Fortran 90 vs Fortran 77

Statement functions

Fortran 77 or Fortran 90 has statement functions, which defines a simple function in several lines, so that you can use that function in that program unit without defining an outside function or subroutine. For example,

```
! Sample program with statement functions
   implicit real*8(a-h,o-z)
! f(x) is a statement function.
   f(x) = exp(-x**3)/sin(x) + cos(x) - sqrt(x)
          .
          .
          .

   y = f(3.5) ! Invocation of the statement function f
```

Comments in Fortran 90

In a line anything that appears to the right of ! character are comments.

```
! The whole line is a comment.
! Written by Sangback Ma, 2009, Feb. 28.
    x = 1.5  ! Initialize x to be 1.5
```

Continuation and Starting Column

Fortran 77 starts in 7th column and continued lines have a character in the 6th column. Fortran 90 is a free format language, so you can

start at any column. If you want to have lines continued just append & character to the previous line.

For example,

```
y = cos(x)/exp(x) -.............. x**3 &
   - log(abs(x))
```

New Features of Fortran 90 vs Fortran 77

- **Dynamic Array** Fortran 99 supports Dynamic array allocation ,like C(eg, malloc command), while Fortran 77 does not.
- **Recursion** Fortran 90 supports recursion ,like c, while Fortran 77 does not.
- **Pointer** Fortran 90 supports Pointers as in C, while Fortran 77 does not.

Fortran vs C Language

	Fortran	C
Variable Declaration	Can be Implicit	Must be Explicit
Array	Column Major	Row Major
Goto Statement	Heavily Used	Rarely Used
Parameter Passing	Call by Reference	Both Call by Reference and Value
Case Sensitivity	Insensitive	Sensitive
Character Handling	Not so Powerful	Powerful

Table 1: Major Differences between Fortran 90 vs C Language

⇒ **However, current existing scientific routines are mainly written in Fortran !!!**

Fortran has a vast repository of subroutine and functions which are public on the internet. www.net.lib.org is one of such repository. Mainly written Fortran77.

The following is the contents of netlib.

```
Netlib Master Index


lib ../a
for algorithms for numerical approximation
editor Eric Grosse
master ornl.gov


lib ../access
for netlib access tools, such as unshar
editor Eric Grosse
master ornl.gov


lib ../aicm
for selected material from Advances in Computational Mathematics
# journal published by Baltzer
master ornl.gov


lib ../alliant
for programs collected from Alliant users
editor Jack Dongarra
master ornl.gov


lib ../amos
for Bessel functions of complex argument and nonnegative order
```

, The Bessel functions H1, H2, I, J, K, and Y, as well as the
, Airy functions Ai, Bi, and their derivatives are provided.
, Exponential scaling and sequence generation are optional.
by D.E. Amos
ref ACM TOMS 12 (1986) 265-273 algorithm 644
master ornl.gov

lib ../ampl
for linear and nonlinear programming.
editor David Gay
master ornl.gov

lib ../anl-reports
for Reports from the MCS division at Argonne
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov

lib ../apollo
for programs collected from Apollo users.
editor Jack Dongarra
master ornl.gov

