

NAG Library Chapter Contents

f08 – Least Squares and Eigenvalue Problems (LAPACK)

f08 Chapter Introduction – a description of the Chapter and an overview of the algorithms available

Function Name	Mark of Introduction	Purpose
f08aac	23	nag_dgels Solves a real linear least squares problem of full rank
f08abc	24	nag_dgeqrt Performs a QR factorization of real general rectangular matrix, with explicit blocking
f08acc	24	nag_dgemqrt Applies the orthogonal transformation determined by nag_dgeqrt (f08abc)
f08aec	7	nag_dgeqrf Performs a QR factorization of real general rectangular matrix
f08afc	7	nag_dorgqr Forms all or part of orthogonal Q from QR factorization determined by nag_dgeqrf (f08aec), nag_dgeqpf (f08bec) or nag_dgeqp3 (f08bfc)
f08agc	7	nag_dormqr Applies an orthogonal transformation determined by nag_dgeqrf (f08aec), nag_dgeqpf (f08bec) or nag_dgeqp3 (f08bfc)
f08ahc	7	nag_dgelqf Performs a LQ factorization of real general rectangular matrix
f08ajc	7	nag_dorglq Forms all or part of orthogonal Q from LQ factorization determined by nag_dgelqf (f08ahc)
f08akc	7	nag_dormlq Applies the orthogonal transformation determined by nag_dgelqf (f08ahc)
f08anc	23	nag_zgels Solves a complex linear least problem of full rank
f08apc	24	nag_zgeqrt Performs a QR factorization of complex general rectangular matrix using recursive algorithm
f08aqc	24	nag_zgemqrt Applies the unitary transformation determined by nag_zgeqrt (f08apc)
f08asc	7	nag_zgeqrf Performs a QR factorization of complex general rectangular matrix
f08atc	7	nag_zungqr Forms all or part of unitary Q from QR factorization determined by nag_zgeqrf (f08asc), nag_zgeqpf (f08bsc) or nag_zgeqp3 (f08btc)
f08auc	7	nag_zunmqr Applies a unitary transformation determined by nag_zgeqrf (f08asc), nag_zgeqpf (f08bsc) or nag_zgeqp3 (f08btc)
f08avc	7	nag_zgelqf Performs a LQ factorization of complex general rectangular matrix
f08awc	7	nag_zunglq Forms all or part of unitary Q from LQ factorization determined by nag_zgelqf (f08avc)
f08axc	7	nag_zunmlq Applies the unitary transformation determined by nag_zgelqf (f08avc)
f08bac	23	nag_dgelsy Computes the minimum-norm solution to a real linear least squares problem
f08bbc	24	nag_dtpqrt QR factorization of real general triangular-pentagonal matrix

