Preface

Computer algebra systems are widely used in pure and applied mathematics, physics, and other natural sciences, engineering, economics, as well as in higher and secondary education (see, e.g., [1–5]). For example, many important calculations in theoretical physics could never be done by hand, without wide use of computer algebra. Polynomial or trigonometric manipulations using paper and pen are becoming as obsolete as school long division in the era of calculators.

There are several powerful general-purpose computer algebra systems. The system *Mathematica* is most popular. It contains a huge amount of mathematical knowledge in its libraries. The fundamental book on this system [6] has more than 1,200 pages. Fortunately, the same information (more up-to-date than in a printed book) is available in the help system and hence is always at the fingertips of any user. Many books about *Mathematica* and its application in various areas have been published; see, for example, the series [7–10] of four books (each more than 1,000 pages long) or [11]. The present book does not try to replace these manuals. Its first part is a short systematic introduction to computer algebra and *Mathematica*; it can (and should) be read sequentially. The second part is a set of unrelated examples from physics and mathematics which can be studied selectively and in any order. Having understood the statement of a problem, try to solve it yourself. Have a look at the book to get a hint only when you get stuck. Explanations in this part are quite short.

This book[1] is a result of teaching at the physics department of Novosibirsk State University. Starting from 2004, the course "Symbolic and numeric computations in physics applications" is given to students preparing for M.Sc., and an introduction to *Mathematica* is the first part of this course (the second part is mainly devoted to Monte Carlo methods). Practical computer classes form a required (and most important) part of the course. Most students have no problems with mastering the basics of *Mathematica* and applying it to problems in their own areas of interest.

The book describes *Mathematica* 9. Most of the material is applicable to other versions too. The *Mathematica* Book (fifth edition) [6], as well as, e.g., the book

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series [7–10], describes *Mathematica* 5. The main source of up-to-date information is the *Mathematica* Help system.

The whole book (except Lecture 1 and Problems for students) consists of *Mathematica* notebooks. They can be found at

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http://www.inp.nsk.su/~grozin/mma/mma.zip
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The zip file is password protected. The password is the last sentence of Lecture 7 (case-sensitive, including the trailing period). The reader is encouraged to experiment with these notebook files. In the printed version of the book, plots use different curve styles (dashed, dotted, etc.) instead of colors.

The book will be useful for students, Ph.D. students, and researchers in the area of physics (and other natural sciences) and mathematics.

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