NAG Library Chapter Contents

F08 – Least Squares and Eigenvalue Problems (LAPACK)

F08 Chapter Introduction

Routine Name	Mark of Introduction	Purpose
F08AAF (DGELS)	21	DGELS nagf_lapack_dgels Solves a real linear least problem of full rank
F08ABF (DGEQRT)	25	DGEQRT nagf_lapack_dgeqrt Performs a QR factorization of real general rectangular matrix, with explicit blocking
F08ACF (DGEMQRT)	25	DGEMQRT nagf_lapack_dgemqrt Applies the orthogonal transformation determined by F08ABF (DGEQRT)
F08AEF (DGEQRF)	16	DGEQRF nagf_lapack_dgeqrf Performs a QR factorization of real general rectangular matrix
F08AFF (DORGQR)	16	DORGQR nagf_lapack_dorgqr Forms all or part of orthogonal Q from QR factorization determined by F08AEF (DGEQRF), F08BEF (DGEQPF) or F08BFF (DGEQP3)
F08AGF (DORMQR)	16	DORMQR nagf_lapack_dormqr Applies an orthogonal transformation determined by F08AEF (DGEQRF), F08BEF (DGEQPF) or F08BFF (DGEQP3)
F08AHF (DGELQF)	16	DGELQF nagf_lapack_dgelqf Performs a LQ factorization of real general rectangular matrix
F08AJF (DORGLQ)	16	DORGLQ nagf_lapack_dorglq Forms all or part of orthogonal Q from LQ factorization determined by F08AHF (DGELQF)
F08AKF (DORMLQ)	16	DORMLQ nagf_lapack_dormlq Applies the orthogonal transformation determined by F08AHF (DGELQF)
F08ANF (ZGELS)	21	ZGELS nagf_lapack_zgels Solves a complex linear least problem of full rank
F08APF (ZGEQRT)	25	ZGEQRT nagf_lapack_zgeqrt Performs a QR factorization of complex general rectangular matrix using recursive algorithm
F08AQF (ZGEMQRT)	25	ZGEMQRT nagf_lapack_zgemqrt Applies the unitary transformation determined by F08APF (ZGEQRT)

F08ASF (ZGEQRF)	16	ZGEQRF nagf_lapack_zgeqrf Performs a QR factorization of complex general rectangular matrix
F08ATF (ZUNGQR)	16	ZUNGQR nagf_lapack_zungqr Forms all or part of unitary Q from QR factorization determined by F08ASF (ZGEQRF), F08BSF (ZGEQPF) or F08BTF (ZGEQP3)
F08AUF (ZUNMQR)	16	ZUNMQR nagf_lapack_zunmqr Applies a unitary transformation determined by F08ASF (ZGEQRF), F08BSF (ZGEQPF) or F08BTF (ZGEQP3)
F08AVF (ZGELQF)	16	ZGELQF nagf_lapack_zgelqf Performs a LQ factorization of complex general rectangular matrix
F08AWF (ZUNGLQ)	16	ZUNGLQ nagf_lapack_zunglq Forms all or part of unitary Q from LQ factorization determined by F08AVF (ZGELQF)
F08AXF (ZUNMLQ)	16	ZUNMLQ nagf_lapack_zunmlq Applies the unitary transformation determined by F08AVF (ZGELQF)
F08BAF (DGELSY)	21	DGELSY nagf_lapack_dgelsy Computes the minimum-norm solution to a real linear least squares problem
F08BBF (DTPQRT)	25	DTPQRT nagf_lapack_dtpqrt QR factorization of real general triangular-pentagonal matrix
F08BCF (DTPMQRT)	25	DTPMQRT nagf_lapack_dtpmqrt Applies the orthogonal transformation determined by F08BBF (DTPQRT)
F08BEF (DGEQPF)	16	DGEQPF nagf_lapack_dgeqpf QR factorization, with column pivoting, of real general rectangular matrix
F08BFF (DGEQP3)	21	DGEQP3 nagf_lapack_dgeqp3 QR factorization, with column pivoting, using BLAS-3, of real general rectangular matrix
F08BHF (DTZRZF)	21	DTZRZF nagf_lapack_dtzrzf Reduces a real upper trapezoidal matrix to upper triangular form
F08BKF (DORMRZ)	21	DORMRZ nagf_lapack_dormrz Applies the orthogonal transformation determined by F08BHF (DTZRZF)
F08BNF (ZGELSY)	21	ZGELSY nagf_lapack_zgelsy Computes the minimum-norm solution to a complex linear least squares problem
F08BPF (ZTPQRT)	25	ZTPQRT nagf_lapack_ztpqrt QR factorization of complex triangular-pentagonal matrix