f08bcc	24	nag_dtpmqrt Applies the orthogonal transformation determined by nag_dtpqrt (f08bbc)
f08bec	7	nag_dgeqpf QR factorization, with column pivoting, of real general rectangular matrix
f08bfc	23	nag_dgeqp3 QR factorization, with column pivoting, using BLAS-3, of real general rectangular matrix
f08bhc	23	nag_dtzrzf Reduces a real upper trapezoidal matrix to upper triangular form
f08bkc	23	nag_dormrz Applies the orthogonal transformation determined by nag_dtzrzf (f08bhc)
f08bnc	23	nag_zgelsy Computes the minimum-norm solution to a complex linear least squares problem
f08bpc	24	nag_ztpqrt QR factorization of complex triangular-pentagonal matrix
f08bqc	24	nag_ztpmqrt Applies the unitary transformation determined by nag_ztpqrt (f08bpc)
f08bsc	7	nag_zgeqpf QR factorization, with column pivoting, of complex general rectangular matrix
f08btc	23	nag_zgeqp3 QR factorization, with column pivoting, using BLAS-3, of complex general rectangular matrix
f08bvc	23	nag_ztzrzf Reduces a complex upper trapezoidal matrix to upper triangular form
f08bxc	23	nag_zunmrz Applies the unitary transformation determined by nag_ztzrzf (f08bvc)
f08cec	23	nag_dgeqlf QL factorization of real general rectangular matrix
f08cfc	23	nag_dorgql Form all or part of orthogonal Q from QL factorization determined by nag_dgeqlf (f08cec)
f08cgc	23	nag_dormql Applies the orthogonal transformation determined by nag_dgeqlf (f08cec)
f08chc	23	nag_dgerqf RQ factorization of real general rectangular matrix
f08cje	23	nag_dorgrq Form all or part of orthogonal Q from RQ factorization determined by nag_dgerqf (f08chc)
f08ckc	23	nag_dormrq Applies the orthogonal transformation determined by nag_dgerqf (f08chc)
f08csc	23	nag_zgeqlf QL factorization of complex general rectangular matrix
f08ctc	23	nag_zungql Form all or part of unitary Q from QL factorization determined by nag_zgeqlf (f08csc)
f08cuc	23	nag_zunmql Applies the unitary transformation determined by nag_zgeqlf (f08csc)
f08cvc	23	nag_zgerqf RQ factorization of complex general rectangular matrix
f08cwc	23	nag_zungrq Form all or part of unitary Q from RQ factorization determined by nag_zgerqf (f08cvc)
f08cxc	23	nag_zunmrq Applies the unitary transformation determined by nag_zgerqf (f08cvc)
f08fac	23	nag_dsyevev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix

f08fbc	23	nag_dsyevx Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix
f08fcc	7	nag_dsyevd Computes all eigenvalues and, optionally, all eigenvectors of real symmetric matrix (divide-and-conquer)
f08fdc	23	nag_dsyevr Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix (Relatively Robust Representations)
f08fec	7	nag_dsytrd Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form
f08ffc	7	nag_dorgtr Generate orthogonal transformation matrix from reduction to tridiagonal form determined by nag_dsytrd (f08fec)
f08fgc	7	nag_dormtr Applies the orthogonal transformation determined by nag_dsytrd (f08fec)
f08flc	23	nag_ddisna Computes the reciprocal condition numbers for the eigenvectors of a real symmetric or complex Hermitian matrix or for the left or right singular vectors of a general matrix
f08fnc	23	nag_zheev Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
f08fpc	23	nag_zheevx Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
f08fqc	7	nag_zheevd Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian matrix (divide-and-conquer)
f08frc	23	nag_zheevr Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix (Relatively Robust Representations)
f08fsc	7	nag_zhetrd Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form
f08ftc	7	nag_zungtr Generate unitary transformation matrix from reduction to tridiagonal form determined by nag_zhetrd (f08fsc)
f08fuc	7	nag_zunmtr Applies the unitary transformation matrix determined by nag_zhetrd (f08fsc)
f08gac	23	nag_dspev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage
f08gbc	23	nag_dspevx Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage
f08gcc	7	nag_dspevd Computes all eigenvalues and, optionally, all eigenvectors of real symmetric matrix, packed storage (divide-and-conquer or Pal–Walker–Kahan variant of the QL or QR algorithm)
f08gec	7	nag_dsptrd Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form, packed storage
f08gfc	7	nag_dopgtr Generate orthogonal transformation matrix from reduction to tridiagonal form determined by nag_dsptrd (f08gec)