lib   ../arpack
for   large-scale eigenvalue problems
master ornl.gov

lib ../atlas
for Autmatically Tuned Linear Algebra Subroutines
by Clint Whaley
master ornl.gov

```
contact atlas@cs.utk.edu

lib ../benchmark
for contains benchmark programs and the table of Linpack timings.
editor Jack Dongarra
master ornl.gov


lib ../bib
for bibliographies:  Golub and Van Loan, 2nd ed.
editor Eric Grosse
master ornl.gov


lib ../bibnet
for BibNet -- Netlib Bibliography Project
# This initiative is a step toward sharing information electronica
# and it will allow scientists to:
#   - provide complete and updated information on their own work,
#   - have an efficient pointer to publications and ongoing resear
#   - simplify the work of preparing publications.
editor Stefano Foresti, Nelson H. F. Beebe, Eric Grosse
master ornl.gov


lib ../bihar
for biharmonic equation in rectangular geometry and polar coordina
by Petter Bjorstad
master nac.no


lib ../blacs
for Basic Linear Algebra Communication Subprograms
editor Clint Whaley <rwhaley@cs.utk.edu>
```

```
contact blacs@cs.utk.edu
master ornl.gov


lib ../blas
for blas (level 1, 2 and 3) and machine constants
rel excellent
age stable
editor Jack Dongarra
master ornl.gov


lib ../blast
for Communications of the BLAST mailing lists
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov

lib ../bmp
for Brent's multiple precision package
master ornl.gov


lib ../c++
for miscellaneous codes in C++
editor Eric Grosse
master ornl.gov


lib ../c
for miscellaneous codes written in C
# Not all C software is in this "miscellaneous" library.
# If it clearly fits into domain specific library, it is assigned
# The principal contents at present is the c/meschach subdirectory
# by David Stewart covering linear algebra and utilities.  See
```

```
# c/index for details.
editor Eric Grosse
master ornl.gov


lib ../cephes
for special functions and IEEE floating point arithmetic
by Stephen L. Moshier <moshier@na-net.ornl.gov>
lang C
master ornl.gov


lib ../chammp
for DOE Computer Hardware, Advanced Mathematics and Model Physics
editor Jack Dongarra
master ornl.gov


lib ../cheney-kincaid
by Ward Cheney & David Kincaid
ref Numerical Mathematics and Computing, 2nd ed., 1985.
master ornl.gov


lib ../clapack
for C version of LAPACK
by J. Demmel and Xiaoye Li
rel pre-release
lang C
master ornl.gov


lib ../commercial
for advertising material for commercial math software
```

```
editor ehg@research.bell-labs.com
master ornl.gov


lib     ../confdb
for     conferences database
editor  Shirley Browne <browne@cs.utk.edu>
contact conferences@cs.utk.edu
master  ornl.gov


lib ../conformal
for the "parameter problem" associated with conformal mapping
editor Eric Grosse
master ornl.gov


lib ../contin
for continuation and limit points
editor Eric Grosse
master ornl.gov


lib ../control
for generation of examples of continuous-time algebraic Riccati eq
by Benner, Laub, and Mehrmann
prec double
lang fortran
gams D8, F2, G3, G4a
master ornl.gov

lib ../crc
for checksums for netlib files
editor Eric Grosse
```

```
master ornl.gov


lib ../cumulvs
for CUMULVS is an infrastructure library that allows a programmer
,       easily extract data from a running parallel simulation and
,       data to a visualization package.  CUMULVS includes the cap
,       steer user-defined parameters in a distributed simulation.
master ornl.gov
contact cumulvs@msr.epm.ornl.gov


lib ../ddsv
for "Linear Algebra Computations on Vector and Parallel Computers"
by Jack Dongarra, Iain Duff, Danny Sorensen, and Henk Van der Vors
master ornl.gov


lib ../dierckx
for spline fitting routines for various kinds of data and geometri
by Paul Dierckx <Paul.Dierckx@cs.kuleuven.ac.be>
# Comp Sci, K. U. Leuven, Celestijnenlaan 200A, B-3001 Heverlee, B
# also called fitpack, but no connection with Alan Cline's library
master ornl.gov


lib ../diffpack
# removed;  Diffpack is now a commercial package
by www.nobjects.com
master ornl.gov


lib ../domino
for multiple tasks to communicate and schedule local tasks for exe
```

```
, These tasks may be on a single processor or spread among multipl
, processors connected by a message-passing network.
by O'Leary, Stewart, Van de Geijn, University of Maryland
lang C, assembler
master ornl.gov


lib ../eispack
for eigenvalues and eigenvectors
, A collection of Fortran subroutines that compute the eigenvalues
, and eigenvectors of nine classes of matrices.  The package can
, determine the eigensystems of complex general, complex Hermitian
, real general, real symmetric, real symmetric band, real symmetri
, tridiagonal, special real tridiagonal, generalized real, and
, generalized real symmetric matrices. In addition, there are two
, routines which use the singular value decomposition to solve
, certain least squares problems.
