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Preface

This volume consists of papers selected from the contributions to the *Fourth International Workshop on Graph Grammars and Their Application to Computer Science* which took place in Bremen, March 5 - 9, 1990. The workshop had 86 participants from 18 countries in 4 continents. The program contained 4 tutorial talks, 36 technical presentations, 4 system demonstrations, a panel discussion and an open-problems session. The organization of the workshop was supported by the ESPRIT Basic Research Working Group *Computing by Graph Transformation.*

The research area of graph grammars is theoretically attractive and well motivated by various applications. More than 20 years ago, the concept of a graph grammar was introduced by A. Rosenfeld in the U.S.A. as a formulation of some problems in pattern recognition and image processing as well as by H.J. Schneider in Germany as a method for data type specification. Since then, researchers from all over the world have contributed steadily to the field. This volume as well as the proceedings of the previous three workshops in Bad Honnef 1978 (published as Lecture Notes in Computer Science 73), in Osnabrück 1982 (Lecture Notes in Computer Science 153) and in Warrenton, Virginia, 1986 (Lecture Notes in Computer Science 291) provide a rich record of the development of the field.

This volume is again intended as a source of information for researchers active in the area as well as for scientists who would like to know more about graph grammars. We think that through this volume the reader can get a good idea of the state of the art of graph grammars, and she/he can recognize the newest trends.

The volume is organized in five sections. The first section contains three short tutorials on hyperedge replacement, node label controlled graph grammars and the algebraic approach based on double and single pushouts as well as a note on the algebraic and the logic description of graph languages. Most of the technical contributions are closely related to at least one of these four graph

grammar approaches. The second section is a collection of statements concerning the future trends in the area of graph grammars and potential applications. The third (short) section consists of four system descriptions. The fourth section provides the technical contributions. The topics of the papers cover foundations, algorithmic and implementational aspects, and various issues from application areas like concurrent computing, functional and logic programming, computer graphics, artificial intelligence and biology. In the last section, the description of the ESPRIT Basic Research Working Group *Computing by Graph Transformation* is given.

We are grateful to all who helped us in reviewing the submitted papers. The referees were: M. Bauderon, M. de Boer, L. Bonsiepen, F.J. Brandenburg, H. Bunke, M. Chytil, B. Courcelle, M. Dauchet, F. Drewes, J. Engelfriet, G. Engels, P. Fitzhorn, F.D. Fracchia, H. Göttler, A. Habel, F. Hinz, D. Janssens, K.P. Jantke, J.R. Kennaway, C. Kim, H.-P. Kriegel, C. Lautemann, M. Löwe, H. Lück, J. Lück, B. Mayoh, M. Nagl, F. Nake, F. Parisi-Presicce, A. Paz, D. Plump, P. Prusinkiewicz, J.-C. Raoult, F. Rossi, H. Schneider, A. Schürr, R. Siromoney, R. Sleep, W. Vogler, E. Wanke, E. Welzl, J. Winkowski. In particular, we would like to thank B. Courcelle, M. Nagl and A. Rosenfeld as the members of the advisory board of the workshop for their support in organizing the workshop and editing the proceedings. We are grateful to Annegret Habel for helping with the local organization. Finally, we gladly acknowledge the financial support by the Commission of the European Communities, and the University of Bremen.

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