f08ggc	7	nag_dopmtr Applies the orthogonal transformation determined by nag_dsprtd (f08gec)
f08gnc	23	nag_zhpev Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
f08gpc	23	nag_zhpevx Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
f08gqc	7	nag_zhpevd Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian matrix, packed storage (divide-and-conquer or Pal–Walker–Kahan variant of the QL or QR algorithm)
f08gsc	7	nag_zhptra Performs a unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form, packed storage
f08gtc	7	nag_zupgtr Generates a unitary transformation matrix from reduction to tridiagonal form determined by nag_zhptra (f08gsc)
f08guc	7	nag_zupmtr Applies the unitary transformation matrix determined by nag_zhptra (f08gsc)
f08hac	23	nag_dsbev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
f08hbc	23	nag_dsbevz Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
f08hcc	7	nag_dsbevd Computes all eigenvalues and, optionally, all eigenvectors of real symmetric band matrix (divide-and-conquer or Pal–Walker–Kahan variant of the QL or QR algorithm)
f08hec	7	nag_dsbtra Performs an orthogonal reduction of real symmetric band matrix to symmetric tridiagonal form
f08hnc	23	nag_zhbev Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix
f08hpc	23	nag_zhbevz Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix
f08hqc	7	nag_zhbevd Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian band matrix (divide-and-conquer)
f08hsc	7	nag_zhbtra Performs a unitary reduction of complex Hermitian band matrix to real symmetric tridiagonal form
f08jac	23	nag_dstev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix
f08jbc	23	nag_dstevz Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix
f08jcc	7	nag_dstevd Computes all eigenvalues and, optionally, all eigenvectors of real symmetric tridiagonal matrix (divide-and-conquer)
f08jdc	23	nag_dstevr Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix (Relatively Robust Representations)

f08jec	7	nag_dsteqr Computes all eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from real symmetric matrix using the implicit QL or QR algorithm
f08jfc	7	nag_dsterf Computes all eigenvalues of real symmetric tridiagonal matrix, root-free variant of the QL or QR algorithm
f08jgc	7	nag_dpsteqr Computes all eigenvalues and eigenvectors of real symmetric positive definite tridiagonal matrix, reduced from real symmetric positive definite matrix
f08jhc	23	nag_dstedc Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix or a matrix reduced to this form (divide-and-conquer)
f08jjc	7	nag_dstebz Computes selected eigenvalues of real symmetric tridiagonal matrix by bisection
f08jkc	7	nag_dstein Computes selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in real array
f08jlc	23	nag_dstegr Computes selected eigenvalues and, optionally, the corresponding eigenvectors of a real symmetric tridiagonal matrix or a symmetric matrix reduced to this form (Relatively Robust Representations)
f08jsc	7	nag_zsteqr Computes all eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from complex Hermitian matrix, using the implicit QL or QR algorithm
f08juc	7	nag_zpsteqr Computes all eigenvalues and eigenvectors of real symmetric positive definite tridiagonal matrix, reduced from complex Hermitian positive definite matrix
f08jvc	23	nag_zstedc Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix or a complex Hermitian matrix reduced to this form (divide-and-conquer)
f08jxc	7	nag_zstein Computes selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in complex array
f08jyc	23	nag_zstegr Computes selected eigenvalues and, optionally, the corresponding eigenvectors of a real symmetric tridiagonal matrix or a complex Hermitian matrix reduced to this form (Relatively Robust Representations)
f08kac	23	nag_dgelss Computes the minimum-norm solution to a real linear least squares problem using singular value decomposition
f08kbc	23	nag_dgesvd Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors
f08kcc	23	nag_dgelsd Computes the minimum-norm solution to a real linear least squares problem using singular value decomposition (divide-and-conquer)
f08kdc	23	nag_dgesdd Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors (divide-and-conquer)
f08kec	7	nag_dgebrd Performs an orthogonal reduction of real general rectangular matrix to bidiagonal form