F08BQF (ZTPMQRT)	25	ZTPMQRT nagf_lapack_ztpmqrt Applies the unitary transformation determined by F08BPF (ZTPQRT)
F08BSF (ZGEQPF)	16	ZGEQPF nagf_lapack_zgeqpf QR factorization, with column pivoting, of complex general rectangular matrix
F08BTF (ZGEQP3)	21	ZGEQP3 nagf_lapack_zgeqp3 QR factorization, with column pivoting, using BLAS-3, of complex general rectangular matrix
F08BVF (ZTZRZF)	21	ZTZRZF nagf_lapack_ztzrzf Reduces a complex upper trapezoidal matrix to upper triangular form
F08BXF (ZUNMRZ)	21	ZUNMRZ nagf_lapack_zunmrz Applies the unitary transformation determined by F08BVF (ZTZRZF)
F08CEF (DGEQLF)	21	DGEQLF nagf_lapack_dgeqlf QL factorization of real general rectangular matrix
F08CFF (DORGQL)	21	DORGQL nagf_lapack_dorgql Form all or part of orthogonal Q from QL factorization determined by F08CEF (DGEQLF)
F08CGF (DORMQL)	21	DORMQL nagf_lapack_dormql Applies the orthogonal transformation determined by F08CEF (DGEQLF)
F08CHF (DGERQF)	21	DGERQF nagf_lapack_dgerqf RQ factorization of real general rectangular matrix
F08CJF (DORGRQ)	21	DORGRQ nagf_lapack_dorgrq Form all or part of orthogonal Q from RQ factorization determined by F08CHF (DGERQF)
F08CKF (DORMRQ)	21	DORMRQ nagf_lapack_dormrq Applies the orthogonal transformation determined by F08CHF (DGERQF)
F08CSF (ZGEQLF)	21	ZGEQLF nagf_lapack_zgeqlf QL factorization of complex general rectangular matrix
F08CTF (ZUNGQL)	21	ZUNGQL nagf_lapack_zungql Form all or part of unitary Q from QL factorization determined by F08CSF (ZGEQLF)
F08CUF (ZUNMQL)	21	ZUNMQL nagf_lapack_zunmql Applies the unitary transformation determined by F08CSF (ZGEQLF)
F08CVF (ZGERQF)	21	ZGERQF nagf_lapack_zgerqf RQ factorization of complex general rectangular matrix

F08CWF (ZUNGRQ)	21	ZUNGRQ nagf_lapack_zungrq Form all or part of unitary Q from RQ factorization determined by F08CVF (ZGERQF)
F08CXF (ZUNMRQ)	21	ZUNMRQ nagf_lapack_zunmrq Applies the unitary transformation determined by F08CVF (ZGERQF)
F08FAF (DSYEV)	21	DSYEV nagf_lapack_dsyev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix
F08FBF (DSYEVX)	21	DSYEVX nagf_lapack_dsyevx Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix
F08FCF (DSYEVD)	19	DSYEVD nagf_lapack_dsyevd Computes all eigenvalues and, optionally, all eigenvectors of real symmetric matrix (divide-and-conquer)
F08FDF (DSYEVR)	21	DSYEVR nagf_lapack_dsyevr Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix (Relatively Robust Representations)
F08FEF (DSYTRD)	16	DSYTRD nagf_lapack_dsytrd Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form
F08FFF (DORGTR)	16	DORGTR nagf_lapack_dorgtr Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08FEF (DSYTRD)
F08FGF (DORMTR)	16	DORMTR nagf_lapack_dormtr Applies the orthogonal transformation determined by F08FEF (DSYTRD)
F08FLF (DDISNA)	21	DDISNA nagf_lapack_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
F08FNF (ZHEEV)	21	ZHEEV nagf_lapack_zheev Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
F08FPF (ZHEEVX)	21	ZHEEVX nagf_lapack_zheevx Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
F08FQF (ZHEEVD)	19	ZHEEVD nagf_lapack_zheevd Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian matrix (divide-and-conquer)
F08FRF (ZHEEVR)	21	ZHEEVR nagf_lapack_zheevr Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix (Relatively Robust Representations)

