NAG Library Chapter Contents

F08 – Least Squares and Eigenvalue Problems (LAPACK)

F08 Chapter Introduction

Routine Name	Mark of Introduction	Purpose
F08AAF	21	DGELS nagf_lapack_dgels Solves an overdetermined or underdetermined real linear system
F08AEF	16	DGEQRF nagf_lapack_dgeqrf QR factorization of real general rectangular matrix
F08AFF	16	DORGQR nagf_lapack_dorgqr Form all or part of orthogonal Q from QR factorization determined by F08AEF (DGEQRF), F08BEF (DGEQPF) or F08BFF (DGEQP3)
F08AGF	16	DORMQR nagf_lapack_dormqr Apply orthogonal transformation determined by F08AEF (DGEQRF), F08BEF (DGEQPF) or F08BFF (DGEQP3)
F08AHF	16	DGELQF nagf_lapack_dgelqf LQ factorization of real general rectangular matrix
F08AJF	16	DORGLQ nagf_lapack_dorglq Form all or part of orthogonal Q from LQ factorization determined by F08AHF (DGELQF)
F08AKF	16	DORMLQ nagf_lapack_dormlq Apply orthogonal transformation determined by F08AHF (DGELQF)
F08ANF	21	ZGELS nagf_lapack_zgels Solves an overdetermined or underdetermined complex linear system
F08ASF	16	ZGEQRF nagf_lapack_zgeqrf QR factorization of complex general rectangular matrix
F08ATF	16	ZUNGQR nagf_lapack_zungqr Form all or part of unitary Q from QR factorization determined by F08ASF (ZGEQRF), F08BSF (ZGEQPF) or F08BTF (ZGEQP3)
F08AUF	16	ZUNMQR nagf_lapack_zunmqr Apply unitary transformation determined by F08ASF (ZGEQRF), F08BSF (ZGEQPF) or F08BTF (ZGEQP3)

F08AVF	16	ZGELQF nagf_lapack_zgelqf LQ factorization of complex general rectangular matrix
F08AWF	16	ZUNGLQ nagf_lapack_zunglq Form all or part of unitary Q from LQ factorization determined by F08AVF (ZGELQF)
F08AXF	16	ZUNMLQ nagf_lapack_zunmlq Apply unitary transformation determined by F08AVF (ZGELQF)
F08BAF	21	DGELSY nagf_lapack_dgelsy Computes the minimum-norm solution to a real linear least squares problem
F08BEF	16	DGEQPF nagf_lapack_dgeqpf QR factorization of real general rectangular matrix with column pivoting
F08BFF	21	DGEQP3 nagf_lapack_dgeqp3 QR factorization of real general rectangular matrix with column pivoting, using BLAS-3
F08BHF	21	DTZRZF nagf_lapack_dtzrzf Reduces a real upper trapezoidal matrix to upper triangular form
F08BKF	21	DORMRZ nagf_lapack_dormrz Apply orthogonal transformation determined by F08BHF (DTZRZF)
F08BNF	21	ZGELSY nagf_lapack_zgelsy Computes the minimum-norm solution to a complex linear least squares problem
F08BSF	16	ZGEQPF nagf_lapack_zgeqpf QR factorization of complex general rectangular matrix with column pivoting
F08BTF	21	ZGEQP3 nagf_lapack_zgeqp3 QR factorization of complex general rectangular matrix with column pivoting, using BLAS-3
F08BVF	21	ZTZRZF nagf_lapack_ztzrzf Reduces a complex upper trapezoidal matrix to upper triangular form
F08BXF	21	ZUNMRZ nagf_lapack_zunmrz Apply unitary transformation determined by F08BVF (ZTZRZF)
F08CEF	21	DGEQLF nagf_lapack_dgeqlf QL factorization of real general rectangular matrix
F08CFF	21	DORGQL nagf_lapack_dorgql Form all or part of orthogonal Q from QL factorization determined by F08CEF (DGEQLF)

