

NAG C Library

Mark 8 News

1 Introduction

At Mark 8 of the NAG C Library new functionality has been introduced in addition to improvements in existing areas. The Library now contains 1006 user-callable routines of which 990 are documented and 146 are new at this mark.

A new chapter on large scale eigenproblems has been introduced, and new algorithms have been included in the areas of optimization, dense and banded linear algebra, direct solution of large scale linear systems, regression, random numbers, time series and the NAG interface to BLAS.

The new chapter on Large Scale Eigenproblems (f12) has functions for the solution of symmetric and nonsymmetric standard and generalized large scale eigenvalue problems. Chapter f11 has been renamed as Large Scale Linear Systems, and new functions for the direct solution of sparse problems have been added.

Chapter e04 (Minimizing or Maximizing a Function) has been updated with new functions for the solution of LP, QP and nonlinear programming problems with sparse linear constraints.

A comprehensive suite of driver functions for the solution of dense and banded linear equations has also been added to Chapter f04 (Simultaneous Linear Equations).

New functions for stepwise regression and mixed effects regression have been included in Chapter g02 (Correlation and Regression Analysis), and a number of new random number generators, including Copulas and improved quasi-random number generators have been added to Chapter g05 (Random Number Generators) and Chapter g13 (Time Series Analysis).

Chapter f16 (NAG Interface to BLAS) now covers the full BLAS specification.

The NAG Boolean type has been withdrawn and replaced by **Nag_Boolean** (see Section 2.2.1.1 of the Essential Introduction). The change had to be made in order to avoid a clash of types with those compiler vendors who also use Boolean.

Individual function documents have been provided at this Mark for Chapter a00 (Library Identification), Chapter a02 (Complex Arithmetic) and Chapter f06 (Linear Algebra Support Functions).

2 New Routines

The 146 new user-callable routines included in the C Library at Mark 8 are as follows.

a00acc	nag_check_licensing Check availability of a valid licence key
e01sgc	nag_2d_shep_interp Interpolating functions, modified Shepard's method, two variables
e01shc	nag_2d_shep_eval Interpolated values, evaluate interpolant computed by nag_2d_shep_interp (e01sgc), function and first derivatives, two variables
e01sjc	nag_2d_triang_interp A function to generate a two-dimensional surface interpolating a set of data points, using either the method of Renka and Cline or the modified Shepard's method
e01skc	nag_2d_triang_eval A function to evaluate, at a set of points, the two-dimensional interpolant function generated by nag_2d_shep_interp (e01sgc)
e02dac	nag_2d_spline_fit_panel Least-squares surface fit, bicubic splines
e02zac	nag_2d_panel_sort Sort two-dimensional data into panels for fitting bicubic splines
e04npc	nag_opt_sparse_convex_qp_init Initialization function for nag_opt_sparse_convex_qp_solve (e04nqc)