F08FSF (ZHETRD)	16	ZHETRD nagf_lapack_zhetrd Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form
F08FTF (ZUNGTR)	16	ZUNGTR nagf_lapack_zungtr Generate unitary transformation matrix from reduction to tridiagonal form determined by F08FSF (ZHETRD)
F08FUF (ZUNMTR)	16	ZUNMTR nagf_lapack_zunmtr Applies the unitary transformation matrix determined by F08FSF (ZHETRD)
F08GAF (DSPEV)	21	DSPEV nagf_lapack_dspev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage
F08GBF (DSPEVX)	21	DSPEVX nagf_lapack_dspevx Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage
F08GCF (DSPEVD)	19	DSPEVD nagf_lapack_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)
F08GEF (DSPTRD)	16	DSPTRD nagf_lapack_dsptrd Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form, packed storage
F08GFF (DOPGTR)	16	DOPGTR nagf_lapack_dopgtr Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08GEF (DSPTRD)
F08GGF (DOPMTR)	16	DOPMTR nagf_lapack_dopmtr Applies the orthogonal transformation determined by F08GEF (DSPTRD)
F08GNF (ZHPEV)	21	ZHPEV nagf_lapack_zhpev Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
F08GPF (ZHPEVX)	21	ZHPEVX nagf_lapack_zhpevx Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
F08GQF (ZHPEVD)	19	ZHPEVD nagf_lapack_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)
F08GSF (ZHPTRD)	16	ZHPTRD nagf_lapack_zhptrd Performs a unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form, packed storage
F08GTF (ZUPGTR)	16	ZUPGTR nagf_lapack_zupgtr Generates a unitary transformation matrix from reduction to tridiagonal form determined by F08GSF (ZHPTRD)

F08GUF (ZUPMTR)	16	ZUPMTR nagf_lapack_zupmtr Applies the unitary transformation matrix determined by F08GSF (ZHPTRD)
F08HAF (DSBEV)	21	DSBEV nagf_lapack_dsbev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
F08HBF (DSBEVX)	21	DSBEVX nagf_lapack_dsbevx Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
F08HCF (DSBEVD)	19	DSBEVD nagf_lapack_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)
F08HEF (DSBTRD)	16	DSBTRD nagf_lapack_dsbtrd Performs an orthogonal reduction of real symmetric band matrix to symmetric tridiagonal form
F08HNF (ZHBEV)	21	ZHBEV nagf_lapack_zhbev Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix
F08HPF (ZHBEVX)	21	ZHBEVX nagf_lapack_zhbevx Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix
F08HQF (ZHBEVD)	19	ZHBEVD nagf_lapack_zhbevd Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian band matrix (divide-and-conquer)
F08HSF (ZHBTRD)	16	ZHBTRD nagf_lapack_zhbtrd Performs a unitary reduction of complex Hermitian band matrix to real symmetric tridiagonal form
F08JAF (DSTEV)	21	DSTEV nagf_lapack_dstev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix
F08JBF (DSTEVX)	21	DSTEVX nagf_lapack_dstevx Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix
F08JCF (DSTEVD)	19	DSTEVD nagf_lapack_dstevd Computes all eigenvalues and, optionally, all eigenvectors of real symmetric tridiagonal matrix (divide-and-conquer)
F08JDF (DSTEVR)	21	DSTEVR nagf_lapack_dstevr Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix (Relatively Robust Representations)
F08JEF (DSTEQR)	16	DSTEQR nagf_lapack_dsteqr Computes all eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from real symmetric matrix using the implicit QL or QR algorithm

