Modern Computer Algebra

Computer algebra systems are now ubiquitous in all areas of science and engineering. This highly successful textbook, widely regarded as the "bible of computer algebra", gives a thorough introduction to the algorithmic basis of the mathematical engine in computer algebra systems. Designed to accompany one- or two-semester courses for advanced undergraduate or graduate students in computer science or mathematics, its comprehensiveness and reliability has also made it an essential reference for professionals in the area.

Special features include: detailed study of algorithms including time analysis; implementation reports on several topics; complete proofs of the mathematical underpinnings; and a wide variety of applications (among others, in chemistry, coding theory, cryptography, computational logic, and the design of calendars and musical scales). A great deal of historical information and illustration enlivens the text.

In this third edition, errors have been corrected and much of the Fast Euclidean Algorithm chapter has been renovated.

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Modern Computer Algebra
Third Edition

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To Dorothea, Rafaela, Désirée
For endless patience

To Mercedes Cappuccino

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Joachim Von Zur Gathen and Jürgen Gerhard
Frontmatter
More information

Contents

Keeping up to date

Addenda and corrigenda, comments, solutions to selected exercises, and ordering information can be found on the book's web page:

`http://cosec.bit.uni-bonn.de/science/mca/`

A Beggar's Book Out-worths a Noble's Blood.[1]
William Shakespeare (1613)

Some books are to be tasted, others to be swallowed,
and some few to be chewed and digested.
Francis Bacon (1597)

Les plus grands analystes eux-mêmes ont bien rarement dédaigné de se tenir à la portée de la classe *moyenne* des lecteurs; elle est en effet la plus nombreuse, et celle qui a le plus à profiter dans leurs écrits.[2]
Anonymous referee (1825)

It is true, we have already a great many Books of *Algebra*,
and one might even furnish a moderate Library
purely with Authors on that Subject.
Isaac Newton (1728)

فحررت هذا الكتاب وجمعت فيه جميع ما يحتاج اليه الحاسب
محترزا عن اشباع ممل و اختصار مخل[3]
Ghiyāth al-Dīn Jamshīd bin Masʿūd bin Maḥmūd al-Kāshī (1427)

[1] The sources for the quotations are given on pages 725–729.
[2] The greatest analysts [mathematicians] themselves have rarely shied away from keeping within the reach of the *average* class of readers; this is in fact the most numerous one, and the one that stands to profit most from their writing.
[3] I wrote this book and compiled in it everything that is necessary for the computer, avoiding both boring verbosity and misleading brevity.