f08kfc	7	nag_dorgbr Generates an orthogonal transformation matrices from reduction to bidiagonal form determined by nag_dgebrd (f08kec)
f08kgc	7	nag_dormbr Applies the orthogonal transformations from reduction to bidiagonal form determined by nag_dgebrd (f08kec)
f08khc	23	nag_dgejsv Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors (preconditioned Jacobi)
f08kjc	23	nag_dgesvj Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors (fast Jacobi)
f08knc	23	nag_zgelss Computes the minimum-norm solution to a complex linear least squares problem using singular value decomposition
f08kpc	23	nag_zgesvd Computes the singular value decomposition of a complex matrix, optionally computing the left and/or right singular vectors
f08kqc	23	nag_zgelsd Computes the minimum-norm solution to a complex linear least squares problem using singular value decomposition (divide-and-conquer)
f08krc	23	nag_zgesdd Computes the singular value decomposition of a complex matrix, optionally computing the left and/or right singular vectors (divide-and-conquer)
f08ksc	7	nag_zgebrd Performs a unitary reduction of complex general rectangular matrix to bidiagonal form
f08ktc	7	nag_zungbr Generates unitary transformation matrices from the reduction to bidiagonal form determined by nag_zgebrd (f08ksc)
f08kuc	7	nag_zunmbr Applies the unitary transformations from reduction to bidiagonal form determined by nag_zgebrd (f08ksc)
f08lec	7	nag_dgbbrd Performs a reduction of real rectangular band matrix to upper bidiagonal form
f08lsc	7	nag_zgbbrd Reduction of complex rectangular band matrix to upper bidiagonal form
f08mdc	23	nag_dbdsdc Computes the singular value decomposition of a real bidiagonal matrix, optionally computing the singular vectors (divide-and-conquer)
f08mec	7	nag_dbdsqr Performs an SVD of real bidiagonal matrix reduced from real general matrix
f08msc	7	nag_zbdsqr Performs an SVD of real bidiagonal matrix reduced from complex general matrix
f08nac	23	nag_dgeev Computes all eigenvalues and, optionally, left and/or right eigenvectors of a real nonsymmetric matrix
f08nbc	23	nag_dgeevx Computes all eigenvalues and, optionally, left and/or right eigenvectors of a real nonsymmetric matrix; also, optionally, the balancing transformation, the reciprocal condition numbers for the eigenvalues and for the right eigenvectors
f08nec	7	nag_dgehrd Performs an orthogonal reduction of real general matrix to upper Hessenberg form

f08nfc	7	nag_dorghr Generates an orthogonal transformation matrix from reduction to Hessenberg form determined by nag_dgehrd (f08nec)
f08ngc	7	nag_dormhr Applies the orthogonal transformation matrix from reduction to Hessenberg form determined by nag_dgehrd (f08nec)
f08nhc	7	nag_dgebal Balances a real general matrix
f08njc	7	nag_dgebak Transforms eigenvectors of real balanced matrix to those of original matrix supplied to nag_dgebal (f08nhc)
f08nnc	23	nag_zgeev Computes all eigenvalues and, optionally, left and/or right eigenvectors of a complex nonsymmetric matrix
f08npc	23	nag_zgeevx Computes all eigenvalues and, optionally, left and/or right eigenvectors of a complex nonsymmetric matrix; also, optionally, the balancing transformation, the reciprocal condition numbers for the eigenvalues and for the right eigenvectors
f08nsc	7	nag_zgehrd Performs a unitary reduction of complex general matrix to upper Hessenberg form
f08ntc	7	nag_zunghr Generates a unitary transformation matrix from reduction to Hessenberg form determined by nag_zgehrd (f08nsc)
f08nuc	7	nag_zunmhr Applies the unitary transformation matrix from reduction to Hessenberg form determined by nag_zgehrd (f08nsc)
f08nvc	7	nag_zgebal Balances a complex general matrix
f08nwc	7	nag_zgebak Transforms eigenvectors of complex balanced matrix to those of original matrix supplied to nag_zgebal (f08nvc)
f08pac	23	nag_dgees Computes for real square nonsymmetric matrix, the eigenvalues, the real Schur form, and, optionally, the matrix of Schur vectors
f08pbc	23	nag_dgeesx Computes for real square nonsymmetric matrix, the eigenvalues, the real Schur form, and, optionally, the matrix of Schur vectors; also, optionally, computes reciprocal condition numbers for selected eigenvalues
f08pec	7	nag_dhseqr Computes the eigenvalues and Schur factorization of real upper Hessenberg matrix reduced from real general matrix
f08pkc	7	nag_dhsein Computes selected right and/or left eigenvectors of real upper Hessenberg matrix by inverse iteration
f08pnc	23	nag_zgees Computes for complex square nonsymmetric matrix, the eigenvalues, the Schur form, and, optionally, the matrix of Schur vectors
f08ppc	23	nag_zgeesx Computes for real square nonsymmetric matrix, the eigenvalues, the Schur form, and, optionally, the matrix of Schur vectors; also computes a reciprocal condition number for the average of the selected eigenvalues and for the right invariant subspace corresponding to these eigenvalues
f08psc	7	nag_zhseqr Computes the eigenvalues and Schur factorization of complex upper Hessenberg matrix reduced from complex general matrix