F08JFF (DSTERF)	16	DSTERF nagf_lapack_dsterf Computes all eigenvalues of real symmetric tridiagonal matrix, root-free variant of the QL or QR algorithm
F08JGF (DPTEQR)	16	DPTEQR nagf_lapack_dpteqr Computes all eigenvalues and eigenvectors of real symmetric positive definite tridiagonal matrix, reduced from real symmetric positive definite matrix
F08JHF (DSTEDC)	21	DSTEDC nagf_lapack_dstedc Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix or a matrix reduced to this form (divide-and-conquer)
F08JJF (DSTEBZ)	16	DSTEBZ nagf_lapack_dstebz Computes selected eigenvalues of real symmetric tridiagonal matrix by bisection
F08JKF (DSTEIN)	16	DSTEIN nagf_lapack_dstein Computes selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in real array
F08JLF (DSTEGR)	21	DSTEGR nagf_lapack_dstegr Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix or a symmetric matrix reduced to this form (Relatively Robust Representations)
F08JSF (ZSTEQR)	16	ZSTEQR nagf_lapack_zsteqr Computes all eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from complex Hermitian matrix, using the implicit QL or QR algorithm
F08JUF (ZPTEQR)	16	ZPTEQR nagf_lapack_zpteqr Computes all eigenvalues and eigenvectors of real symmetric positive definite tridiagonal matrix, reduced from complex Hermitian positive definite matrix
F08JVF (ZSTEDC)	21	ZSTEDC nagf_lapack_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)
F08JXF (ZSTEIN)	16	ZSTEIN nagf_lapack_zstein Computes selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in complex array
F08JYF (ZSTEGR)	21	ZSTEGR nagf_lapack_zstegr Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix or a complex Hermitian matrix reduced to this form (Relatively Robust Representations)
F08KAF (DGELSS)	21	DGELSS nagf_lapack_dgelss Computes the minimum-norm solution to a real linear least squares problem using singular value decomposition

F08KBF (DGESVD)	21	DGESVD nagf_lapack_dgesvd Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors
F08KCF (DGELSD)	21	DGELSD nagf_lapack_dgelsd Computes the minimum-norm solution to a real linear least squares problem using singular value decomposition (divide-and-conquer)
F08KDF (DGESDD)	21	DGESDD nagf_lapack_dgesdd Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors (divide-and-conquer)
F08KEF (DGEBRD)	16	DGEBRD nagf_lapack_dgebrd Performs an orthogonal reduction of real general rectangular matrix to bidiagonal form
F08KFF (DORGBR)	16	DORGBR nagf_lapack_dorgbr Generates an orthogonal transformation matrices from reduction to bidiagonal form determined by F08KEF (DGEBRD)
F08KGF (DORMBR)	16	DORMBR nagf_lapack_dormbr Applies the orthogonal transformations from reduction to bidiagonal form determined by F08KEF (DGEBRD)
F08KHF (DGEJSV)	23	DGEJSV nagf_lapack_dgejsv Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors (preconditioned Jacobi)
F08KJF (DGESVJ)	23	DGESVJ nagf_lapack_dgesvj Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors (fast Jacobi)
F08KNF (ZGELSS)	21	ZGELSS nagf_lapack_zgelss Computes the minimum-norm solution to a complex linear least squares problem using singular value decomposition
F08KPF (ZGESVD)	21	ZGESVD nagf_lapack_zgesvd Computes the singular value decomposition of a complex matrix, optionally computing the left and/or right singular vectors
F08KQF (ZGELSD)	21	ZGELSD nagf_lapack_zgelsd Computes the minimum-norm solution to a complex linear least squares problem using singular value decomposition (divide-and-conquer)
F08KRF (ZGESDD)	21	ZGESDD nagf_lapack_zgesdd Computes the singular value decomposition of a complex matrix, optionally computing the left and/or right singular vectors (divide-and-conquer)