by NATS Project at Argonne National Laboratory <dongarra@cs.utk.ed
prec double
see seispack
rel excellent
age stable
ref B.T. Smith, J.M. Boyle, J.J. Dongarra, B.S. Garbow, Y. Ikebe,
, V.C. Klema, and C.B. Moler.  Matrix Eigensystem Routines -
, EISPACK Guide, volume 6 of Lecture Notes in Computer Science,
, Springer-Verlag, Berlin, 1976.
,
, B.S. Garbow, J.M. Boyle, J.J. Dongarra, and C.B. Moler.
, Matrix Eigensystem Routines - EISPACK Guide Extension, volume 51
, Lecture Notes in Computer Science, Springer-Verlag, Berlin, 1977
master ornl.gov


lib ../elefunt
```

```
for testing elementary function programs provided with Fortran com
ref Software Manual for the  Elementary Functions, Prentice Hall,
by W. J. Cody and W. Waite
master ornl.gov


lib ../env
for integrated problem solving environments
editor Eric Grosse <ehg@research.bell-labs.com>
master ornl.gov


lib       ../etemplates
for       Electronic templates
master    ornl.gov

lib ../f2c
for converting Fortran to C
by Feldman, Gay, Maimone, and Schryer
editor David Gay
master ornl.gov
gams s1


lib ../fdlibm
for C math library for machines that support IEEE 754 floating-poi
by Kwok C Ng <kwok.ng@sun.com>
# Version: 5.3
# Maintained-hy: fdlibm-comments@sun.com
# Platforms: Require ANSI C compiler with IEEE 754 style arithmeti
# Copying-Policy: Freely Redistributable
# Keywords: libm,exp,log,sin,cos,floating-point,IEEE754
master ornl.gov
```

```
lib ../fftpack
for Fast Fourier Transform of periodic and other symmetric sequenc
# This package consists of programs which perform Fast Fourier
# Transforms for both complex and real periodic sequences and
# certain other symmetric sequences.
by Paul Swarztrauber, NCAR.
see double precision version in bihar
rel excellent
age stable
master ornl.gov


lib ../fishpack
for finite differences for elliptic boundary value problems.
by Paul Swarztrauber and Roland Sweet.
# CRAYFISHPAK is an expanded version of FISHPAK that has been tota
# rewritten for vector computers, on which order of magnitude spee
# have been commonly observed.  For more information, see
#  http://www.greenmtn.com/software
rel excellent
age stable
master ornl.gov


lib ../fitpack
for splines under tension.  (an early version)
by Alan K. Cline
# For a current copy and for other routines, contact:
# Pleasant Valley Software, 8603 Altus Cove, Austin TX 78759, USA
master ornl.gov


lib ../floppy
```

```
for fortan code syntax and flow control checker
master ornl.gov


lib ../fmm
ref Computer Methods for Mathematical Computations
by George Forsythe, Mike Malcolm, and Cleve Moler.
prec double
see sfmm
master ornl.gov


lib ../fn
for special functions
by Wayne Fullerton
master ornl.gov


lib ../fortran-m
for small set of extensions to f77 that supports modular message-p
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov


lib ../fortran
for tools specific to Fortran:  a single/double converter; static
master ornl.gov


lib ../fp
for floating point arithmetic
editor David Gay
master ornl.gov
```

```
lib ../gcv
for Generalized Cross Validation spline smoothing
editor Eric Grosse
master ornl.gov


lib ../gmat
for multi-processing Time Line and State Graph tools.
by Mark Seager (LLNL Oct 8, 1987)
master ornl.gov
contact werner@ramius.llnl.gov (Nancy Werner) 26 Oct 90


lib ../gnu
for utilities useful to netlib clients, covered by GNU public lice
editor David Gay
master ornl.gov


lib ../go
for Golden Oldies:  widely used,  but not in standard libraries.
# Nominations welcome!
rel excellent
age old
editor Eric Grosse
master ornl.gov


lib ../graphics
for scientific visualization
editor Eric Grosse
master ornl.gov
```

```
lib ../harwell
for sparse unsymmetric matrix routine MA28 from the Harwell librar
editor Iain Duff
master ornl.gov


lib ../hence
for Heterogenous Network Computing Environment, a visual parallel
, programming environment
keywords visual,parallel,computation,graph,PVM,Heterogeneous
editor Peter Newton <newton@cs.utk.edu>
contact hence@cs.utk.edu
master ornl.gov


lib ../hompack
for solving nonlinear systems of equations by homotopy methods
# fixed point, zero finding, and general homotopy curve tracking p
# utilizing both dense and sparse Jacobian matrices;
# ODE-based, normal flow, and augmented Jacobian.
by Layne T. Watson  ltw@vtopus.cs.vt.edu  (703) 231-7540
# Department of Computer Science, VPI & SU, Blacksburg, VA 24061
master ornl.gov


lib     ../hpf
for     HPF language specifications
by      High Performance Fortran Forum
master  ornl.gov

lib ../hypercube
master ornl.gov
editor Jack Dongarra <dongarra@cs.utk.edu>
```

```
lib ../ieeecss
for IEEE / Control Systems Society
# sqred, Van Loan's "square reduced" algorithm.
# Systems and Control Analysis and Design Environment by J. D. Bir
editor Jack Dongarra
master ornl.gov


lib ../ijsa
for International Journal of Supercomputer Applications
