Werkzeuge zur Behandlung von linearen Gleichungssystemen

	Bibliotheken	Abgeschlossene Programme
symbolisch	muParser (C++, C#)	Maple Mathematica MuPad ...
numerisch	IMSL NAG LAPACK / BLAS LINPACK Numerical Recipes matplotlib (Python) ...	Matlab Scilab Octave ...

Matlab

Mit Hilfe von Matlab können viele Analysemethoden einfach angewandt werden. Matlab basiert auf effizienten Berechnungsmethoden der linearen Algebra.

```
A = [ 1 2 4; 2 13 23; 4 23 77 ]
b = [ 3 -4 5 ]'
A * b
A \ b
inv(A)
inv(A) * b
L = chol(A)'
[ L, U ] = lu(A)
L * U
[ Q, R ] = qr(A)
Q * R
pinv([ 1 2 4 7; 2 13 23 30; 4 23 77 100 ])
pinv([ 1 2 4; 2 13 23; 4 23 77; 8 33 140 ])
```

Maple

Maple ermöglicht das symbolische Rechnen mit dem Computer.

```
with(linalg);
A := matrix(3, 3, [ [ 1, 2, 4 ], [ 2, 13, 23 ], [ 4, 23, 77 ] ]);
b := vector(3, [ 3, -4, 5 ]);
inverse(A);
multiply(inverse(A), b);
linsolve(A, b);
A := matrix(3, 3, [ [ a11, a21, a31 ], [ a12, a22, a32 ],
                    [ a13, a23, a33 ] ]);
b := vector(3, [ b1, b2, b3 ]);
inverse(A);
multiply(inverse(A), b);
linsolve(A, b);
```

LAPACK/BLAS:

Die numerische Bibliothek LAPACK stellt eine umfassende Sammlung hochentwickelter Numerik–Unterprogramme für die Analyse linearer Probleme dar. Sie greift für die Elementarrechnungen auf die maschinenabhängig optimierte Bibliothek BLAS zurück.

```
NAME
      DGETRF  -  compute an LU factorization of a general M-by-N
      matrix A using partial pivoting with row interchanges
SYNOPSIS
      SUBROUTINE DGETRF( M, N, A, LDA, IPIV, INFO )
      INTEGER           INFO, LDA, M, N
      INTEGER           IPIV( * )
      DOUBLE PRECISION A( LDA, * )
PURPOSE
      DGETRF computes an LU factorization of a general M-by-N
      matrix A using partial pivoting with row interchanges.
      The factorization has the form
          A = P * L * U
      where P is a permutation matrix, L is lower triangular
      with unit diagonal elements (lower trapezoidal if m > n),
      and U is upper triangular (upper trapezoidal if m < n).
      This is the right-looking Level 3 BLAS version of the algorithm.
ARGUMENTS
      M       (input) INTEGER
               The number of rows of the matrix A.  M >= 0.
      N       (input) INTEGER
               The number of columns of the matrix A.  N >= 0.
      A       (input/output) DOUBLE PRECISION array, dimension (LDA,N)
               On entry, the M-by-N matrix to be factored. On
               exit, the factors L and U from the factorization
               A = P*L*U; the unit diagonal elements of L are not stored.
      LDA     (input) INTEGER
               The leading dimension of the array A.  LDA >= max(1,M).
      IPIV    (output) INTEGER array, dimension (min(M,N))
               The pivot indices; for 1 <= i <= min(M,N), row i
               of the matrix was interchanged with row IPIV(i).
      INFO    (output) INTEGER
               = 0:  successful exit
               < 0:  if INFO = -i, the i-th argument had an illegal value
               > 0:  if INFO = i, U(i,i) is exactly zero. The
               factorization has been completed, but the factor U
               is exactly singular, and division by zero will
               occur if it is used to solve a system of equations.
NAME
      DGETRS  - solve a system of linear equations  A * X = B or
      A' * X = B with a general N-by-N matrix  A  using the  LU
      factorization computed by DGETRF
SYNOPSIS
      SUBROUTINE DGETRS( TRANS,  N,  NRHS, A, LDA, IPIV, B, LDB, INFO )
      CHARACTER         TRANS
      INTEGER           INFO, LDA, LDB, N, NRHS
      INTEGER           IPIV( * )
      DOUBLE            PRECISION A( LDA, * ), B( LDB, * )
```

Informationsbeschaffung zur Numerischen Mathematik im Internet:

Diskussionsforen in News–Gruppen:

`news://news.uni-stuttgart.de/sci.math.num-analysis`

Software–Bibliotheken im Internet:

`http://www.netlib.no/`
`http://www.netlib.org/`