e04nqc	nag_opt_sparse_convex_qp_solve LP or QP problem (suitable for sparse problems)
e04nrc	nag_opt_sparse_convex_qp_option_set_file Supply optional parameter values for nag_opt_sparse_convex_qp_solve (e04nqc) from external file
e04nsc	nag_opt_sparse_convex_qp_option_set_string Set a single option for nag_opt_sparse_convex_qp_solve (e04nqc) from a character string
e04ntc	nag_opt_sparse_convex_qp_option_set_integer Set a single option for nag_opt_sparse_convex_qp_solve (e04nqc) from an Integer argument
e04nuc	nag_opt_sparse_convex_qp_option_set_double Set a single option for nag_opt_sparse_convex_qp_solve (e04nqc) from a double argument
e04nxc	nag_opt_sparse_convex_qp_option_get_integer Get the setting of an Integer valued option of nag_opt_sparse_convex_qp_solve (e04nqc)
e04nyc	nag_opt_sparse_convex_qp_option_get_double Get the setting of a double valued option of nag_opt_sparse_convex_qp_solve (e04nqc)
e04vgc	nag_opt_sparse_nlp_init Initialization function for nag_opt_sparse_nlp_solve (e04vhc)
e04vhc	nag_opt_sparse_nlp_solve General sparse nonlinear optimizer
e04vjc	nag_opt_sparse_nlp_jacobian Determine the pattern of nonzeros in the Jacobian matrix for nag_opt_sparse_nlp_solve (e04vhc)
e04vkc	nag_opt_sparse_nlp_option_set_file Supply optional parameter values for nag_opt_sparse_nlp_solve (e04vhc) from external file
e04vlc	nag_opt_sparse_nlp_option_set_string Set a single option for nag_opt_sparse_nlp_solve (e04vhc) from a character string
e04vmc	nag_opt_sparse_nlp_option_set_integer Set a single option for nag_opt_sparse_nlp_solve (e04vhc) from an Integer argument
e04vnc	nag_opt_sparse_nlp_option_set_double Set a single option for nag_opt_sparse_nlp_solve (e04vhc) from a double argument
e04vrc	nag_opt_sparse_nlp_option_get_integer Get the setting of an Integer valued option of nag_opt_sparse_nlp_solve (e04vhc)
e04vsc	nag_opt_sparse_nlp_option_get_double Get the setting of a double valued option of nag_opt_sparse_nlp_solve (e04vhc)
e04wcc	nag_opt_nlp_init Initialization function for nag_opt_nlp_solve (e04wdc)
e04wdc	nag_opt_nlp_solve Solves the nonlinear programming (NP) problem
e04wec	nag_opt_nlp_option_set_file Supply optional parameter values for nag_opt_nlp_solve (e04wdc) from external file
e04wfc	nag_opt_nlp_option_set_string Set a single option for nag_opt_nlp_solve (e04wdc) from a character string
e04wgc	nag_opt_nlp_option_set_integer Set a single option for nag_opt_nlp_solve (e04wdc) from an Integer argument
e04whc	nag_opt_nlp_option_set_double Set a single option for nag_opt_nlp_solve (e04wdc) from a double argument
e04wkc	nag_opt_nlp_option_get_integer Get the setting of an Integer valued option of nag_opt_nlp_solve (e04wdc)
e04wlc	nag_opt_nlp_option_get_double Get the setting of a double valued option of nag_opt_nlp_solve (e04wdc)
f04bac	nag_real_gen_lin_solve Computes the solution and error-bound to a real system of linear equations
f04bbc	nag_real_band_lin_solve Computes the solution and error-bound to a real banded system of linear equations
f04bcc	nag_real_tridiag_lin_solve Computes the solution and error-bound to a real tridiagonal system of linear equations
f04bdc	nag_real_sym_posdef_lin_solve Computes the solution and error-bound to a real symmetric positive-definite system of linear equations

f04bec	nag_real_sym_posdef_packed_lin_solve Computes the solution and error-bound to a real symmetric positive-definite system of linear equations, packed storage
f04bfc	nag_real_sym_posdef_band_lin_solve Computes the solution and error-bound to a real symmetric positive-definite banded system of linear equations
f04bgc	nag_real_sym_posdef_tridiag_lin_solve Computes the solution and error-bound to a real symmetric positive-definite tridiagonal system of linear equations
f04bhc	nag_real_sym_lin_solve Computes the solution and error-bound to a real symmetric system of linear equations
f04bjc	nag_real_sym_packed_lin_solve Computes the solution and error-bound to a real symmetric system of linear equations, packed storage
f04cac	nag_complex_gen_lin_solve Computes the solution and error-bound to a complex system of linear equations
f04cbc	nag_complex_band_lin_solve Computes the solution and error-bound to a complex banded system of linear equations
f04ccc	nag_complex_tridiag_lin_solve Computes the solution and error-bound to a complex tridiagonal system of linear equations
f04cdc	nag_herm_posdef_lin_solve Computes the solution and error-bound to a complex Hermitian positive-definite system of linear equations
f04cec	nag_herm_posdef_packed_lin_solve Computes the solution and error-bound to a complex Hermitian positive-definite system of linear equations, packed storage
f04cfc	nag_herm_posdef_band_lin_solve Computes the solution and error-bound to a complex Hermitian positive-definite banded system of linear equations
f04cgc	nag_herm_posdef_tridiag_lin_solve Computes the solution and error-bound to a complex Hermitian positive-definite tridiagonal system of linear equations
f04chc	nag_herm_lin_solve Computes the solution and error-bound to a complex Hermitian system of linear equations
f04cjc	nag_herm_packed_lin_solve Computes the solution and error-bound to a complex Hermitian system of linear equations, packed storage
f04dhc	nag_complex_sym_lin_solve Computes the solution and error-bound to a complex symmetric system of linear equations
f04djc	nag_complex_sym_packed_lin_solve Computes the solution and error-bound to a complex symmetric system of linear equations, packed storage.
f06fec	nag_drsc1 Multiply real vector by reciprocal of scalar
f06kec	nag_zrsc1 Multiply complex vector by reciprocal of real scalar
f11mdc	nag_superlu_column_permutation Real sparse nonsymmetric linear systems, setup for nag_superlu_lu_factorize (f11mec)
f11mec	nag_superlu_lu_factorize <i>LU</i> factorization of real sparse matrix
f11mfc	nag_superlu_solve_lu Solution of real sparse simultaneous linear equations (coefficient matrix already factorized)
f11mgc	nag_superlu_condition_number_lu Estimate condition number of real matrix, matrix already factorized by nag_superlu_lu_factorize (f11mec)
f11mhc	nag_superlu_refine_lu Refined solution with error bounds of real system of linear equations, multiple right-hand sides
f11mkc	nag_superlu_matrix_product Real sparse nonsymmetric matrix matrix multiply, compressed column storage