editor Jack Dongarra
master ornl.gov


lib ../image
for image processing
editor Eric Grosse
master ornl.gov
see popi, a/blur


lib ../intercom
for Interprocessor Collective Communications (InterCom) Library
by Mike Barnett, David Payne, Satya Gupta, Lance Shuler,
, Robert van de Geijn, and Jerrell Watts
contact intercom@cs.utexas.edu
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov


lib ../itpack
for Iterative Linear System Solvers
```

```
# Jacobi method, SOR, SSOR with conjugate gradient acceleration
# or with Chebyshev (semi-iteration - SI) acceleration.
by Young and Kincaid and the group at U of Texas.
# kincaid@cs.utexas.edu oppe@scri1.scri.fsu.edu joubert@cs.utexas.
# Center for Numerical Analysis; (512) 471-1242
# RLM Bldg. 13.150; University of Texas at Austin; Austin TX 78713
editor Bill Coughran
master ornl.gov


lib ../jakef
for automatic differentiation
, a precompiler that analyses a given Fortran77 source code for
, the evaluation of a scalar or vector function and then generates
, expanded Fortran subroutine that simultaneously evaluates the gr
, or Jacobian respectively. For scalar functions the ratio between
, run-time of the resulting gradient routine and that of the origi
, evaluation routine is never greater than a fixed bound of about
, The storage requirement may be considerable as it is also propor
, to the run-time of the original routine. Since no differencing i
, the partial derivative values obtained are exact up to round-off
by A. Griewank, Argonne National Laboratory <griewank@mcs.anl.gov>
master ornl.gov


lib ../java
for miscellaneous codes written in java
, Not all java software is in this "miscellaneous" library.
, If it clearly fits into a domain specific library then it is
, assigned there instead.
editor Jeremy Millar (millar@cs.utk.edu)
master ornl.gov

lib ../kincaid-cheney
```

```
by Ward Cheney & David Kincaid
ref Numerical Analysis: The Mathematics of Scientific Computing, 1
master ornl.gov


lib ../la-net
for SIAG/LA news and conference arrangements
editor John Gilbert <gilbert@parc.xerox.com>
master ornl.gov


lib ../lanczos
for a few eigenvalues/eigenvectors of a large (sparse) symmetric m
# real symmetric and  Hermitian matrices
# singular values and vectors of real, rectangular matrices
by Jane Cullum and Ralph A. Willoughby, IBM Yorktown  914-945-1589
ref Lanczos Algorithms for Large Symmetric Eigenvalue Computations
# Additional codes, for factored inverses, real symmetric generali
# problems, complex symmetric problems and real symmetric block co
# are available from the authors.
master ornl.gov
see go/underwood.f


lib ../lanz
for Large Sparse Symmetric Generalized Eigenproblem
by Mark T. Jones and Merrell L. Patrick
master ornl.gov
see go/underwood.f
gams d4b1


lib ../lapack++
for the c++ version of lapack (see www.netlib.org/lapack/)
```

```
rel excellent
age research
ref LAPACK Users' Guide, May 1992, available from SIAM;
, 3600 University City Science Center;
, Philadelphia, PA 19104-2688; 215-382-9800, FAX 215-386-7999;
, service@siam.org
master ornl.gov
contact lapack@cs.utk.edu

lib ../lapack
for the most common problems in numerical linear algebra
, linear equations, linear least squares problems, eigenvalue prob
, and singular value problems. It has been designed to be efficien
, on a wide range of modern high-performance computers.
by Ed Anderson, Z. Bai, Chris Bischof, Jim Demmel, Jack Dongarra,
, Jeremy Du Croz, Anne Greenbaum, Sven Hammarling,  Alan McKenney,
, Susan Ostrouchov, and Danny Sorensen <lapack@cs.utk.edu>
rel excellent
age research
ref LAPACK Users' Guide, May 1992, available from SIAM;
, 3600 University City Science Center;
, Philadelphia, PA 19104-2688; 215-382-9800, FAX 215-386-7999;
, service@siam.org
master ornl.gov
contact lapack@cs.utk.edu


lib     ../lapack3e
for     update to lapack v3.0 enhanced with features of fortran 90
editor  Ed Anderson
contact lapack@cs.utk.edu
master  ornl.gov
```

```
lib ../lapack90
for Fortran90 interface for LAPACK
by J. J. Dongarra, J. Du Croz, S. Hammarling, J. Wasniewski,
, A. Zemla <lapack@cs.utk.edu>
age experimental
ref LAPACK Working Note 101:  A Proposal for a Fortran 90 Interfac
, for LAPACK (http://www.netlib.org/lapack/lawns/lawn101.ps)
master ornl.gov
contact lapack@cs.utk.edu

lib ../laso
for a few eigenvalues/eigenvectors of a large (sparse) symmetric m
alg Lanczos
by David Scott
master ornl.gov
see go/underwood.f


lib ../lawson-hanson
for least squares
by C. Lawson and R. Hanson
ref "Solving Least Squares Problems," SIAM Publications
lang Fortran77, Fortran90
master ornl.gov


lib ../linalg
for various functions complementing the bigger linear algebra libr
editor Jack Dongarra
master ornl.gov


lib ../linpack
for linear  equations and linear least squares problems
```

```
