



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. $M \geq 0$.

N (input) INTEGER
The number of columns of the matrix A. $N \geq 0$.

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. $LDA \geq \max(1, M)$.

IPIV (output) INTEGER array, dimension (min(M,N))
The pivot indices; for $1 \leq i \leq \min(M, N)$, 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/`