F08CGF	21	DORMQL nagf_lapack_dormql Apply orthogonal transformation determined by F08CEF (DGEQLF)
F08CHF	21	DGERQF nagf_lapack_dgerqf RQ factorization of real general rectangular matrix
F08CJF	21	DORGRQ nagf_lapack_dorgrq Form all or part of orthogonal Q from RQ factorization determined by F08CHF (DGERQF)
F08CKF	21	DORMRQ nagf_lapack_dormrq Apply orthogonal transformation determined by F08CHF (DGERQF)
F08CSF	21	ZGEQLF nagf_lapack_zgeqlf QL factorization of complex general rectangular matrix
F08CTF	21	ZUNGQL nagf_lapack_zungql Form all or part of orthogonal Q from QL factorization determined by F08CSF (ZGEQLF)
F08CUF	21	ZUNMQL nagf_lapack_zunmql Apply unitary transformation determined by F08CSF (ZGEQLF)
F08CVF	21	ZGERQF nagf_lapack_zgerqf RQ factorization of complex general rectangular matrix
F08CWF	21	ZUNGRQ nagf_lapack_zungrq Form all or part of orthogonal Q from RQ factorization determined by F08CVF (ZGERQF)
F08CXF	21	ZUNMRQ nagf_lapack_zunmrq Apply unitary transformation determined by F08CVF (ZGERQF)
F08FAF	21	DSYEV nagf_lapack_dsyev Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix
F08FBF	21	DSYEVX nagf_lapack_dsyevx Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix
F08FCF	19	DSYEVD nagf_lapack_dsyevd Computes all eigenvalues and, optionally, all eigenvectors of real symmetric matrix (divide-and-conquer)
F08FDF	21	DSYEVR nagf_lapack_dsyevr Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix (Relatively Robust Representations)
F08FEF	16	DSYTRD nagf_lapack_dsytrd Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form

F08FFF	16	DORGTR
		nagf_lapack_dorgtr
		Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08FEF (DSYTRD)
F08FGF	16	DORMTR
		nagf_lapack_dormtr
		Apply orthogonal transformation determined by F08FEF (DSYTRD)
F08FLF	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	21	ZHEEV
		nagf_lapack_zheev
		Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
F08FPF	21	ZHEEVX
		nagf_lapack_zheevx
		Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
F08FQF	19	ZHEEVD
		nagf_lapack_zheevd
		Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian matrix (divide-and-conquer)
F08FRF	21	ZHEEVR
		nagf_lapack_zheevr
		Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix (Relatively Robust Representations)
F08FSF	16	ZHETRD
		nagf_lapack_zhetrd
		Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form
F08FTF	16	ZUNGTR
		nagf_lapack_zungtr
		Generate unitary transformation matrix from reduction to tridiagonal form determined by F08FSF (ZHETRD)
F08FUF	16	ZUNMTR
		nagf_lapack_zunmtr
		Apply unitary transformation matrix determined by F08FSF (ZHETRD)
F08GAF	21	DSPEV
		nagf_lapack_dspev
		Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage
F08GBF	21	DSPEVX
		nagf_lapack_dspevx
		Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage
F08GCF	19	DSPEVD
		nagf_lapack_dspevd
		Computes all eigenvalues and, optionally, all eigenvectors of real symmetric matrix, packed storage (divide-and-conquer)

