we have reached page 50 (out of 250) before getting to the six main chapters on techniques in polynomial algebra, and the three chapters on their application. The inconsistent and confusing notation for residue class rings, finite fields and p-adic rings in the first chapters perhaps only deserves mentioning because of the contrast with otherwise high standards of exposition and consistency, and the reasonably adequate TEX typography and layout.

The six main chapters are concerned with "computing with homomorphic images" (Chinese remaindering, p-adic lifting, discrete Fourier transform), common divisors of polynomials, factorization of polynomials (over finite fields, integers, and number fields), decomposition of polynomials, solving systems of linear equations, and Gröbner bases. Each of these provides a good introduction into the area with many clear examples and exercises. Usually the author cuts a more or less straight path through the jungle of results, and although he does point out certain byways (particularly in the very good bibliographic notes), it is not always clear what their status is. For example, Berlekamp's polynomial factorization algorithm is nicely covered, and the chapter notes mention the existence of alternatives (like Cantor-Zassenhaus), but their relative merits are not discussed at all.

The three motivating applications are quantifier elimination in real closed fields, requiring a decision procedure for systems of polynomial (in)equalities (used in robotics, for example); indefinite summation, in particular of hypergeometric functions; and parametrization of algebraic curves. Gosper's algorithm for solving the second problem and the sketch of Collins's cylindrical algebraic decomposition algorithm for the first both suffer didactically from requiring very little of the background material. The discussion of curve parametrization builds much more nicely on the previous chapters.

In summary, this book provides a good, accessible, and up-to-date account of a particular branch of algorithmic algebra that may perhaps be described as the type practised at RISC, Linz. To me it does not seem suitable as an introductory text on polynomial algebra by way of algorithms, but it will probably prove to be of value to users of computer algebra systems in getting a feeling for the background, capabilities, and difficulties that such systems have in dealing with problems involving polynomial arithmetic.

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22[00A69]—*Computer algebra in industry: Problem solving in practice*, Arjeh M. Cohen (Editor), Wiley, Chichester, 1993, x+252 pp., $23\frac{1}{2}$ cm, \$45.00

Computer algebra systems (e.g., Mathematica, MAPLE, etc.) are now familiar to the academic community. Courses are taught on their use and textbooks are being written using them, which in turn require the reader to use them to solve problems. An example is the differential geometry text by Gray [1]. The publicity for these systems uses phrases such as "environment for technical computing", and questions about how such systems have changed the practice of mathematics are being examined, for example, by Devlin [2]. There has not been much yet on applications of such systems in industry.

The book under review here is the result of the SCAFI Seminar held in Amsterdam in 1992 (I could not find the definition of the acronym in the text, but it must be something like Seminar on Computer Algebra For Industry). According to the Preface, the seminar theme was "to show how computer algebra in industry can be useful and cost effective". To that end, eleven applications from industry are described: three originate in the movement of fluids, three from the dynamics of mechanical systems, three from electronics, and two from other areas. The computer algebra systems used in the treatment of these applications include MAPLE, Mathematica, AXIOM, and REDUCE. The descriptions are fairly uniform in format. Each has a summary of the problem to be solved and how it was rendered into a mathematical model. Then there is a description of how computer algebra was applied to reduction of the model to a solvable form followed by results. Sometimes the computer algebra programs are supplied. The book begins with a chapter containing an instructive overview of what computer algebra is and what its problem solving scope is. The book closes with two chapters on interfacing computer algebra systems to systems more suitable to numerical computation.

I feel the most important feature of this book is that it deals primarily with the mathematical features of the applications treated, not the numerical. The reader is shown examples of how powerful tools can be brought to bear in dealing with aspects of the solutions that would be very time consuming if these tools were not available. As such, the book indeed demonstrates that computer algebra is changing the practice of mathematics, and it makes good reading for all mathematical practitioners, especially those in industry. I recommend it also to teachers who include computer algebra in their courses for use as a reference and sourcebook.

Finally, I want to especially recommend this book to those who have not used a computer algebra system yet. I am writing this review on my workstation which, as I write, is busy using the computer algebra system I have installed to do a numerical integration for me in the background. Before the numerical work, it did symbolic integration to reduce the integral to a more practical form. I cannot imagine working any other way now. Perhaps a reading of this book will make a convert out of you, too.

References

[1] Gray, Alfred, *Modern differential geometry of curves and surfaces with Mathematica*, Second Edition, CRC Press, 1997.

[2] Devlin, Keith, *The logical structure of computer-aided mathematical reasoning*, Amer. Math. Monthly, Vol. 104, No. 7, pp. 632–646, 1997. CMP 97:17

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