, linear systems whose matrices are general, banded, symmetric
, indefinite, symmetric positive definite, triangular, and tridiag
, square.  In addition, the package computes the QR and singular v
, decompositions of rectangular matrices and applies them to least
, squares problems.
by Jack Dongarra <dongarra@cs.utk.edu>,
, Jim Bunch, Cleve Moler and Pete Stewart.
rel excellent
age stable
ref J. Bunch, J. Dongarra, C. Moler, and G.W. Stewart.  LINPACK Us
, Guide.  SIAM, Philadelphia, PA, 1979.
master ornl.gov


lib ../list
for various databases searched by netlib's "find" and "who is" com
# By default, "find" searches a large collection of one-line descr
# of netlib items.  You can also search in some proprietary librar
# by sending a request of the form
#    find bessel from imsl nag port.
# Of course, you can't get the actual source code from netlib!
# By default, "whois" searches the SIAM Membership List and the "n
# files.  Use the form
#    whois Ed Block.


lib ../lp
for linear programming test problems
editor David Gay
master ornl.gov


lib  ../lyapack
for  Riccati and Lyapunov eqations, optimal control
```

```
lib ../machines
for information on high performance computers
editor Jack Dongarra
master ornl.gov


lib ../magic
for finding matrices for implication connectives
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov


lib ../maspar
for MasPar-specific libraries and tools
editor Petter Bjorstad
master nac.no


lib     ../math77/
for     MATH77 and mathc90
editor  Fred Krogh
master  ornl.gov


lib ../mds
for multidimensional scaling
editor kruskal@research.bell-labs.com
master ornl.gov


lib ../microscope
for looking closely at functions
# Given an  interpolation or  approximation  scheme, it
```

```
# allows the following questions, among others, to   be answered:
# Does the  scheme  interpolate?    How  often is  it
# differentiable?    What functions does it reproduce exactly?  If
# the scheme is polynomial, what is its polynomial degree?  Where
# is the smoothness of a function reduced?  Where are the bugs in
# a FORTRAN implementation?
by Peter Alfeld and Bill Harris, Dept. Math., University of Utah
# 801-581-6842 or 801-581-6851
master ornl.gov


lib ../minpack
for nonlinear equations and nonlinear least squares problems.
, Five algorithmic paths each include a core subroutine and an
, easy-to-use driver.  The algorithms proceed either from an analy
, specification of the Jacobian matrix or directly from the proble
, functions.  The paths include facilities for systems of equation
, with a banded Jacobian matrix, for least squares problems with a
, large amount of data, and for checking the consistency of the
, Jacobian matrix with the functions.
by Jorge More', Burt Garbow, and Ken Hillstrom at Argonne National
prec double
see sminpack
master ornl.gov


lib ../misc
for various stuff collected over time
editor Jack Dongarra
master ornl.gov


lib ../mpfun
for multiple precision arithmetic
```

```
by David Bailey <dbailey@nas.nasa.gov>
master ornl.gov


lib ../mpi
for message passing interface draft standard.
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov

lib ../mpicl
for MPICL is a subroutine library for collecting information
on communication and user-defined events in message-passing
parallel programs written in C or FORTRAN.
contact Pat Worley <worley@epm.ornl.gov>

lib     ../na-digest-html
for     html versions of the NA-Digests and a search interface
editor  Cleve Moler (moler@mathworks.com)
master ornl.gov

lib ../na-digest
for archives of the numerical interest mailing group
editor Cleve Moler


lib ../napack
for linear algebra and optimization
# A collection of Fortran subroutines to solve linear systems,
# to estimate the condition number or the norm of a matrix,
# to compute determinants, to multiply a matrix by a vector,
# to invert a matrix, to solve least squares problems, to perform
# unconstrained minimization, to compute eigenvalues, eigenvectors
# the singular value decomposition, or the QR decomposition.
# The package has special routines for general, band, symmetric,
```

```
# indefinite, tridiagonal, upper Hessenberg, and circulant matrice
by Bill Hager
# Mathematics, Univ. Florida, Gainesville, FL 32611, hager@math.uf
ref Applied Numerical Linear Algebra, Prentice-Hall, 1988.
master ornl.gov


lib ../netsolve
for     The motivation behind NetSolve was to devise a fast,
, efficient, easy-to-use system to effectively solve large
, computational problems, regardless of the type of
, computer one happens to be using. Issues such as
, Networking, Heterogeneity, Portability Numerical
, Computing Fault Tolerance Load Balancing are all dealt
, with by the system freeing the user to focus on other
, aspects of the application.  NetSolve has been designed
, to overcome hardware and software restrictions so that
