Arbeitsumgebungen

Man kann Mathematiksoftware auf unterschiedliche Weise nutzen:

- interaktiv (textorientiert, graphisch),
- Bibliotheksfunktionen für eigene Programme (z. B. C oder FORTRAN),
- Programmierung innerhalb eines Matheprogramms.

Anwendungsbereiche

Die meisten mathematischen Softwarepakete kann man in folgende Kategorien einteilen:

- Computeralgebra für symbolische Umformungen
- Programme für numerische Berechnungen

und evtl. externe Programme zu Ein- und Ausgabezwecken.

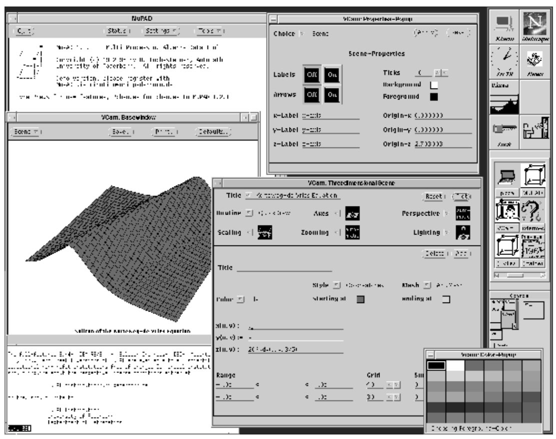
Programmpakete

Es gibt eine große Auswahl von Mathepaketen (viele davon frei verfügbar) für Linux:

- MuPAD
- Reduce
- Maple
- Mathematica
- Macsyma
- Matlab
- Octave
- Pari
- Singular
- GMP
- Lisp-Stat
- GAP

MuPAD

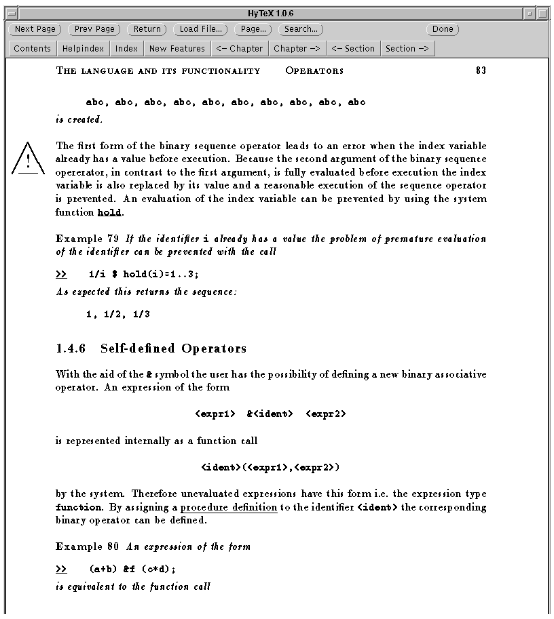
Das “Multi Processing Algebra Data Tool” (MuPAD) ist ein universelles Algebrawerkzeug, das mit einer vollständigen Arbeitsumgebung ausgerüstet ist:



MuPAD - Beispiel

```
  *----*     MuPAD 1.2.2 -- Multi Processing Algebra Data Tool
 /|   /|
*----* |     Copyright (c) 1992-95 by B. Fuchssteiner, Automath
| *--|-*     University of Paderborn.  All rights reserved.
|/   |/
*----*       Demo version, please register with
             MuPAD-distribution@uni-paderborn.de

>> int(exp(-x)*sin(x)*cos(x),x);

                              cos(2 x)   sin(2 x)
                            - -------- - ---------
                              5 exp(x)   10 exp(x)


>> solve(x^4+a*x^2+1=0,x);

--  1/2          2     1/2 1/2     1/2          2     1/2 1/2
|  2    (- a + (a  - 4)   )       2    (- a + (a  - 4)   )
|  --------------------------, - --------------------------,
--             2                            2

    1/2          2     1/2 1/2     1/2          2     1/2 1/2 --
   2    (- a - (a  - 4)   )       2    (- a - (a  - 4)   )     |
   --------------------------, - --------------------------    |
               2                            2                 --
```


MuPAD - Hypertext-Hilfe



THE LANGUAGE AND ITS FUNCTIONALITY OPERATORS 83

```
abc, abc, abc, abc, abc, abc, abc, abc, abc, abc
```

is created.