F08GEF	16	DSPTRD
		nagf_lapack_dsptrd
		Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form, packed storage
F08GFF	16	DOPGTR
		nagf_lapack_dopgtr
		Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08GEF (DSPTRD)
F08GGF	16	DOPMTR
		nagf_lapack_dopmtr
		Apply orthogonal transformation determined by F08GEF (DSPTRD)
F08GNF	21	ZHPEV
		nagf_lapack_zhpev
		Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
F08GPF	21	ZHPEVX
		nagf_lapack_zhpevx
		Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
F08GQF	19	ZHPEVD
		nagf_lapack_zhpevd
		Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian matrix, packed storage (divide-and-conquer)
F08GSF	16	ZHPTRD
		nagf_lapack_zhptrd
		Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form, packed storage
F08GTF	16	ZUPGTR
		nagf_lapack_zupgtr
		Generate unitary transformation matrix from reduction to tridiagonal form determined by F08GSF (ZHPTRD)
F08GUF	16	ZUPMTR
		nagf_lapack_zupmtr
		Apply unitary transformation matrix determined by F08GSF (ZHPTRD)
F08HAF	21	DSBEV
		nagf_lapack_dsbev
		Computes all eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
F08HBF	21	DSBEVX
		nagf_lapack_dsbevx
		Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
F08HCF	19	DSBEVD
		nagf_lapack_dsbevd
		Computes all eigenvalues and, optionally, all eigenvectors of real symmetric band matrix (divide-and-conquer)
F08HEF	16	DSBTRD
		nagf_lapack_dsbtrd
		Orthogonal reduction of real symmetric band matrix to symmetric tridiagonal form

F08HNF	21	ZHBEV
		nagf_lapack_zhbev
		Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix

F08HPF	21	ZHBEVX
		nagf_lapack_zhbevx
		Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix

F08HQF	19	ZHBEVD
		nagf_lapack_zhbevd
		Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian band matrix (divide-and-conquer)

F08HSF	16	ZHBTRD
		nagf_lapack_zhbtrd
		Unitary reduction of complex Hermitian band matrix to real symmetric tridiagonal form

F08JAF	21	DSTEV
		nagf_lapack_dstev
		Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix

F08JBF	21	DSTEVX
		nagf_lapack_dstevx
		Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix

F08JCF	19	DSTEVD
		nagf_lapack_dstevd
		Computes all eigenvalues and, optionally, all eigenvectors of real symmetric tridiagonal matrix (divide-and-conquer)

F08JDF	21	DSTEVR
		nagf_lapack_dstevr
		Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix (Relatively Robust Representations)

F08JEF	16	DSTEQR
		nagf_lapack_dsteqr
		All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from real symmetric matrix using the implicit QL or QR algorithm

F08JFF	16	DSTERF
		nagf_lapack_dsterf
		All eigenvalues of real symmetric tridiagonal matrix, root-free variant of the QL or QR algorithm

F08JGF	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	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	16	DSTEBZ
		nagf_lapack_dstebz
		Selected eigenvalues of real symmetric tridiagonal matrix by bisection

F08JKF	16	DSTEIN nagf_lapack_dstein Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in real array
F08JLF	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	16	ZSTEQR nagf_lapack_zsteqr All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from complex Hermitian matrix, using the implicit QL or QR algorithm
F08JUF	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	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	16	ZSTEIN nagf_lapack_zstein Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in complex array
F08JYF	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	21	DGELSS nagf_lapack_dgelss Computes the minimum-norm solution to a real linear least squares problem using singular value decomposition
F08KBF	21	DGESVD nagf_lapack_dgesvd Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors
F08KCF	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	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	16	DGEBRD nagf_lapack_dgebrd Orthogonal reduction of real general rectangular matrix to bidiagonal form

F08KFF	16	DORGBR
		nagf_lapack_dorgbr
		Generate orthogonal transformation matrices from reduction to bidiagonal form determined by F08KEF (DGEBRD)
F08KGF	16	DORMBR
		nagf_lapack_dormbr
		Apply orthogonal transformations from reduction to bidiagonal form determined by F08KEF (DGEBRD)
F08KHF	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	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	21	ZGELSS
		nagf_lapack_zgelss
		Computes the minimum-norm solution to a complex linear least squares problem using singular value decomposition
F08KPF	21	ZGESVD
		nagf_lapack_zgesvd
		Computes the singular value decomposition of a complex matrix, optionally computing the left and/or right singular vectors
F08KQF	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	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	16	ZGEBRD
		nagf_lapack_zgebrd
		Unitary reduction of complex general rectangular matrix to bidiagonal form
F08KTF	16	ZUNGBR
		nagf_lapack_zungbr
		Generate unitary transformation matrices from reduction to bidiagonal form determined by F08KSF (ZGEBRD)
F08KUF	16	ZUNMBR
		nagf_lapack_zunmbr
		Apply unitary transformations from reduction to bidiagonal form determined by F08KSF (ZGEBRD)
F08LEF	19	DGBBRD
		nagf_lapack_dgbbrd
		Reduction of real rectangular band matrix to upper bidiagonal form
F08LSF	19	ZGBBRD
		nagf_lapack_zgbbrd
		Reduction of complex rectangular band matrix to upper bidiagonal form

