1.   Introduction
1.1   Symbolic Computation

The terms "Symbolic Computing" or "Computer Algebra" denote the handling of symbols by a computer according to rules which may be prescribed by the user, in particular performing analytic computations; this also includes exact numeric calculations. One of the first of these processors, which is still in use, is REDUCE: But there are forrunners, for example, Schoonship and others.

Present-day programme packages for symbolic computations can accomplish much more. For example:

Analytic Computations
    Exact numeric calculations (for integers and rationals)
    Solving systems of linear equations
    Matrix Calculations
    Substitutions and Eliminations
    Series Expansions
    Manipulations of Series (Addition, Multiplication, Inverse Series,...)
    Summation of finite and infinite sums and products
    Solving algebraic equations
    Solving some transcendental equations
    Differentiation, Integration
    Solving ordinary differential equations
    Solving differential equations with Lie's theory
    Vector algebra   and
    Vector analysis in orthogonal curvilinear coordinates
    Treating symbols (representing e.g. functions or operators)
        according to rules prescribed by the user
    Programmes

Procedures for Numeric Calculations
    Numeric calculations with given (arbitrary) precision
    Eigenvalues and -vectors of matrices
    Solving linear and algebraic equations
    Finding roots of transcendental equations (Newton)
    Numerical Quadrature
    Numerical Integration of Differential Equations
    Programmes for Elementary and Special Functions

Graphics

        Drawing points and curves in 2 and 3 D
        Drawing Surfaces in 3 D
        Statistics (Histograms)
        etc.

1.2   Software & Literature for Symbolic Computations (Computer Algebra)

At universities and professional institutes mainly **Mathematica** und **Maple** are used.

1.2.1 Maple

Alexander Walz : Maple 7 - Rechnen und Programmieren, m. CD-ROM, Oldenbourg, 2002.

Douglas B. Meade, S.J. Michael May, C-K. Cheung, G.E. Keough: Getting Started with Maple. Wiley, 2009

1.2.2 Mathematica
      s. 1.3

1.2.3 Maxima

W. Haager: Computer Algebra mit Maxima: Grundlagen der Anwendung und Programmierung. Carl Hanser Verlag (7. August 2014). ISBN13: 978-3446442030 .

1.2.4 Cheaper Computer Algebra Systeme (CAS)

In schools also the following CAS systems are used: **Derive, Mathcad, MuPAD.**

A free CAS is the **Calculus Calculator**, a Freeware-Programm based on DOS. The enhanced Windows-Version of the Calculus Calculators is called **X(plore)** and is still free.

See the following website (in German) for a discussion ot these systems.
http://www.mathe-werkstatt.de/themen/cas.htm

1.3   Some Literature for Mathematica

Stephen Wolfram: An elementary introduction to the Wolfram Language.
Taschenbuch, 328 Seiten. Wolfram Media, Inc. (14. Jan. 2016).
ISBN-10: 1944183000, ISBN-13: 978-1944183004
See also: Mathematica **Help (s. math2a.nb 2.2.11 Help)**

1.3.1   Introductory Textbooks:

Cliff Hastings, Kelvin Mischo: Hands-on start to Wolfram Mathematica. 469 pages.
Wolfram Media, Inc. (15, Sept. 2015). **ISBN-13:** 978-1579550776 .

Wade Ellis, Jr. and Ed Lodi: A Tutorial Introduction to Mathematica.
(Brooks/Cole, 1991) , ISBN 0-534-15588-X (paperback/92 pages) .

Alex Kilian: Programmieren mit Wolfram Mathematica. [Taschenbuch]
Springer, Berlin; Auflage: 1 (Oktober 2009).
ISBN-13: 978-3642046711

Martha L. Abell and James P. Braselton: Mathematica by Example, Rev. Ed.
(AP Professional, 1994), ISBN 0-12-041530-5 (paperback/523 pages)

M.L. Abell, J. Braselton: The Mathematica Handbook, Academic Press 1992.

