylvania*
John Reynolds, *Carnegie-Mellon University*

In addition, there were contributed talks by sixteen researchers, as well as a number of shorter presentations. These last were presented during the *Organizers' Sessions*, which were a new and innovative feature of the conference. They were designed to add flexibility to the program to accommodate interesting new developments which were not available at the time of the *Call for Papers*. Two papers from that session, those by John Gray and by A. J. Power, are included in this volume. In addition, the paper by C. A. R. Hoare and He Jifeng has evolved from a series of invited lectures which the authors presented at the Fourth MFPS workshop, which was held in Boulder, Colorado in 1988.

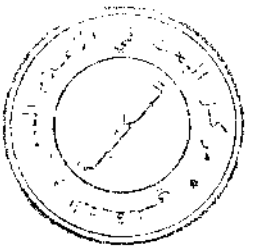
An informal preconference meeting took place on March 27 and 28, and it was at this gathering that Samson Abramsky presented a talk on the Kahn Principle, which is the topic of his contribution to these Proceedings. Also, a session organized by Carl Gunter (University of Pennsylvania) on the semantics of inheritance took place during the fifth conference and presented new results in this emerging area.

The Program Committee was chaired by Austin Melton and David Schmidt. In addition to the editors of this volume, the Committee consisted of Boumediene Belkhouche, Steve Brookes, Carl Gunter, Jimmie Lawson, Frank Oles, George Revesz, Teodor Rus, Robert Tennent and Eric Wagner. The editors wish to express their thanks to the other members of the Committee for their efforts in reviewing the papers submitted for presentation at the Conference. Additional thanks are due to Boumediene Belkhouche, who also served so capably as the Local Arrangements Chairman for the Conference.

The Conference was supported by funds from the Office of Naval Research and from the National Science Foundation. We thank these organizations for their generous support of the Conference.

Thanks are due to the many people who helped make the conference run so smoothly. These include Michael Huth, Peggy Jordan, John Kozma, Marguerite Saacks and Han Zhang. Finally, we all owe a special thank you to Geralyn Caradona, Administrative Assistant of the Mathematics Department of Tulane University, who managed to oversee virtually all of the small details of running the conference (even to the extent of relocating the major social gathering on the day it occurred) with such dispatch that the rest of us were able to concentrate on the main order of business, the program.

*Michael Main* *Austin Melton* *Michael Mislove* *David Schmidt*
*February, 1990*





## Table of Contents

A Generalized Kahn Principle for Abstract Asynchronous Networks ..... 1
*Samson Abramsky*

Operations on Records ..... 22
*Luca Cardelli and John C. Mitchell*

Connections Between a Concrete and an Abstract Model of Concurrent Systems ..... 53
*Eugene W. Stark*

A Hierarchy of Domains for Real-time Distributed Computing ..... 80
*G. M. Reed*

Factorizing Proofs in Timed CSP ..... 129
*Jim Davies and Steve Schneider*

Unbounded Nondeterminism in CSP ..... 160
*A. W. Roscoe and Geoff Barrett*

The Semantics of Priority and Fairness in occam ..... 194
*Geoff Barrett*

Inductively Defined Types in the Calculus of Constructions ..... 209
*Frank Pfenning and Christine Paulin-Mohring*

On Some Semantic Issues in the Reflective Tower ..... 229
*Karoline Malmkjaer*

Semantic Models for Total Correctness and Fairness ..... 247
*Michael G. Main and David L. Black*

Equationally Fully Abstract Models of PCF ..... 271
*Allen Stoughton*

Generalization of Final Algebra Semantics by Relativization ..... 284
*Lawrence S. Moss and Satish R. Thatte*

Termination, Deadlock and Divergence ..... 301
*Luca Aceto and Matthew Hennessy*

A Category-theoretic Semantics for Unbounded Indeterminacy ..... 319
*Prakash Panangaden and James R. Russell*

Algebraic Types in PER Models ..... 333
*J.M.E. Hyland, E.P. Robinson, and G. Rosolini*

Pseudo-retract Functors for Local Lattices and Bifinite L-domains ..... 351
*Elsa L. Gunter*

L-domains and Lossless Powerdomains ..... 364
*Radhakrishnan Jagadeesan*

Does "N+1 times" Prove More Programs Correct Than "N times"?.....373
*Ana Pasztor*

An Algebraic Formulation for Data Refinement.....390
*A. J. Power*

Categorical Semantics for Programming Languages.....402
*He Jifeng and C. A. R. Hoare*

Initial Algebra Semantics for Lambda Calculi.....418
*John W. Gray*

# A Generalized Kahn Principle for Abstract Asynchronous Networks

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**Abstract**

Our general motivation is to answer the question: "What is a model of concurrent computation?". As a preliminary exercise, we study dataflow networks. We develop a very general notion of model for asynchronous networks. The "Kahn Principle", which states that a network built from functional nodes is the least fixpoint of a system of equations associated with the network, has become a benchmark for the formal study of dataflow networks. We formulate a generalized version of the Kahn Principle, which applies to a large class of non-deterministic systems, in the setting of abstract asynchronous networks; and prove that the Kahn Principle holds under certain natural assumptions on the model. We also show that a class of models, which represent networks that compute over arbitrary event structures, generalizing dataflow networks which compute over streams, satisfy these assumptions.