F08MDF	21	DBDSDC
		nagf_lapack_dbdsdc
		Computes the singular value decomposition of a real bidiagonal matrix, optionally computing the singular vectors (divide-and-conquer)
F08MEF	16	DBDSQR
		nagf_lapack_dbdsqr
		SVD of real bidiagonal matrix reduced from real general matrix
F08MSF	16	ZBDSQR
		nagf_lapack_zbdsqr
		SVD of real bidiagonal matrix reduced from complex general matrix
F08NAF	21	DGEEV
		nagf_lapack_dgeev
		Computes all eigenvalues and, optionally, left and/or right eigenvectors of a real nonsymmetric matrix
F08NBF	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	16	DGEHRD
		nagf_lapack_dgehrd
		Orthogonal reduction of real general matrix to upper Hessenberg form
F08NFF	16	DORGHR
		nagf_lapack_dorghr
		Generate orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (DGEHRD)
F08NGF	16	DORMHR
		nagf_lapack_dormhr
		Apply orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (DGEHRD)
F08NHF	16	DGEBAL
		nagf_lapack_dgebal
		Balance real general matrix
F08NJF	16	DGEBAK
		nagf_lapack_dgebak
		Transform eigenvectors of real balanced matrix to those of original matrix supplied to F08NHF (DGEBAL)
F08NNF	21	ZGEEV
		nagf_lapack_zgeev
		Computes all eigenvalues and, optionally, left and/or right eigenvectors of a complex nonsymmetric matrix
F08NPF	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	16	ZGEHRD
		nagf_lapack_zgehrd
		Unitary reduction of complex general matrix to upper Hessenberg form

F08NTF	16	ZUNGHR nagf_lapack_zunghr Generate unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (ZGEHRD)
F08NUF	16	ZUNMHR nagf_lapack_zunmhr Apply unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (ZGEHRD)
F08NVF	16	ZGEBAL nagf_lapack_zgebal Balance complex general matrix
F08NWF	16	ZGEBAK nagf_lapack_zgebak Transform eigenvectors of complex balanced matrix to those of original matrix supplied to F08NVF (ZGEBAL)
F08PAF	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	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	16	DHSEQR nagf_lapack_dhseqr Computes the eigenvalues and Schur factorization of real upper Hessenberg matrix reduced from real general matrix
F08PKF	16	DHSEIN nagf_lapack_dhsein Selected right and/or left eigenvectors of real upper Hessenberg matrix by inverse iteration
F08PNF	21	ZGEES nagf_lapack_zgees Computes for complex square nonsymmetric matrix, the eigenvalues, the Schur form, and, optionally, the matrix of Schur vectors
F08PPF	21	ZGEESX nagf_lapack_zgeesx Computes for real square nonsymmetric matrix, the eigenvalues, the Schur form, and, optionally, the matrix of Schur vectors; also, optionally, computes reciprocal condition numbers for selected eigenvalues
F08PSF	16	ZHSEQR nagf_lapack_zhseqr Computes the eigenvalues and Schur factorization of complex upper Hessenberg matrix reduced from complex general matrix
F08PXF	16	ZHSEIN nagf_lapack_zhsein Selected right and/or left eigenvectors of complex upper Hessenberg matrix by inverse iteration
F08QFF	16	DTREXC nagf_lapack_dtrexc Reorder Schur factorization of real matrix using orthogonal similarity transformation