Hans-Gert Gräbe, Michael Kofler:
 Mathematica 6: Einführung, Grundlagen, Beispiele (Bafög-Ausgabe)
Peason Studium; Auflage: 5. Aktual. (12. Dezember 2008)

M. Kofler: Mathemtica, Einführung und Leitfaden für den Praktiker.
Addison/Wesley 1992.

Schaum's Outline of Mathematica [Taschenbuch]
Mcgraw Hill Book Co; Auflage: 0002 (1. Juni 2009)

1.3.2   Graphics Books:

Oliver Gloor, Beatrice Amrhein, and Roman E. Maeder: Illustrated Mathematics:
Visualization of Mathematical Objects with Mathematica.
(TELOS/Springer-Verlag, 1995, SBN 0-387-14222-3 (CD-ROM with booklet)

Cameron Smith and Nancy Blachman: The Mathematica Graphics Guidebook.
Addison-Wesley, 1995.

Tom Wickham-Jones: Mathematica Graphics: Techniques & Applications.
(TELOS/Springer-Verlag, 1994)

M. Trott: The Mathematica Guidebook: Graphics. Springer, 2004.

1.3.3   Programming with Mathematica

R. E. Maeder: Programming in Mathematica , Addison-Wesley Pub Co, 1996.
M. Trott: The Mathmatica Guide Book for Programming. Springer, 2004.
P. Wellin: Programming with Mathematica. An Introduction. Cambridge University Press, 20013

1.3.4   Theoretical Physics and Mathematica

Peter Collier: A most incomprehensible thing: Notes toward a very gentle introduction to the
mathematics of relativity.
Taschenbuch, 340 Seiten. Incomprehensible books (2. Ed., 30. Juni 2014).
ISBN-10: 09577389450, ISBN-13: 978-09577389458.

Gerd Baumann: Mathematica in Theoretical Physics: Selected Examples from
Classical Mechanics to Fractals. Springer 1996.
(Mathematica in der Theoretischen Physik, Springer 1993).

James M. Feagin: Quantum Methods with Mathematica. Springer 1994.
(Methoden der Quantenmechanik mit Mathematica, Springer 1995).
J.P. Kuska: Mathematica und C in der modernen Theoretischen Physik mit Schwerpunkt QM.
Springer Verlag, 1997.

Erwin Kreyszig: Advanced Engineering Math 9th edition with Mathematica Computer Manual
9th Edition Set.9 th. Rev.Ed. Wiley & Sons, 2005.

William T. Shaw: Complex Analysis with Mathematica
Cambridge University Press, 2008. (Mathematica 5)

1.4   Further References for Mathematica

Journals:

The Mathematica Journal 1 (1990) - 6 (1996),   Freeman.
                             7(1997) - 13(2011)   Wolfram Research
http://www.mathematica-journal.com/

Mathematica in Education and Research. 4 (1995), Springer Verlag. Eingestellt.

Internet Newsgroup
http://www.mathematica.ch/

Wolfram's Web-page
HYPERLINK http://www.wri.com/
HYPERLINK http://www.stephenwolfram.com/about-mathematica/
HYPERLINK http://www.wolfram.com/company/mathematica-history.html

1.5 Comparison of various systems for Symbolic Computations

http://www.mathe-werkstatt.de/themen/cas.htm

D. M. Cook, R. Dubisch, Gl. Sowell, P. Tam, D. Donelly, A comparison of several symbol-manipulating programs.
Part I: Computers in Physics, 6, 411-420 (1992); Part II: ibid.530-540.

J.Fitch, Mathematics goes automatic. Physics World, June 1993,

D. Harper, Ch. Wooff, D. Hodgkinson, A Guide to Computer Algebra
Systems. Wiley 1991.

I.H. Cohen, J.P.Fitch, Uses made of computer algebra in physics.
J. Symbolic Computation 11, 291-305 (1991)

St. M. Christensen: Resources for Computer Algebra.
Computers in Physics, 8, 308-316 (1994)

U. Schwardmann: Computer-Algebra. Programme für Mathematik mit dem Computer. Addison-Wesley 1995

J.H.Davenport, Y.Siret, E. Tournier, Computer Algebra, Systems and
Algorithms for Algebraic Computations. 2 nd ed., Academic Press 1993
(More suited for computer scientists and mathematicians than for users.)