f11mlc	nag_superlu_matrix_norm 1-norm, ∞ -norm, largest absolute element, real general matrix
f11mmc	nag_superlu_diagnostic_lu Real sparse nonsymmetric linear systems, diagnostic for nag_superlu_lu_factorize (f11mec)
f12aac	nag_real_sparse_eigensystem_init Initialization routine for (nag_real_sparse_eigensystem_iter (f12abc)) computing selected eigenvalues and, optionally, eigenvectors of a real nonsymmetric sparse (standard or generalized) eigenproblem
f12abc	nag_real_sparse_eigensystem_iter Implements a reverse communication interface for the Implicitly Restarted Arnoldi iteration for computing selected eigenvalues and, optionally, eigenvectors of a real nonsymmetric sparse (standard or generalized) eigenproblem
f12acc	nag_real_sparse_eigensystem_sol Returns the converged approximations (as determined by nag_real_sparse_eigensystem_iter (f12abc)) to eigenvalues of a real nonsymmetric sparse (standard or generalized) eigenproblem and, optionally, the corresponding approximate eigenvectors and/or an orthonormal basis for the associated approximate invariant subspace
f12adc	nag_real_sparse_eigensystem_option Set a single option from a string (nag_real_sparse_eigensystem_iter (f12abc)/nag_real_sparse_eigensystem_sol (f12acc)/nag_real_banded_sparse_eigensystem_sol (f12agc))
f12aec	nag_real_sparse_eigensystem_monit Provides monitoring information for nag_real_sparse_eigensystem_iter (f12abc)
f12afc	nag_real_banded_sparse_eigensystem_init Initialization routine for (nag_real_banded_sparse_eigensystem_sol (f12agc)) computing selected eigenvalues and, optionally, eigenvectors of a real nonsymmetric banded (standard or generalized) eigenproblem
f12agc	nag_real_banded_sparse_eigensystem_sol Computes approximations to selected eigenvalues of a real nonsymmetric banded (standard or generalized) eigenproblem and, optionally, the corresponding approximate eigenvectors and/or an orthonormal basis for the associated approximate invariant subspace
f12anc	nag_complex_sparse_eigensystem_init Initialization routine for (nag_complex_sparse_eigensystem_iter (f12apc)) computing selected eigenvalues and, optionally, eigenvectors of a complex sparse (standard or generalized) eigenproblem
f12apc	nag_complex_sparse_eigensystem_iter Implements a reverse communication interface for the Implicitly Restarted Arnoldi iteration for computing selected eigenvalues and, optionally, eigenvectors of a complex sparse (standard or generalized) eigenproblem
f12aqc	nag_complex_sparse_eigensystem_sol Returns the converged approximations (as determined by nag_real_sparse_eigensystem_iter (f12abc)) to eigenvalues of a complex sparse (standard or generalized) eigenproblem and, optionally, the corresponding approximate eigenvectors and/or an orthonormal basis for the associated approximate invariant subspace
f12arc	nag_complex_sparse_eigensystem_option Set a single option from a string (nag_complex_sparse_eigensystem_iter (f12apc)/nag_complex_sparse_eigensystem_sol (f12aqc))
f12asc	nag_complex_sparse_eigensystem_monit Provides monitoring information for nag_complex_sparse_eigensystem_iter (f12apc)
f12fac	nag_real_symm_sparse_eigensystem_init Initialization routine for (nag_real_symm_sparse_eigensystem_iter (f12fbc)) computing selected eigenvalues and, optionally, eigenvectors of a real symmetric sparse (standard or generalized) eigenproblem
f12fbc	nag_real_symm_sparse_eigensystem_iter Implements a reverse communication interface for the Implicitly Restarted Arnoldi iteration for computing selected eigenvalues and, optionally, eigenvectors of a real symmetric sparse (standard or generalized) eigenproblem

