

# Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

266

---

Grzegorz Rozenberg (Ed.)



Advances  
in Petri Nets 1987

---



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**

G. Rozenberg  
Institute of Applied Mathematics and Computer Science  
University of Leiden  
Niels Bohrweg 1, P.O. Box 9512, 2300 RA Leiden, The Netherlands

CR Subject Classification (1987): F.1-3, C.1-2, D.4, I.6

ISBN 3-540-18086-9 Springer-Verlag Berlin Heidelberg New York  
ISBN 0-387-18086-9 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 1987  
Printed in Germany

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

## PREFACE

The idea behind the series of volumes "Advances in Petri Nets" is to present to the general computer science community recent results which are the most significant for the development of the area.

The main source of papers for "Advances" are the annual "European Workshops on Applications and Theory of Petri Nets"; the "best" papers from the past workshops are considered for the series (however, they go through an independent refereeing process and, if accepted, they often appear in "Advances" in a quite revised and extended form). Independently of the workshop papers, "Advances" present also papers submitted directly for publication in "Advances" - potential authors are encouraged to submit papers directly to the Editor of "Advances".

The main aims of "Advances" are:

- (1) to present to the "outside" scientific community a fair picture of recent advances in the area of Petri nets, and
- (2) to encourage those interested in applications and the theory of concurrent systems to take a closer look at Petri nets and then join the group of researchers working in this fascinating and challenging area.

To facilitate (2) above "Advances" also contain surveys and tutorials on various important topics from Petri nets. The current volume contains a survey on complexity of problems related to Petri nets written by R.R. Howell and L.E. Rosier.

A special feature of this volume is the bibliography on Petri nets, containing more than 2000 entries!, compiled by the GMD team consisting of S. Drees, D. Gomm, H. Plünnecke, W. Reisig and R. Walter.

"Advances in Petri Nets 1987" covers the 7th "European Workshop on Applications and Theory of Petri Nets" held in Oxford, Great Britain in June 1986. I would like to thank the members of the program committee and especially the chairman M. Diaz for the help in selecting papers from the workshop to be submitted for "Advances".

Another important event of 1986 was the Advanced Course on Petri Nets that took place in September 1986 in Bad Honnef, West Germany. The proceedings from this course have appeared, in two volumes, as "Advances in Petri Nets 1986, Part I" and "Advances in Petri Nets 1986, Part II".

Special thanks go to the referees of papers in this volume who very

often are responsible for considerable improvement of papers presented here. The referees were: M. Ajmone-Marsan, C. Andre, E. Best, J. Billington, W. Brauer, P. Chretienne, F. de Cindio, J. Desel, M. Diaz, F. Feldbrugge, H. Goeman, U. Goltz, L. Groenewegen, D. Hillen, M. Jantzen, K. Jensen, I. Keesmaat, J.W. Klop, L. Lambert, M. Lyndquist, G. Memmi, A. Merceron, G. de Michelis, M. Nielsen, H. Oberquelle, B. Paech, A. Pagnoni, E. Pelz, L. Pomello, R. Razouk, M. Silva, C. Simone, E. Smith, P.S. Thiagarajan, R. Valk, J. Vautherin, G. Vidal-Naquet, H. Vogler, K. Voss, W. Zuberek.

Leiden, April 1987

G. Rozenberg  
Editor

## TABLE OF CONTENTS

C. Girault, C. Chatelain, S. Haddad Specification and properties of a cache coherence protocol model	1
F. De Cindio, G. De Michelis, C. Simone GAMERU: A language for the analysis and design of human communication pragmatics within organizational systems	21
R.R. Howell, L.E. Rosier Recent results on the complexity of problems related to Petri nets	45
S. Haddad, C. Girault Algebraic structure of flows of a regular coloured net	73
R. Janicki, M. Koutny On equivalent execution semantics of concurrent systems	89
F. Krückeberg, M. Jaxy Mathematical methods for calculating invariants in Petri nets	104
M. Ajmone Marsan, G. Chiola On Petri nets with deterministic and exponentially distributed firing times	132
M. Ajmone Marsan, G. Chiola, A. Fumagalli An accurate performance model of CSMA/CD bus LAN	146
E. Meijer Petri net models for the $\lambda$ -calculus	162

A. Merceron	
Fair processes	181
E.-R. Olderog	
Operational Petri net semantics for CCSF	196
E. Pelz	
Infinitary languages of Petri nets and logical sentences	224
W. Reisig	
A strong part of concurrency	238
C.A. Petri, E. Smith	
Concurrency and continuity	273
J. Vautherin	
Parallel systems specifications with coloured Petri nets and algebraic specifications	293
S. Drees, D. Gomm, H. Plünnecke, W. Reisig, R. Walter	
Bibliography of Petri nets	309