, resources can be available to any user anywhere on the
, network.
editor Dorian Arnold, University of Tennessee
contact netsolve@cs.utk.edu
master ornl.gov


lib ../news
for netlib column for SIAM News
lang LaTeX
by Eric Grosse
master ornl.gov


lib ../numeralgo
for algorithms from the new journal "Numerical Algorithms"
master ornl.gov
```

```
lib ../ode
for initial and boundary value ordinary differential equation solv
# colsys, dverk, rksuite, ode
editor Eric Grosse
master ornl.gov


lib ../odepack
for ODE package (LSODE, LSODES, LSODA, LSODAR, LSODPK, LSODKR, LSO
by Alan Hindmarsh <alanh@llnl.gov> and others
prec single, double
lang Fortran
see sodepack
master ornl.gov


lib ../odrpack
for Orthogonal Distance Regression
by Boggs Byrd Rogers Schnabel
# A portable collection of Fortran subprograms for fitting a model
# data.  It is designed primarily for instances when the independe
# as well as the dependent variables have significant errors,
# implementing a highly efficient algorithm for solving the weight
# orthogonal distance regression problem, i.e., for minimizing the
# sum of the squares of the weighted orthogonal distances between
# each data point and the curve described by the model equation.
master ornl.gov


lib ../opt
for nonlinear optimization and zero-finding
editor David Gay
```

```
master ornl.gov


lib ../p4
for parallel programming system.
# subroutines and macors for writing portable parallel
# programs in Frtran or C for execution on a wide variety of paral
# machines and workstation networks.
by Rusty Lusk, Argonne National Laboratory
contact p4@mcs.anl.gov
master ornl.gov


lib ../paragraph
for graphical display of message-passing multiprocessor architectu
by Jennifer Etheridge and Michael Heath, Oak Ridge National Lab.
master ornl.gov


lib ../paranoia
for exploring the floating point system on your computer.
by Kahan, Berkeley
editor David Gay
master ornl.gov


lib ../parkbench
for parallel benchmark working group
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov


lib ../parmacs
for parallel programmming macros for monitors and send/receive
```

```
by Rusty Lusk, Argonne National Lab (lusk@anl-mcs.arpa)
master ornl.gov


lib ../pascal
for miscellaneous codes written in Pascal
# At present, codes from J.C. Nash, Compact Numerical Methods for
# Computers: Linear Algebra and Function Minimisation, Second Edit
# Adam Hilger: Bristol & American Institute of Physics: New York,
editor Eric Grosse
master ornl.gov


lib ../pdes
for partial differential equation packages
editor Bill Coughran
master ornl.gov


lib ../performance

lib ../photo
for snapshots from numerical analysis conferences (contributions w
editor ehg@research.bell-labs.com
master ornl.gov


lib ../picl
for PICL is a subroutine library that implements a generic
message-passing interface on a variety of multiprocessors.
editor Pat Worley <worley@epm.ornl.gov>
master ornl.gov
```

```
master  ornl.gov

lib ../pltmg
for elliptic partial differential equations in general regions of
# It features adaptive local mesh
# refinement, multigrid iteration, and a pseudo-arclength
# continuation option for parameter dependencies.  The package
# includes an initial mesh generator and several graphics
# packages.
ref PLTMG User's Guide, SIAM publications
by Randy Bank
editor Bill Coughran, Eric Grosse
master ornl.gov


lib ../poly2
for conversion tools for polyhedra library
by Stewart Dickson
master ornl.gov


lib ../polyhedra
for angles, vertex locations, etc of geometric solids
by Andrew Hume
master ornl.gov


lib ../popi
for arbitrary manipulation of digitized images.
ref Chap 5,6 of Beyond Photography--The Digital Darkroom, Prentice
by Gerard J. Holzmann
master ornl.gov
```

```
lib ../port
for public subset of the PORT library
# Includes the latest version of Gay's NL2SOL nonlinear least squa
# The rest of the PORT3 library is available by license from Lucen
editor David Gay
master ornl.gov


lib ../posix
for an experiment sponsored by the IEEE Computer Society
# to make available draft documents, meeting notices, and
# minutes for its POSIX standardization activities.
# Initially, only a very limited subset of working groups
# and documents is provided.
editor Andrew Hume  andrew@netlib.att.com
# (kept only at netlib@netlib.att.com)


lib ../pppack
for splines
by Carl de Boor
ref A Practical Guide to Splines, Springer Verlag.
# Some calling sequences differ slightly from those in the book.
rel excellent
age old
editor Eric Grosse
master ornl.gov


lib ../presto
for an environment for writing object-oriented parallel programs
master ornl.gov
```

```
lib ../problem-set
master ornl.gov

lib ../pvm3
for software and papers on a Parallel Virtual Machine (PVM)
, software for heterogeneous networking parallel processing in
, Fortran or C for execution on a wide variety of parallel