f12fcc	nag_real_symm_sparse_eigensystem_sol Returns the converged approximations (as determined by nag_real_sparse_eigensystem_iter (f12abc)) to eigenvalues of a real symmetric sparse (standard or generalized) eigenproblem and, optionally, the corresponding approximate eigenvectors and/or an orthonormal basis for the associated approximate invariant subspace
f12fdc	nag_real_symm_sparse_eigensystem_option Set a single option from a string (nag_real_symm_sparse_eigensystem_iter (f12fbc)/nag_real_symm_sparse_eigensystem_sol (f12fcc)/nag_real_symm_banded_sparse_eigensystem_sol (f12fgc))
f12fec	nag_real_symm_sparse_eigensystem_monit Provides monitoring information for nag_real_symm_sparse_eigensystem_iter (f12fbc)
f12ffc	nag_real_symm_banded_sparse_eigensystem_init Initialization routine for (nag_real_symm_banded_sparse_eigensystem_sol (f12fgc)) computing selected eigenvalues and, optionally, eigenvectors of a real symmetric banded (standard or generalized) eigenproblem
f12fgc	nag_real_symm_banded_sparse_eigensystem_sol Computes approximations to selected eigenvalues of a real symmetric banded (standard or generalized) eigenproblem and, optionally, the corresponding approximate eigenvectors and/or an orthonormal basis for the associated approximate invariant subspace
f16pac	nag_dgemv Matrix-vector product, real rectangular matrix
f16pbc	nag_dgbmv Matrix-vector product, real rectangular band matrix
f16pcc	nag_dsymv Matrix-vector product, real symmetric matrix
f16pdc	nag_dsmbv Matrix-vector product, real symmetric band matrix
f16pec	nag_dspmv Matrix-vector product, real symmetric packed matrix
f16pfc	nag_dtrmv Matrix-vector product, real triangular matrix
f16pgc	nag_dtbmv Matrix-vector product, real triangular band matrix
f16phc	nag_dtpmv Matrix-vector product, real triangular packed matrix
f16pkc	nag_dtbsv System of equations, real triangular band matrix
f16plc	nag_dtpsv System of equations, real triangular packed matrix
f16pmc	nag_dger Rank-1 update, real rectangular matrix
f16ppc	nag_dsyr Rank-1 update, real symmetric matrix
f16pqc	nag_dspr Rank-1 update, real symmetric packed matrix
f16prc	nag_dsyr2 Rank-2 update, real symmetric matrix
f16psc	nag_dspr2 Rank-2 update, real symmetric packed matrix
f16sac	nag_zgemv Matrix-vector product, complex rectangular matrix
f16sbc	nag_zgbmv Matrix-vector product, complex rectangular band matrix
f16scc	nag_zhemv Matrix-vector product, complex Hermitian matrix
f16sdc	nag_zhbm v Matrix-vector product, complex Hermitian band matrix
f16sec	nag_zhpmv Matrix-vector product, complex Hermitian packed matrix