f08pxc	7	nag_zhsein Computes selected right and/or left eigenvectors of complex upper Hessenberg matrix by inverse iteration
f08qfc	7	nag_dtrexc Reorders a Schur factorization of real matrix using orthogonal similarity transformation
f08qgc	7	nag_dtrsen Reorders a Schur factorization of real matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
f08qhc	7	nag_dtrsyl Solves the real Sylvester matrix equation $AX + XB = C$, A and B are upper quasi-triangular or transposes
f08qkc	7	nag_dtrevc Computes left and right eigenvectors of real upper quasi-triangular matrix
f08qlc	7	nag_dtrsna Computes estimates of sensitivities of selected eigenvalues and eigenvectors of real upper quasi-triangular matrix
f08qtc	7	nag_ztrexc Reorders a Schur factorization of complex matrix using unitary similarity transformation
f08quc	7	nag_ztrsen Reorders a Schur factorization of complex matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
f08qvc	7	nag_ztrsyl Solves the complex Sylvester matrix equation $AX + XB = C$, A and B are upper triangular or conjugate-transposes
f08qxc	7	nag_ztrevc Computes left and right eigenvectors of complex upper triangular matrix
f08qyc	7	nag_ztrsna Computes estimates of sensitivities of selected eigenvalues and eigenvectors of complex upper triangular matrix
f08rac	24	nag_dorcsd Computes the CS decomposition of an orthogonal matrix partitioned into four real submatrices
f08rnc	24	nag_zuncsd Computes the CS decomposition of a unitary matrix partitioned into four complex submatrices
f08sac	23	nag_dsygv Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
f08sbc	23	nag_dsygvx Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
f08scc	23	nag_dsygvd Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem (divide-and-conquer)
f08sec	7	nag_dsygst Performs a reduction to standard form of real symmetric-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $BAx = \lambda x$, B factorized by nag_dpoftr (f07fdc)
f08snc	23	nag_zhegv Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem
f08spc	23	nag_zhegvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem

f08sqc	23	nag_zhegvd Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem (divide-and-conquer)
f08ssc	7	nag_zhegst Performs a reduction to standard form of complex Hermitian-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $BAx = \lambda x$, B factorized by nag_zpotrf (f07frc)
f08tac	23	nag_dspgv Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage
f08tbc	23	nag_dspgvx Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage
f08tcc	23	nag_dspgvd Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage (divide-and-conquer)
f08tec	7	nag_dspgst Performs a reduction to standard form of real symmetric-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $BAx = \lambda x$, packed storage, B factorized by nag_dpptf (f07gdc)
f08tnc	23	nag_zhpgv Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage
f08tpc	23	nag_zhpgvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage
f08tqc	23	nag_zhpgvd Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage (divide-and-conquer)
f08tsc	7	nag_zhpgst Performs a reduction to standard form of complex Hermitian-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $BAx = \lambda x$, packed storage, B factorized by nag_zpptf (f07grc)
f08uac	23	nag_dsbgv Computes all the eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
f08ubc	23	nag_dsbgvx Computes selected eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
f08ucc	23	nag_dsbgvd Computes all the eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem (divide-and-conquer)
f08uec	7	nag_dsbgst Performs a reduction of real symmetric-definite banded generalized eigenproblem $Ax = \lambda Bx$ to standard form $Cy = \lambda y$, such that C has the same bandwidth as A
f08ufc	7	nag_dpbstf Computes a split Cholesky factorization of real symmetric positive definite band matrix A
f08unc	23	nag_zhbgv Computes all the eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem
f08upc	23	nag_zhbgvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem

f08uqc	23	nag_zhbgvd Computes all the eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem (divide-and-conquer)
f08usc	7	nag_zhbgst Performs a reduction of complex Hermitian-definite banded generalized eigenproblem $Ax = \lambda Bx$ to standard form $Cy = \lambda y$, such that C has the same bandwidth as A
f08utc	7	nag_zpbstf Computes a split Cholesky factorization of complex Hermitian positive definite band matrix A
f08vac	9	nag_dggsvd Computes the generalized singular value decomposition of a real matrix pair
f08vcc	26.0	nag_dggsvd3 Computes, using BLAS-3, the generalized singular value decomposition of a real matrix pair
f08vec	23	nag_dggsvp Produces orthogonal matrices that simultaneously reduce the m by n matrix A and the p by n matrix B to upper triangular form
f08vgc	26.0	nag_dggsvp3 Produces orthogonal matrices, using BLAS-3, that simultaneously reduce the m by n matrix A and the p by n matrix B to upper triangular form
f08vnc	9	nag_zggsvd Computes the generalized singular value decomposition of a complex matrix pair
f08vqc	26.0	nag_zggsvd3 Computes, using BLAS-3, the generalized singular value decomposition of a complex matrix pair
f08vsc	23	nag_zggsvp Produces unitary matrices that simultaneously reduce the complex, m by n , matrix A and the complex, p by n , matrix B to upper triangular form
f08vuc	26.0	nag_zggsvp3 Produces unitary matrices, using BLAS-3, that simultaneously reduce the complex, m by n , matrix A and the complex, p by n , matrix B to upper triangular form
f08wac	23	nag_dggeev Computes, for a real nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
f08wbc	23	nag_dggeevx Computes, for a real nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors; also, optionally, the balancing transformation, the reciprocal condition numbers for the eigenvalues and for the right eigenvectors
f08wcc	26.0	nag_dggeev3 Computes, for a real nonsymmetric matrix pair, using BLAS-3, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
f08wec	7	nag_dggghrd Performs an orthogonal reduction of a pair of real general matrices to generalized upper Hessenberg form
f08wfc	26.0	nag_dggghd3 Performs, using BLAS-3, an orthogonal reduction of a pair of real general matrices to generalized upper Hessenberg form
f08whc	7	nag_dggbal Balances a pair of real, square, matrices
f08wjc	7	nag_dggbak Transforms eigenvectors of a pair of real balanced matrices to those of original matrix pair supplied to nag_dggbal (f08whc)