F08QGF	16	DTRSEN
		nagf_lapack_dtrsen
		Reorder Schur factorization of real matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
F08QHF	16	DTRSYL
		nagf_lapack_dtrsyl
		Solve real Sylvester matrix equation $AX + XB = C$, A and B are upper quasi-triangular or transposes
F08QKF	16	DTREVC
		nagf_lapack_dtrevc
		Left and right eigenvectors of real upper quasi-triangular matrix
F08QLF	16	DTRSNA
		nagf_lapack_dtrsna
		Estimates of sensitivities of selected eigenvalues and eigenvectors of real upper quasi-triangular matrix
F08QTF	16	ZTREXC
		nagf_lapack_ztrexc
		Reorder Schur factorization of complex matrix using unitary similarity transformation
F08QUF	16	ZTRSEN
		nagf_lapack_ztrsen
		Reorder Schur factorization of complex matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
F08QVF	16	ZTRSYL
		nagf_lapack_ztrsyl
		Solve complex Sylvester matrix equation $AX + XB = C$, A and B are upper triangular or conjugate-transposes
F08QXF	16	ZTREVC
		nagf_lapack_ztrevc
		Left and right eigenvectors of complex upper triangular matrix
F08QYF	16	ZTRSNA
		nagf_lapack_ztrsna
		Estimates of sensitivities of selected eigenvalues and eigenvectors of complex upper triangular matrix
F08SAF	21	DSYGV
		nagf_lapack_dsygv
		Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
F08SBF	21	DSYGVX
		nagf_lapack_dsygvx
		Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
F08SCF	21	DSYGVD
		nagf_lapack_dsygvd
		Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem (divide-and-conquer)
F08SEF	16	DSYGST
		nagf_lapack_dsygst
		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	21	ZHEGV nagf_lapack_zhegv Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem
F08SPF	21	ZHEGVX nagf_lapack_zhegvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem
F08SQF	21	ZHEGVD nagf_lapack_zhegvd Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem (divide-and-conquer)
F08SSF	16	ZHEGST nagf_lapack_zhegst 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	21	DSPGV nagf_lapack_dspgv Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage
F08TBF	21	DSPGVX nagf_lapack_dspgvx Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage
F08TCF	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	16	DSPGST nagf_lapack_dspgst 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	21	ZHPGV nagf_lapack_zhpgv Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage
F08TPF	21	ZHPGVX nagf_lapack_zhpgvx Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage
F08TQF	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	16	ZHPGST nagf_lapack_zhpgst 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	21	DSBGV
		nagf_lapack_dsbgv
		Computes all the eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
F08UBF	21	DSBGVX
		nagf_lapack_dsbgvx
		Computes selected eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
F08UCF	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	19	DSBGST
		nagf_lapack_dsbgst
		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	19	DPBSTF
		nagf_lapack_dpbstf
		Computes a split Cholesky factorization of real symmetric positive definite band matrix A
F08UNF	21	ZHBGV
		nagf_lapack_zhbgv
		Computes all the eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem
F08UPF	21	ZHBGVX
		nagf_lapack_zhbgvx
		Computes selected eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem
F08UQF	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	19	ZHBGST
		nagf_lapack_zhbgst
		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	19	ZPBSTF
		nagf_lapack_zpbstf
		Computes a split Cholesky factorization of complex Hermitian positive definite band matrix A
F08VAF	21	DGGSVD
		nagf_lapack_dggsvd
		Computes the generalized singular value decomposition of a real matrix pair
F08VEF	21	DGGSVP
		nagf_lapack_dggsvp
		Computes orthogonal matrices as processing steps for computing the generalized singular value decomposition of a real matrix pair
F08VNF	21	ZGGSVD
		nagf_lapack_zggsvd
		Computes the generalized singular value decomposition of a complex matrix pair