f16sfc	nag_ztrmv Matrix-vector product, complex triangular matrix
f16sgc	nag_ztbmv Matrix-vector product, complex triangular band matrix
f16shc	nag_ztpmv Matrix-vector product, complex triangular packed matrix
f16skc	nag_ztbsv System of equations, complex triangular band matrix
f16slc	nag_ztpsv System of equations, complex triangular packed matrix
f16smc	nag_zger Rank-1 update, complex rectangular matrix, unconjugated vector
f16spc	nag_zher Rank-1 update, complex Hermitian matrix
f16sqc	nag_zhpr Rank-1 update, complex Hermitian packed matrix
f16src	nag_zher2 Rank-2 update, complex Hermitian matrix
f16ssc	nag_zhpr2 Rank-2 update, complex Hermitian packed matrix
f16tac	nag_zsymv Matrix-vector product, complex symmetric matrix
f16tcc	nag_zspm Matrix-vector product, complex symmetric packed matrix
f16yac	nag_dgemm Matrix-matrix product, two real rectangular matrices
f16ycc	nag_dsymm Matrix-matrix product, one real symmetric matrix, one real rectangular matrix
f16yfc	nag_dtrmm Matrix-matrix product, one real triangular matrix, one real rectangular matrix
f16ypc	nag_dsyk Rank- k update of a real symmetric matrix
f16yrc	nag_dsyk2 Rank- $2k$ update of a real symmetric matrix
f16zac	nag_zgemm Matrix-matrix product, two complex rectangular matrices
f16zcc	nag_zhemm Matrix-matrix product, one complex Hermitian matrix, one complex rectangular matrix
f16zfc	nag_ztrmm Matrix-matrix product, one complex triangular matrix, one complex rectangular matrix
f16zpc	nag_zherk Rank- k update of a complex Hermitian matrix
f16zrc	nag_zherk2 Rank- $2k$ update of a complex Hermitian matrix
f16ztc	nag_zsymm Matrix-matrix product, one complex symmetric matrix, one complex rectangular matrix
f16zuc	nag_zsyk Rank- k update of a complex symmetric matrix
f16zwc	nag_zsyk2 Rank- $2k$ update of a complex symmetric matrix
g02efc	nag_full_step_regsn Stepwise linear regression
g02ewc	nag_full_step_regsn_monit Monitor function for full stepwise regression
g02jac	nag_reml_mixed_regsn Linear mixed effects regression using Restricted Maximum Likelihood (REML)
g02jbc	nag_ml_mixed_regsn Linear mixed effects regression using Maximum Likelihood (ML)

g05lxc	nag_rngs_matrix_multi_students_t Generates a matrix of random numbers from a multivariate Student's <i>t</i> -distribution, seeds and generator passed explicitly
g05lyc	nag_rgn_matrix_multi_normal Generates a matrix of random numbers from a multivariate Normal distribution, seeds and generator passed explicitly
g05rac	nag_rngs_copula_normal Generates a matrix of random numbers from a Gaussian Copula, seeds and generator passed explicitly
g05rbc	nag_rngs_copula_students_t Generates a matrix of random numbers from a Student's <i>t</i> -Copula, seeds and generator passed explicitly
g13bgc	nag_tsa_multi_inp_update Multivariate time series, update state set for forecasting from multi-input model
g13ddc	nag_tsa_varma_estimate Multivariate time series, estimation of VARMA model
g13djc	nag_tsa_varma_forecast Multivariate time series, forecasts and their standard errors
g13dkc	nag_tsa_varma_update Multivariate time series, updates forecasts and their standard errors
g13dsc	nag_tsa_varma_diagnostic Multivariate time series, diagnostic checking of residuals, following nag_tsa_varma_estimate (g13ddc)
x04acc	nag_open_file Open unit number for reading, writing or appending, and associate unit with named file
x04adc	nag_close_file Close file associated with given unit number
x04bac	nag_write_line Write formatted record to external file
x04bbc	nag_read_line Read formatted record from external file
x04nac	nag_enum_name_to_value Converts NAG enum member name to value
x04nbc	nag_enum_value_to_name Converts NAG enum member value to its name
x04ncc	nag_error_name_to_code Converts NAG error name to its code value

3 Routines Scheduled for Withdrawal

The routines listed below are scheduled for withdrawal from the C Library, because improved routines have now been included in the Library. Users are advised to stop using routines which are scheduled for withdrawal immediately and to use recommended replacement routines instead. See the document 'Advice on Replacement Calls for Withdrawn/Superseded Functions' for more detailed guidance, including advice on how to change a call to the old routine into a call to its recommended replacement.

The following routines have been superseded, but will not be withdrawn from the Library until Mark 10 at the earliest.

Superseded

Routine	Replacement Routine(s)
nag_2d_scatter_interpolant (e01sac)	nag_2d_shep_interp (e01sgc) or nag_2d_triangular_interp (e01sjc)
nag_2d_scatter_eval (e01sbc)	nag_2d_shep_eval (e01shc) or nag_2d_triangular_eval (e01skc)
nag_2d_scatter_free (e01szc)	No replacement document required
nag_opt_bounds_no_deriv (e04jbc)	nag_opt_nlp_solve (e04wdc)
nag_opt_bounds_deriv (e04kbc)	nag_opt_nlp_solve (e04wdc)
nag_opt_sparse_convex_qp (e04nkc)	nag_opt_sparse_convex_qp_solve (e04nqc)
nag_opt_nlp (e04ucc)	nag_opt_nlp_solve (e04wdc)