Numerical libraries

+ Save time, sweat and tears
+ Well tested and reliable subroutines
+ Optimized for efficiency
- Not always suitable for the own task
- Commercial libraries: source code not available, cannot be modified nor ported to another environment

BLAS, Lapack: free, source code available, freely distributable

Nag, IMSL: commercial, available for many different platforms. Quite expensive, often an annual license fee.

Hardware manufacturers often have libraries tuned for their machines.

Netlib (`www.netlib.org`): lots of free libraries for different fields.

CSC has a lot of libraries and programs. See the web pages (`www.csc.fi`) for more links.

Free libraries

BLAS (Basic lineara algebra subprograms)

Simple vector and matrix operations:

- BLAS 1: scalar product, vector norm, generalized addition (SAXPY, $y = ax + b$).
- BLAS 2: product of a matrix and a vector, solution of a set equations when the coefficient matrix is upper or lower triangular.
- ¿BLAS 3: matrix products

Lapack

- set of linear equations
- eigenvalues of a matrix
- linear least squares solution
- various decompositions

Routines for real and complex-valued matrices

Commercial libraries

IMSL (`www.vni.com`)

Over a thousand routines.

- BLAS
- interpolation
- solution of nonlinear equations
- integration
- solution of differential equations
- optimization
- special functions
- statistical tests
- analysis of variances
- time series
- factorial analysis
- probability distributions

Nag (`www.nag.co.uk`)

Even bigger than IMSL.

Includes example programs how to use each of the routines.