F08VSF	21	ZGGSVP
		nagf_lapack_zggsvp
		Computes orthogonal matrices as processing steps for computing the generalized singular value decomposition of a complex matrix pair
F08WAF	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	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	20	DGGHRD
		nagf_lapack_dgghrd
		Orthogonal reduction of a pair of real general matrices to generalized upper Hessenberg form
F08WHF	20	DGGBAL
		nagf_lapack_dggbal
		Balance a pair of real general matrices
F08WJF	20	DGGBAK
		nagf_lapack_dggbak
		Transform eigenvectors of a pair of real balanced matrices to those of original matrix pair supplied to F08WHF (DGGBAL)
F08WNF	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	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	20	ZGGHRD
		nagf_lapack_zgghrd
		Unitary reduction of a pair of complex general matrices to generalized upper Hessenberg form
F08WVF	20	ZGGBAL
		nagf_lapack_zggbal
		Balance a pair of complex general matrices
F08WWF	20	ZGGBAK
		nagf_lapack_zggbak
		Transform eigenvectors of a pair of complex balanced matrices to those of original matrix pair supplied to F08WVF (ZGGBAL)
F08XAF	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	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	20	DHGEQZ
		nagf_lapack_dhgeqz
		Eigenvalues and generalized Schur factorization of real generalized upper Hessenberg form reduced from a pair of real general matrices
F08XNF	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	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	20	ZHGEQZ
		nagf_lapack_zhgeqz
		Eigenvalues and generalized Schur factorization of complex generalized upper Hessenberg form reduced from a pair of complex general matrices
F08YEF	21	DTGSJA
		nagf_lapack_dtgsja
		Computes the generalized singular value decomposition of a real upper triangular (or trapezoidal) matrix pair
F08YFF	21	DTGEXC
		nagf_lapack_dtgexc
		Reorders the generalized real Schur decomposition of a real matrix pair using an orthogonal equivalence transformation
F08YGF	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	21	DTGSYL
		nagf_lapack_dtgsyl
		Solves the real-valued generalized Sylvester equation
F08YKF	20	DTGEVC
		nagf_lapack_dtgevc
		Left and right eigenvectors of a pair of real upper quasi-triangular matrices
F08YLF	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	21	ZTGSJA
		nagf_lapack_ztgsja
		Computes the generalized singular value decomposition of a complex upper triangular (or trapezoidal) matrix pair

F08YTF	21	ZTGEXC
		nagf_lapack_ztgexc
		Reorders the generalized Schur decomposition of a complex matrix pair using an unitary equivalence transformation
F08YUF	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	21	ZTGSYL
		nagf_lapack_ztgsyl
		Solves the complex generalized Sylvester equation
F08YXF	20	ZTGEVC
		nagf_lapack_ztgevc
		Left and right eigenvectors of a pair of complex upper triangular matrices
F08YYF	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	21	DGGLSE
		nagf_lapack_dgglse
		Solves the real linear equality-constrained least squares (LSE) problem
F08ZBF	21	DGGGLM
		nagf_lapack_dggglm
		Solves a real general Gauss–Markov linear model (GLM) problem
F08ZEF	21	DGGQRF
		nagf_lapack_dggqrf
		Computes a generalized QR factorization of a real matrix pair
F08ZFF	21	DGGRQF
		nagf_lapack_dggrqf
		Computes a generalized RQ factorization of a real matrix pair
F08ZNF	21	ZGGLSE
		nagf_lapack_zgglse
		Solves the complex linear equality-constrained least squares (LSE) problem
F08ZPF	21	ZGGGLM
		nagf_lapack_zggglm
		Solves a complex general Gauss–Markov linear model (GLM) problem
F08ZSF	21	ZGGQRF
		nagf_lapack_zggqrf
		Computes a generalized QR factorization of a complex matrix pair
F08ZTF	21	ZGGRQF
		nagf_lapack_zggrqf
		Computes a generalized RQ factorization of a complex matrix pair