f08wnc	23	nag_zggeev Computes, for a complex nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
f08wpc	23	nag_zggevx Computes, for a complex nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors; also, optionally, the balancing transformation, the reciprocal condition numbers for the eigenvalues and for the right eigenvectors
f08wqc	26.0	nag_zggeev3 Computes, for a complex nonsymmetric matrix pair, using BLAS-3, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
f08wsc	7	nag_zgghrd Performs a unitary reduction of a pair of complex general matrices to generalized upper Hessenberg form
f08wtc	26.0	nag_zgghd3 Performs, using BLAS-3, a unitary reduction of a pair of complex general matrices to generalized upper Hessenberg form
f08wvc	7	nag_zggbal Balances a pair of complex, square, matrices
f08wwc	7	nag_zggbak Transforms eigenvectors of a pair of complex balanced matrices to those of original matrix pair supplied to nag_zggbal (f08wvc)
f08xac	23	nag_dgges Computes, for a real nonsymmetric matrix pair, the generalized eigenvalues, the generalized real Schur form and, optionally, the left and/or right matrices of Schur vectors
f08xbc	23	nag_dggesx Computes, for a real nonsymmetric matrix pair, the generalized eigenvalues, the generalized real Schur form and, optionally, the left and/or right matrices of Schur vectors; also, optionally, computes reciprocal condition numbers for selected eigenvalues
f08xcc	26.0	nag_dgges3 Computes, for a real nonsymmetric matrix pair, using BLAS-3, the generalized eigenvalues, the generalized real Schur form and, optionally, the left and/or right matrices of Schur vectors
f08xec	7	nag_dhgeqz Computes eigenvalues and generalized Schur factorization of real generalized upper Hessenberg form reduced from a pair of real general matrices
f08xnc	23	nag_zgges Computes, for a complex nonsymmetric matrix pair, the generalized eigenvalues, the generalized complex Schur form and, optionally, the left and/or right matrices of Schur vectors
f08xpc	23	nag_zggesx Computes, for a complex nonsymmetric matrix pair, the generalized eigenvalues, the generalized complex Schur form and, optionally, the left and/or right matrices of Schur vectors; also, optionally, computes reciprocal condition numbers for selected eigenvalues
f08xqc	26.0	nag_zgges3 Computes, for a complex nonsymmetric matrix pair, using BLAS-3, the generalized eigenvalues, the generalized complex Schur form and, optionally, the left and/or right matrices of Schur vectors
f08xsc	7	nag_zhgeqz Eigenvalues and generalized Schur factorization of complex generalized upper Hessenberg form reduced from a pair of complex, square, matrices
f08yec	23	nag_dtgsja Computes the generalized singular value decomposition of a real upper triangular (or trapezoidal) matrix pair

f08yfc	23	nag_dtgexc Reorders the generalized real Schur decomposition of a real matrix pair using an orthogonal equivalence transformation
f08ygc	23	nag_dtgsen Reorders the generalized real Schur decomposition of a real matrix pair using an orthogonal equivalence transformation, computes the generalized eigenvalues of the reordered pair and, optionally, computes the estimates of reciprocal condition numbers for eigenvalues and eigenspaces
f08yhc	23	nag_dtgsyl Solves the real-valued, generalized, quasi-triangular, Sylvester equation
f08ykc	7	nag_dtgevc Computes right and left generalized eigenvectors of the matrix pair (A, B) which is assumed to be in generalized upper Schur form
f08ylc	23	nag_dtgsna Estimates reciprocal condition numbers for specified eigenvalues and/or eigenvectors of a real matrix pair in generalized real Schur canonical form
f08ysc	23	nag_ztgsja Computes the generalized singular value decomposition of a complex upper triangular (or trapezoidal) matrix pair
f08ytc	23	nag_ztgexc Reorders the generalized Schur decomposition of a complex matrix pair using an unitary equivalence transformation
f08yuc	23	nag_ztgsen Reorders the generalized Schur decomposition of a complex matrix pair using an unitary equivalence transformation, computes the generalized eigenvalues of the reordered pair and, optionally, computes the estimates of reciprocal condition numbers for eigenvalues and eigenspaces
f08yvc	23	nag_ztgsyl Solves the complex generalized Sylvester equation
f08yxc	7	nag_ztgevc Computes left and right eigenvectors of a pair of complex upper triangular matrices
f08yyc	23	nag_ztgsna Estimates reciprocal condition numbers for specified eigenvalues and/or eigenvectors of a complex matrix pair in generalized Schur canonical form
f08zac	9	nag_dgglse Solves the real linear equality-constrained least squares (LSE) problem
f08zbc	9	nag_dggglm Solves a real general Gauss–Markov linear model (GLM) problem
f08zec	23	nag_dggqrf Computes a generalized QR factorization of a real matrix pair
f08zfc	23	nag_dggrqf Computes a generalized RQ factorization of a real matrix pair
f08znc	9	nag_zgglse Solves the complex linear equality-constrained least squares (LSE) problem
f08zpc	9	nag_zggglm Solves a complex general Gauss–Markov linear model (GLM) problem
f08zsc	23	nag_zggqrf Computes a generalized QR factorization of a complex matrix pair
f08ztc	23	nag_zggrqf Computes a generalized RQ factorization of a complex matrix pair