, machines, supercomputers, and workstation networks.
by Beguelin, Dongarra, Geist, Jiang, Manchek, Moore, and Sunderam
editor Jack Dongarra, University of Tennessee and Oak Ridge Nation
contact pvm@msr.epm.ornl.gov
master ornl.gov


lib ../quadpack
for definite univariate integrals
by Piessens,  de Donker,  Kahaner
# (slatec version)
master ornl.gov


lib ../random
for random number generators
editor Eric Grosse
master ornl.gov


lib ../research
for small tools from Computing Science Research, Bell Labs
editor Eric Grosse
master ornl.gov


lib     ../rib
```

```
for     software package for creating WWW metadat repositories
editor  Jeremy Millar
master  ornl.gov


lib ../scalapack
for software for MIMD distributed memory computers for some of the
# lapack routines
editor Jack Dongarra, University of Tennessee and Oak Ridge Nation
master ornl.gov


lib ../sched
for the Schedule package, to aid transportable
# implementation of parallel algorithms in a Fortran setting.
by Jack Dongarra and Dan Sorensen
master ornl.gov


lib ../scilib
, a portable FORTRAN emulation (by M.J. McBride and S.H. Lamson)
, of CRAY SCILIB, a library of scientific applications subprograms
, developed by Cray Research, Inc.
editor Jack Dongarra
contact Scott Lamson <lamson@crd.ge.com>
master ornl.gov


lib ../seispack
for eigenvalues and eigenvectors
, A collection of Fortran subroutines that compute the eigenvalues
, and eigenvectors of nine classes of matrices.  The package can
, determine the eigensystems of complex general, complex Hermitian
, real general, real symmetric, real symmetric band, real symmetri
```

```
, tridiagonal, special real tridiagonal, generalized real, and
, generalized real symmetric matrices. In addition, there are two
, routines which use the singular value decomposition to solve
, certain least squares problems.
by NATS Project at Argonne National Laboratory.
prec single
see eispack
master ornl.gov


lib ../sequent
for software from the Sequent Users Group
editor Jack Dongarra
master ornl.gov


lib ../sfmm
ref Computer Methods for Mathematical Computations
by George Forsythe, Mike Malcolm, and Cleve Moler.
see fmm
prec single
master ornl.gov


lib ../slap
for iterative symmetric and non-symmetric linear system solution
, Sparse Linear Algebra Package.
,   Included in  this package  are  core routines  to   do  Iterat
,   Refinement   iteration,  Preconditioned   Conjugate   Gradi
,   iteration,  Preconditioned Conjugate Gradient   iteration on
,   Normal Equations,  Preconditioned BiConjugate Gradient iterati
,   Preconditioned BiConjugate Gradient  Squared iteration,  Ortho
,   iteration  and  Generalized  Minimum  Residual  iteration.   C
,   routines  require the   user  to supply  "MATVEC"  (Matrix Vec
```

```
,   Multiply) and "MSOLVE" (Preconditiong) routines.
by Mark K. Seager & Anne Greenbaum
editor Jack Dongarra
master ornl.gov


lib ../slatec
for comprehensive software library containing over 1400 general
,  purpose mathematical and statistical routines written in Fortra
editor Tom Rowan
master ornl.gov


lib ../sminpack
for nonlinear equations and nonlinear least squares problems.
, Five algorithmic paths each include a core subroutine and an
, easy-to-use driver.  The algorithms proceed either from an analy
, specification of the Jacobian matrix or directly from the proble
, functions.  The paths include facilities for systems of equation
, with a banded Jacobian matrix, for least squares problems with a
, large amount of data, and for checking the consistency of the
, Jacobian matrix with the functions.
by Jorge More', Burt Garbow, and Ken Hillstrom at Argonne National
prec single
see minpack
master ornl.gov


lib ../sodepack
#  see  /netlib/odepack
master ornl.gov


lib ../sparse-blas
```

```
for sparse extension to Basic Linear Algebra Subprograms.
by Dave Dodson  convex!dodson@a.cs.uiuc.edu
editor Jack Dongarra
master ornl.gov


lib ../sparse
for large sparse systems of linear equations using LU factorizatio
, real and complex square
, Besides being able to solve linear systems,
, it is solves transposed systems, find determinants, multiplies
, a vector by a matrix, and estimate errors due to
, ill-conditioning in the system of equations and instability in
, the computations.  Sparse does not require symmetry
, and is able to perform numerical pivoting (either diagonal or
, complete) to avoid unnecessary error in the solution.
by Ken Kundert, Alberto Sangiovanni-Vincentelli. (sparse@ic.berkel
lang C
editor Jack Dongarra
master ornl.gov


lib ../sparspak
# withdrawn by authors' request
master ornl.gov


lib ../specfun
for special functions and accompanying test programs
by W.J. Cody, Argonne National Laboratory
master ornl.gov


lib ../spin
```

```
for Automated Verification of Concurrent Systems.
