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Edited by G. Goos and J. Hartmanis

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PREFACE

This volume contains the invited papers presented at the EUROCAL 85 conference (European Conference on Computer Algebra, April 1-3 1985, Johannes Kepler University, Linz, Austria). This conference was intended to combine the features of a research meeting with those of a spring school. Special emphasis was laid on reporting and establishing interactions of computer algebra with neighboring areas. In this endeavor the invited papers played a crucial role. They were deliberately chosen in such a way that newcomers to the field could obtain a quick introduction to the state of the art in computer algebra and the expert audience should be stimulated to pursue new directions that are motivated by past and possible future interactions of computer algebra with other fields. The invited papers fall into three groups:

Introduction to computer algebra: **B. Caviness** gives an overview on past and future of computer algebra with an emphasis on the development of algebraic algorithms in the past twenty years. The papers by **R. Pavelle** and **D. R. Stoutemyer** reflect the state of the art of computer algebra software systems by respectively reviewing the present potential of the world's largest computer algebra system MACSYMA and of the muMATH system available on personal computers. Finally, **J. Padget**'s paper on the present state of LISP covers important problems and developments in the language that is used most for computer algebra systems.

Interactions of computer algebra and neighboring fields: The paper by **J. M. Drouffe** is intended to recall some typical applications of computer algebra in physics, which was traditionally the main field of stimulation and application for computer algebra. **A. Balaban** describes a number of successful and important symbolic computations in chemistry, where even more vigorous interactions can be expected in the future. Traditionally the connection between algebra and geometry has always been intimate. The papers by **G. Collins** on cylindrical algebraic decomposition and by **T. Ottmann** on computational geometry stand for two main research directions in the algorithmic solution of geometrical problems. Actually, G. Collin's research stimulated and initiated a considerable portion of computer algebra research. **T. Beth**'s contribution describes the range of algorithmic algebraic problems that arise in signal processing, coding theory and cryptography. Two papers show the possible interactions between computer algebra and (numerical) analysis using two totally different approaches: **N. Lehmann** shows the potential of symbolic systems for deriving analytical formulae that are particularly suitable for numerical computation and **U. Kulisch** presents his method of exact numerical computation involving computer-assisted proofs of existence and uniqueness of solutions within the calculated bounds. **H. Zassenhaus**' paper (on the occasion of his inauguration as honorary professor at the Johannes Kepler University in Linz) views computer algebra as a part of and a challenge for the whole field of mathematics. Finally, three papers establish the links between computer algebra and symbolic computation on formulae and programs. **A.W. Biermann** gives an introduction into algorithmic methods in program synthesis and **G. Kreisel** shows the fundamental potential and limitations of program synthesis in the light of proof theory. **T. Coquand** and **G. Huet** describe a new higher order proof system for mechanizing mathematics that is based on advanced theoretical achievements and shows impressive practical potential.

Integration of computer algebra and neighboring fields: Starting from an introduction to computer algebra and branching into various neighboring fields the invited papers finally were brought together by the view of "scientific computation" as an integration of algebraic, numeric, graphic and logical computation in the paper by **E. Engeler** and **R. Mäder.** This view has both a theoretical and a practical aspect. Practically, we are at the doorstep of designing and realizing the "mathematical workplace of the future" that will have to integrate algebraic, numeric, graphic and logic computation. Theoretically, it is becoming increasingly clear that there are common algorithmic methods that underly algebraic, logical and graphic computation and that they should be studied together. Therefore the coincidence of EUROCAL 85 with the initiation of the new Journal of Symbolic Computation, intended to serve as a common forum for research in computer algebra, automated theorem proving, automatic programming and computational geometry, is more than random.

More information about the EUROCAL 85 conference is contained in the companion proceedings volume of research contributions. The two invited lectures by G.E. Collins and H. Zassenhaus, which are not yet available in written form, will appear in the near future in the Journal of Symbolic Computation.

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B. Buchberger

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