F08KSF (ZGEBRD)	16	ZGEBRD nagf_lapack_zgebrd Performs a unitary reduction of complex general rectangular matrix to bidiagonal form
F08KTF (ZUNGBR)	16	ZUNGBR nagf_lapack_zungbr Generates unitary transformation matrices from the reduction to bidiagonal form determined by F08KSF (ZGEBRD)
F08KUF (ZUNMBR)	16	ZUNMBR nagf_lapack_zunmbr Applies the unitary transformations from reduction to bidiagonal form determined by F08KSF (ZGEBRD)
F08LEF (DGBBRD)	19	DGBBRD nagf_lapack_dgbbrd Performs a reduction of real rectangular band matrix to upper bidiagonal form
F08LSF (ZGBBRD)	19	ZGBBRD nagf_lapack_zgbbrd Reduction of complex rectangular band matrix to upper bidiagonal form
F08MDF (DBDSDC)	21	DBDSDC nagf_lapack_dbdsdc Computes the singular value decomposition of a real bidiagonal matrix, optionally computing the singular vectors (divide-and-conquer)
F08MEF (DBDSQR)	16	DBDSQR nagf_lapack_dbdsqr Performs an SVD of real bidiagonal matrix reduced from real general matrix
F08MSF (ZBDSQR)	16	ZBDSQR nagf_lapack_zbdsqr Performs an SVD of real bidiagonal matrix reduced from complex general matrix
F08NAF (DGEEV)	21	DGEEV nagf_lapack_dgeev Computes all eigenvalues and, optionally, left and/or right eigenvectors of a real nonsymmetric matrix
F08NBF (DGEEVX)	21	DGEEVX nagf_lapack_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
F08NEF (DGEHRD)	16	DGEHRD nagf_lapack_dgehrd Performs an orthogonal reduction of real general matrix to upper Hessenberg form
F08NFF (DORGHR)	16	DORGHR nagf_lapack_dorghr Generates an orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (DGEHRD)
F08NGF (DORMHR)	16	DORMHR nagf_lapack_dormhr Applies the orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (DGEHRD)
F08NHF (DGEBAL)	16	DGEBAL nagf_lapack_dgebal Balances a real general matrix

F08NJF (DGEBAK)	16	DGEBAK nagf_lapack_dgebak Transforms eigenvectors of real balanced matrix to those of original matrix supplied to F08NHF (DGEBAL)
F08NNF (ZGEEV)	21	ZGEEV nagf_lapack_zgeev Computes all eigenvalues and, optionally, left and/or right eigenvectors of a complex nonsymmetric matrix
F08NPF (ZGEEVX)	21	ZGEEVX nagf_lapack_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
F08NSF (ZGEHRD)	16	ZGEHRD nagf_lapack_zgehrd Performs a unitary reduction of complex general matrix to upper Hessenberg form
F08NTF (ZUNGHR)	16	ZUNGHR nagf_lapack_zunghr Generates a unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (ZGEHRD)
F08NUF (ZUNMHR)	16	ZUNMHR nagf_lapack_zunmhr Applies the unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (ZGEHRD)
F08NVF (ZGEBAL)	16	ZGEBAL nagf_lapack_zgebal Balances a complex general matrix
F08NWF (ZGEBAK)	16	ZGEBAK nagf_lapack_zgebak Transforms eigenvectors of complex balanced matrix to those of original matrix supplied to F08NVF (ZGEBAL)
F08PAF (DGEES)	21	DGEES nagf_lapack_dgees Computes for real square nonsymmetric matrix, the eigenvalues, the real Schur form, and, optionally, the matrix of Schur vectors
F08PBF (DGEESX)	21	DGEESX nagf_lapack_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
F08PEF (DHSEQR)	16	DHSEQR nagf_lapack_dhseqr Computes the eigenvalues and Schur factorization of real upper Hessenberg matrix reduced from real general matrix
F08PKF (DHSEIN)	16	DHSEIN nagf_lapack_dhsein Computes selected right and/or left eigenvectors of real upper Hessenberg matrix by inverse iteration
F08PNF (ZGEES)	21	ZGEES nagf_lapack_zgees Computes for complex square nonsymmetric matrix, the eigenvalues, the Schur form, and, optionally, the matrix of Schur vectors