The first form of the binary sequence operator leads to an error when the index variable already has a value before execution. Because the second argument of the binary sequence opererator, in contrast to the first argument, is fully evaluated before execution the index variable is also replaced by its value and a reasonable execution of the sequence operator is prevented. An evaluation of the index variable can be prevented by using the system function **hold**.

Example 79 *If the identifier* i *already has a value the problem of premature evaluation of the identifier can be prevented with the call*

```
>>    1/i $ hold(i)=1..3;
```

As expected this returns the sequence:

```
1, 1/2, 1/3
```

1.4.6 Self-defined Operators

With the aid of the & symbol the user has the possibility of defining a new binary associative operator. An expression of the form

```
<expr1>  &<ident>  <expr2>
```

is represented internally as a function call

```
<ident>(<expr1>,<expr2>)
```

by the system. Therefore unevaluated expressions have this form i.e. the expression type **function**. By assigning a procedure definition to the identifier **<ident>** the corresponding binary operator can be defined.

Example 80 *An expression of the form*

```
>>    (a+b) &f (c*d);
```

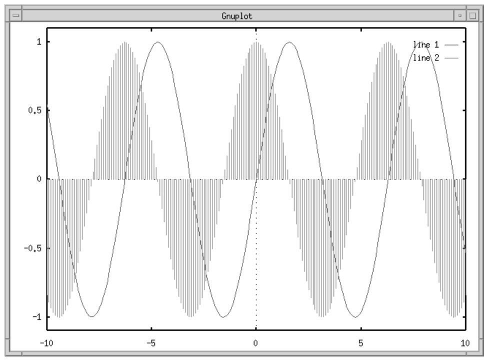
is equivalent to the function call

Octave - Beispielgrafik

High-Level-Sprache für numerische Berechnungen.

Ocatve ruft Gnuplot auf, um Graphen anzuzeigen.

```
Octave, version 0.71.1.  Copyright (C) 1992, 1993, John W. Eaton.
This is free software with ABSOLUTELY NO WARRANTY.
For details, type 'warranty'.

octave:1> x = (-10:0.1:10)';
octave:2> data = [x, sin(x), cos(x)];
octave:3> gplot [-10:10] [-1.1:1.1] data with lines, data using 1:3 with
                                                                 impulses
```



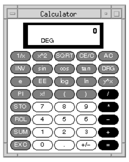
Octave - Beispiel

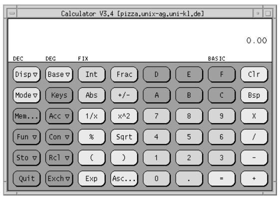
```
octave:44> for i = 1:5
> for j = 1:5
> a(i,j)= 10*i+j;
> endfor
> endfor
octave:45> a
a =

 11 12 13 14 15
 21 22 23 24 25
 31 32 33 34 35
 41 42 43 44 45
 51 52 53 54 55

octave:46> a .^ 2
ans =

 121 144 169 196 225
 441 484 529 576 625
 961 1024 1089 1156 1225
 1681 1764 1849 1936 2025
 2601 2704 2809 2916 3025

octave:47> a ^ 2
ans =

 2115 2180 2245 2310 2375
 3665 3780 3895 4010 4125
 5215 5380 5545 5710 5875
 6765 6980 7195 7410 7625
 8315 8580 8845 9110 9375
```

Rechenhilfen

Graphische Taschenrechner:

- xcalc
- calctool





Textbasierte Taschenrechner beliebiger Genauigkeit:

- dc (Umgekehrte Polnische Notation)
- bc

Übernahme in eigene Programme

Viele Programme bieten die Möglichkeit, ihre Funktionalität in eigene Programme aufzunehmen:

- Ausgabe von Sourcecode (C, Pascal, FORTRAN),
- Bibliotheksfunktion zum Dazulinken

Hilfsprogramme

- Editor (Emacs)
- Funktionsplotter (Gnuplot)
- Text- und Formelsatz (LaTeX)

weitere Informationen

MuPAD: `http://math-www.uni-paderborn.de/MuPAD/`

Linux: `http://lusk1.mines.edu/hjjou/linux_prg.html`

Unix: `ftp://www.mathematik.uni-kl.de/pub/Math/Singular/CAS/`

`http://www.zib-berlin.de/Symbolik/`

`http://mthwww.uwc.edu/wwwmahes/files/math01.htm`