ref ‘Design and Validation of Computer Protocols,’ Prentice Hall,
by Gerard J. Holzmann
master ornl.gov


lib ../srwn
for Software Repository Working Notes
editor Jack Dongarra <dongarra@cs.utk.edu>
contact nhse@netlib.org
master ornl.gov


lib ../stoeplitz
for linear systems of Toeplitz or circulant form
, and for orthogonal factorization of column-circulant matrices.
by Burt Garbow at Argonne National Laboratory,
, as a culmination of Soviet-American collaborative effort.
prec single
see toeplitz
master ornl.gov


lib ../stringsearch
for testing string matching algorithms
# This is a library of code, test data and harnesses for
# various kinds of string matching, includeing Boyer-Moore.
by Hume and Sunday   andrew@netlib.bell-labs.com
ref "Fast String Searching", Software-Practice and Experience
master ornl.gov


lib ../svdpack
for singular values and singular vectors of large sparse matrices.
```

```
by Mike Berry, University of Tennessee.
master ornl.gov
contact berry@cs.utk.edu

lib ../templates
for "one-liner" drivers of common numerical algorithms
, Also, codes from Templates book.
master ornl.gov


lib ../tennessee
for Reports from the University of Tennessee
editor Jack Dongarra <dongarra@cs.utk.edu>
master ornl.gov


lib ../textbook
for codes associated with numerical analysis textbooks
editor Eric Grosse
master ornl.gov


lib ../toeplitz
for linear systems of Toeplitz or circulant form
, and for orthogonal factorization of column-circulant matrices.
by Burt Garbow at Argonne National Laboratory,
, as a culmination of Soviet-American collaborative effort.
prec double
see stoeplitz
master ornl.gov


lib ../toms
for Collected Algorithms of the ACM
```

```
ref ACM Transactions on Mathematical Software
master ornl.gov


lib ../tomspdf
for early Collected Algorithms, now at http://portal.acm.org/
seealso toms
master ornl.gov


lib ../transform
for FFT and other digital signal processing tools
editor Eric Grosse <ehg@research.bell-labs.com>
master ornl.gov


lib ../typesetting
for troff and TeX macros
editor Eric Grosse
master ornl.gov


lib ../uncon
for unconstrained optimization
master ornl.gov


lib ../vanhuffel
for total least squares, Partial Singular Value Decomposition
# The TLS problem assumes an overdetermined set of linear equation
# AX = B, where both the data matrix A as well as the observation
# matrix B are inaccurate.
# The subroutine PTLS solves the Total Least Squares (TLS) problem
# using a Partial Singular Value Decomposition (PSVD), hereby impr
```

```
# considerably the computational efficiency with respect to the cl
# cal TLS algorithm.
by Sabine VAN HUFFEL, KU Leuven.
master ornl.gov


lib ../vfftpack
for a vectorized version of fftpack, for multiple sequences.
by Sweet, Lindgren, and Boisvert.
master ornl.gov


lib ../vfnlib
for vectorized evaluation of special functions
alg chebyshev series approximation
by Ron Boisvert and Bonita Saunders
ref ACM Trans Math Softw, vol 18 (1992), no 4, pp 456-469
age research
see fn
master ornl.gov


lib ../voronoi
for Voronoi regions and Delaunay triangulations
editor Eric Grosse
master ornl.gov


lib ../xblas
for Extra Precise Basic Linear Algebra Subroutines
by by Xiaoye Li, Jim Demmel, David Bailey, Yozo Hida, Jimmy Iskand
,       Anil Kapur, Michael Martin, Brandon Thompson, Teresa Tung,
,       Daniel Yoo, with help from Ben Wanzo, Berkat Tung, Weihua
,       Jason Riedy, and Deaglan Halligan - BERKELEY
```

```
ref     Chapters 2 and 4 of the new BLAS Standard,
,       from: http://www.netlib.org/blas/blast-forum/
master ornl.gov
contact extended_blas@cs.berkeley.edu

lib ../xmagic
for X windows front-end to MaGIC
master ornl.gov


lib ../xnetlib
for X Windows netlib file retrieval application
editor Reed Wade <wade@cs.utk.edu>
contact xnetlib@cs.utk.edu
master ornl.gov


lib ../y12m
for sparse linear systems
by Zahari Zlatev, Jerzy Wasniewski and Kjeld Schaumburg
, Comp Sci; Math Inst; Univ Aarhus; Ny Munkegade; DK 8000 Aarhus
ref     Z. Zlatev et.al., Y12M solution of large and sparse system
,       linear algebraic equations, Lecture Notes in Computer Scie
,       Volume 121, Springer, 1981.
master ornl.gov
```

Recursion in Fortran90

Fibonnaci number, F(n) = F(n-1) + F(n-2), F(0) = 0, F(1) = 1.

```
integer fibo

write(*, *) fibo(7)

stop
end

recursive integer function fibo(N) result(FB)

if(n == 0) then
  FB = 0
else if(n == 1) then
  FB = 1
else
  FB = fibo(n-1) + fibo(n-2)
endif

return
end
```

```
dimension A(20, 30), B(30, 50), C(80), D(80), Z(20, 50)

C = 1 ! Assign 1 to the whole C vector.
D(1:50) = 0.5  ! You can designate a section of a vector.
D(51:80) = 0.8

A = 0.7
B = 0.3
!  Matmul is a built-in library for matrix multiplication
Z = matmul(A, B) ! Z = A B, matrix multiplication

! Also, a built-in library for dot_product.
result = dot_product(C, D) ! C and D must have the same length.
```