F08PPF (ZGEESX)	21	ZGEESX nagf_lapack_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
F08PSF (ZHSEQR)	16	ZHSEQR nagf_lapack_zhseqr Computes the eigenvalues and Schur factorization of complex upper Hessenberg matrix reduced from complex general matrix
F08PXF (ZHSEIN)	16	ZHSEIN nagf_lapack_zhsein Computes selected right and/or left eigenvectors of complex upper Hessenberg matrix by inverse iteration
F08QFF (DTREXC)	16	DTREXC nagf_lapack_dtrexc Reorders a Schur factorization of real matrix using orthogonal similarity transformation
F08QGF (DTRSEN)	16	DTRSEN nagf_lapack_dtrsen Reorders a Schur factorization of real matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
F08QHF (DTRSYL)	16	DTRSYL nagf_lapack_dtrsyl Solves the real Sylvester matrix equation $AX + XB = C$, A and B are upper quasi-triangular or transposes
F08QKF (DTREVC)	16	DTREVC nagf_lapack_dtrevc Computes left and right eigenvectors of real upper quasi-triangular matrix
F08QLF (DTRSNA)	16	DTRSNA nagf_lapack_dtrsna Computes estimates of sensitivities of selected eigenvalues and eigenvectors of real upper quasi-triangular matrix
F08QTF (ZTREXC)	16	ZTREXC nagf_lapack_ztrexc Reorders a Schur factorization of complex matrix using unitary similarity transformation
F08QUF (ZTRSEN)	16	ZTRSEN nagf_lapack_ztrsen Reorders a Schur factorization of complex matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
F08QVF (ZTRSYL)	16	ZTRSYL nagf_lapack_ztrsyl Solves the complex Sylvester matrix equation $AX + XB = C$, A and B are upper triangular or conjugate-transposes
F08QXF (ZTREVC)	16	ZTREVC nagf_lapack_ztrevc Computes left and right eigenvectors of complex upper triangular matrix
F08QYF (ZTRSNA)	16	ZTRSNA nagf_lapack_ztrsna Computes estimates of sensitivities of selected eigenvalues and eigenvectors of complex upper triangular matrix

F08RAF (DORCSD)	25	DORCSD nagf_lapack_dorcsd Computes the CS decomposition of an orthogonal matrix partitioned into four real submatrices
F08RNF (ZUNCSD)	25	ZUNCSD nagf_lapack_zuncsd Computes the CS decomposition of a unitary matrix partitioned into four complex submatrices
F08SAF (DSYGV)	21	DSYGV nagf_lapack_dsygv Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
F08SBF (DSYGVX)	21	DSYGVX nagf_lapack_dsygvx Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
F08SCF (DSYGVD)	21	DSYGVD nagf_lapack_dsygvd Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem (divide-and-conquer)
F08SEF (DSYGST)	16	DSYGST nagf_lapack_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 F07FDF (DPOTRF)
F08SNF (ZHEGV)	21	ZHEGV nagf_lapack_zhegv Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem
F08SPF (ZHEGVX)	21	ZHEGVX nagf_lapack_zhegvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem
F08SQF (ZHEGVD)	21	ZHEGVD nagf_lapack_zhegvd Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem (divide-and-conquer)
F08SSF (ZHEGST)	16	ZHEGST nagf_lapack_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 F07FRF (ZPOTRF)
F08TAF (DSPGV)	21	DSPGV nagf_lapack_dspgv Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage
F08TBF (DSPGVX)	21	DSPGVX nagf_lapack_dspgvx Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage

F08TCF (DSPGVD)	21	DSPGVD nagf_lapack_dspgvd Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage (divide-and-conquer)
F08TEF (DSPGST)	16	DSPGST nagf_lapack_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 F07GDF (DPPTRF)
F08TNF (ZHPGV)	21	ZHPGV nagf_lapack_zhpgv Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage
F08TPF (ZHPGVX)	21	ZHPGVX nagf_lapack_zhpgvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage
F08TQF (ZHPGVD)	21	ZHPGVD nagf_lapack_zhpgvd Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage (divide-and-conquer)
F08TSF (ZHPGST)	16	ZHPGST nagf_lapack_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 F07GRF (ZPPTRF)
F08UAF (DSBGV)	21	DSBGV nagf_lapack_dsbgv Computes all the eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
F08UBF (DSBGVX)	21	DSBGVX nagf_lapack_dsbgvx Computes selected eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
F08UCF (DSBGVD)	21	DSBGVD nagf_lapack_dsbgvd Computes all the eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem (divide-and-conquer)
F08UEF (DSBGST)	19	DSBGST nagf_lapack_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
F08UFF (DPBSTF)	19	DPBSTF nagf_lapack_dpbstf Computes a split Cholesky factorization of real symmetric positive definite band matrix A

F08UNF (ZHBGV)	21	ZHBGV nagf_lapack_zhbgv Computes all the eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem
F08UPF (ZHBGVX)	21	ZHBGVX nagf_lapack_zhbgvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem
F08UQF (ZHBGVD)	21	ZHBGVD nagf_lapack_zhbgvd Computes all the eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem (divide-and-conquer)
F08USF (ZHBGST)	19	ZHBGST nagf_lapack_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
F08UTF (ZPBSTF)	19	ZPBSTF nagf_lapack_zpbstf Computes a split Cholesky factorization of complex Hermitian positive definite band matrix A
F08VAF (DGGSVD)	21	DGGSVD nagf_lapack_dggsvd Computes the generalized singular value decomposition of a real matrix pair
F08VEF (DGGSVP)	21	DGGSVP nagf_lapack_dggsvp Produces orthogonal matrices that simultaneously reduce the m by n matrix A and the p by n matrix B to upper triangular form
F08VNF (ZGGSVD)	21	ZGGSVD nagf_lapack_zggsvd Computes the generalized singular value decomposition of a complex matrix pair
F08VSF (ZGGSVP)	21	ZGGSVP nagf_lapack_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
F08WAF (DGGEV)	21	DGGEV nagf_lapack_dggev Computes, for a real nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
F08WBF (DGGEVX)	21	DGGEVX nagf_lapack_dggevx 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
F08WEF (DGGHRD)	20	DGGHRD nagf_lapack_dgghrd Performs an orthogonal reduction of a pair of real general matrices to generalized upper Hessenberg form

F08WHF (DGGBAL)	20	DGGBAL nagf_lapack_dggbal Balances a pair of real, square, matrices
F08WJF (DGGBAK)	20	DGGBAK nagf_lapack_dggbak Transforms eigenvectors of a pair of real balanced matrices to those of original matrix pair supplied to F08WHF (DGGBAL)
F08WNF (ZGGEV)	21	ZGGEV nagf_lapack_zggev Computes, for a complex nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
F08WPF (ZGGEVX)	21	ZGGEVX nagf_lapack_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
F08WSF (ZGGHRD)	20	ZGGHRD nagf_lapack_zgghrd Performs a unitary reduction of a pair of complex general matrices to generalized upper Hessenberg form
F08WVF (ZGGBAL)	20	ZGGBAL nagf_lapack_zggbal Balances a pair of complex, square, matrices
F08WWF (ZGGBAK)	20	ZGGBAK nagf_lapack_zggbak Transforms eigenvectors of a pair of complex balanced matrices to those of original matrix pair supplied to F08WVF (ZGGBAL)
F08XAF (DGGES)	21	DGGES nagf_lapack_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
F08XBF (DGGESX)	21	DGGESX nagf_lapack_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
F08XEF (DHGEQZ)	20	DHGEQZ nagf_lapack_dhgeqz Computes eigenvalues and generalized Schur factorization of real generalized upper Hessenberg form reduced from a pair of real general matrices
F08XNF (ZGGES)	21	ZGGES nagf_lapack_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

F08XPF (ZGGESX)	21	ZGGESX nagf_lapack_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
F08XSF (ZHGEQZ)	20	ZHGEQZ nagf_lapack_zhgeqz Eigenvalues and generalized Schur factorization of complex generalized upper Hessenberg form reduced from a pair of complex, square, matrices
F08YEF (DTGSJA)	21	DTGSJA nagf_lapack_dtgsja Computes the generalized singular value decomposition of a real upper triangular (or trapezoidal) matrix pair
F08YFF (DTGEXC)	21	DTGEXC nagf_lapack_dtgexc Reorders the generalized real Schur decomposition of a real matrix pair using an orthogonal equivalence transformation
F08YGF (DTGSEN)	21	DTGSEN nagf_lapack_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
F08YHF (DTGSYL)	21	DTGSYL nagf_lapack_dtgsyl Solves the real-valued, generalized, quasi-trangular, Sylvester equation
F08YKF (DTGEVC)	20	DTGEVC nagf_lapack_dtgevc Computes right and left generalized eigenvectors of the matrix pair (A, B)) which is assumed to be in generalized upper Schur form
F08YLF (DTGSNA)	21	DTGSNA nagf_lapack_dtgsna Estimates reciprocal condition numbers for specified eigenvalues and/or eigenvectors of a real matrix pair in generalized real Schur canonical form
F08YSF (ZTGSJA)	21	ZTGSJA nagf_lapack_ztgsja Computes the generalized singular value decomposition of a complex upper triangular (or trapezoidal) matrix pair
F08YTF (ZTGEXC)	21	ZTGEXC nagf_lapack_ztgexc Reorders the generalized Schur decomposition of a complex matrix pair using an unitary equivalence transformation
F08YUF (ZTGSEN)	21	ZTGSEN nagf_lapack_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
F08YVF (ZTGSYL)	21	ZTGSYL nagf_lapack_ztgsyl Solves the complex generalized Sylvester equation

F08YXF (ZTGEVC)	20	ZTGEVC nagf_lapack_ztgevc Computes left and right eigenvectors of a pair of complex upper triangular matrices
F08YYF (ZTGSNA)	21	ZTGSNA nagf_lapack_ztgsna Estimates reciprocal condition numbers for specified eigenvalues and/or eigenvectors of a complex matrix pair in generalized Schur canonical form
F08ZAF (DGGLSE)	21	DGGLSE nagf_lapack_dgglse Solves the real linear equality-constrained least squares (LSE) problem
F08ZBF (DGGGLM)	21	DGGGLM nagf_lapack_dggglm Solves a real general Gauss–Markov linear model (GLM) problem
F08ZEF (DGGQRF)	21	DGGQRF nagf_lapack_dggqrf Computes a generalized QR factorization of a real matrix pair
F08ZFF (DGGRQF)	21	DGGRQF nagf_lapack_dggrqf Computes a generalized RQ factorization of a real matrix pair
F08ZNF (ZGGLSE)	21	ZGGLSE nagf_lapack_zgglse Solves the complex linear equality-constrained least squares (LSE) problem
F08ZPF (ZGGGLM)	21	ZGGGLM nagf_lapack_zggglm Solves a complex general Gauss–Markov linear model (GLM) problem
F08ZSF (ZGGQRF)	21	ZGGQRF nagf_lapack_zggqrf Computes a generalized QR factorization of a complex matrix pair
F08ZTF (ZGGRQF)	21	ZGGRQF nagf_lapack_zggrqf Computes a generalized RQ factorization of a complex matrix pair