

NAG Library Chapter Contents

F08 – Least-squares and Eigenvalue Problems (LAPACK)

F08 Chapter Introduction

Routine Name	Mark of Introduction	Purpose
F08AAF	21	DGELS Solves an overdetermined or underdetermined real linear system
F08AEF	16	DGEQRF QR factorization of real general rectangular matrix
F08AFF	16	DORGQR Form all or part of orthogonal Q from QR factorization determined by F08AEF (DGEQRF) or F08BEF (DGEQPF)
F08AGF	16	DORMQR Apply orthogonal transformation determined by F08AEF (DGEQRF) or F08BEF (DGEQPF)
F08AHF	16	DGELQF LQ factorization of real general rectangular matrix
F08AJF	16	DORGLQ Form all or part of orthogonal Q from LQ factorization determined by F08AHF (DGELQF)
F08AKF	16	DORMLQ Apply orthogonal transformation determined by F08AHF (DGELQF)
F08ANF	21	ZGELS Solves an overdetermined or underdetermined complex linear system
F08ASF	16	ZGEQRF QR factorization of complex general rectangular matrix
F08ATF	16	ZUNGQR Form all or part of unitary Q from QR factorization determined by F08ASF (ZGEQRF) or F08BSF (ZGEQPF)
F08AUF	16	ZUNMQR Apply unitary transformation determined by F08ASF (ZGEQRF) or F08BSF (ZGEQPF)
F08AVF	16	ZGELQF LQ factorization of complex general rectangular matrix
F08AWF	16	ZUNGLQ Form all or part of unitary Q from LQ factorization determined by F08AVF (ZGELQF)
F08AXF	16	ZUNMLQ Apply unitary transformation determined by F08AVF (ZGELQF)
F08BAF	21	DGELSY Computes the minimum-norm solution to a real linear least-squares problem
F08BEF	16	DGEQPF QR factorization of real general rectangular matrix with column pivoting

F08BFF	21	DGEQP3 <i>QR</i> factorization of real general rectangular matrix with column pivoting, using BLAS-3
F08BHF	21	DTZRZF Reduces a real upper trapezoidal matrix to upper triangular form
F08BKF	21	DORMRZ Apply orthogonal transformation determined by F08BHF (DTZRZF)
F08BNF	21	ZGELSY Computes the minimum-norm solution to a complex linear least-squares problem
F08BSF	16	ZGEQPF <i>QR</i> factorization of complex general rectangular matrix with column pivoting
F08BTF	21	ZGEQP3 <i>QR</i> factorization of complex general rectangular matrix with column pivoting, using BLAS-3
F08BVF	21	ZTZRFZ Reduces a complex upper trapezoidal matrix to upper triangular form
F08BXF	21	ZUNMRZ Apply unitary transformation determined by F08BVF (ZTZRFZ)
F08CEF	21	DGEQLF <i>QL</i> factorization of real general rectangular matrix
F08CFF	21	DORGQL Form all or part of orthogonal <i>Q</i> from <i>QL</i> factorization determined by F08CEF (DGEQLF)
F08CGF	21	DORMQL Apply orthogonal transformation determined by F08CEF (DGEQLF)
F08CHF	21	DGERQF <i>RQ</i> factorization of real general rectangular matrix
F08CJF	21	DORGRQ Form all or part of orthogonal <i>Q</i> from <i>RQ</i> factorization determined by F08CHF (DGERQF)
F08CKF	21	DORMRQ Apply orthogonal transformation determined by F08CHF (DGERQF)
F08CSF	21	ZGEQLF <i>QL</i> factorization of complex general rectangular matrix
F08CTF	21	ZUNGQL Form all or part of orthogonal <i>Q</i> from <i>QL</i> factorization determined by F08CSF (ZGEQLF)
F08CUF	21	ZUNMQL Apply unitary transformation determined by F08CSF (ZGEQLF)
F08CVF	21	ZGERQF <i>RQ</i> factorization of complex general rectangular matrix
F08CWF	21	ZUNGRQ Form all or part of orthogonal <i>Q</i> from <i>RQ</i> factorization determined by F08CVF (ZGERQF)
F08CXF	21	ZUNMRQ Apply unitary transformation determined by F08CVF (ZGERQF)

F08FAF	21	DSYEV Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix
F08FBF	21	DSYEVX Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix
F08FCF	19	DSYEVD Computes all eigenvalues and, optionally, all eigenvectors of real symmetric matrix (divide-and-conquer)
F08FDF	21	DSYEV Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix (Relatively Robust Representations)
F08FEF	16	DSYTRD Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form
F08FFF	16	DORGTR Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08FEF (DSYTRD)
F08FGF	16	DORMTR Apply orthogonal transformation determined by F08FEF (DSYTRD)
F08FLF	21	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 Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
F08FPF	21	ZHEEVX Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix
F08FQF	19	ZHEEVD Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian matrix (divide-and-conquer)
F08FRF	21	ZHEEVR Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix (Relatively Robust Representations)
F08FSF	16	ZHETRD Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form
F08FTF	16	ZUNGTR Generate unitary transformation matrix from reduction to tridiagonal form determined by F08FSF (ZHETRD)
F08FUF	16	ZUNMTR Apply unitary transformation matrix determined by F08FSF (ZHETRD)
F08GAF	21	DSPEV Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage
F08GBF	21	DSPEVX Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric matrix, packed storage

F08GCF	19	DSPEVD Computes all eigenvalues and, optionally, all eigenvectors of real symmetric matrix, packed storage (divide-and-conquer)
F08GEF	16	DSPTRD Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form, packed storage
F08GFF	16	DOPGTR Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08GEF (DSPTRD)
F08GGF	16	DOPMTR Apply orthogonal transformation determined by F08GEF (DSPTRD)
F08GNF	21	ZHPEV Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
F08GPF	21	ZHPEVX Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian matrix, packed storage
F08GQF	19	ZHPEVD Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian matrix, packed storage (divide-and-conquer)
F08GSF	16	ZHPTRD Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form, packed storage
F08GTF	16	ZUPGTR Generate unitary transformation matrix from reduction to tridiagonal form determined by F08GSF (ZHPTRD)
F08GUF	16	ZUPMTR Apply unitary transformation matrix determined by F08GSF (ZHPTRD)
F08HAF	21	DSBEV Computes all eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
F08HBF	21	DSBEVX Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric band matrix
F08HCF	19	DSBEVD Computes all eigenvalues and, optionally, all eigenvectors of real symmetric band matrix (divide-and-conquer)
F08HEF	16	DSBTRD Orthogonal reduction of real symmetric band matrix to symmetric tridiagonal form
F08HNF	21	ZHBEV Computes all eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix
F08HPF	21	ZHBEVX Computes selected eigenvalues and, optionally, eigenvectors of a complex Hermitian band matrix
F08HQF	19	ZHBEVD Computes all eigenvalues and, optionally, all eigenvectors of complex Hermitian band matrix (divide-and-conquer)

F08HSF	16	ZHBTRD Unitary reduction of complex Hermitian band matrix to real symmetric tridiagonal form
F08JAF	21	DSTEV Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix
F08JBF	21	DSTEVX Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix
F08JCF	19	DSTEVD Computes all eigenvalues and, optionally, all eigenvectors of real symmetric tridiagonal matrix (divide-and-conquer)
F08JDF	21	DSTEVR Computes selected eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix (Relatively Robust Representations)
F08JEF	16	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 All eigenvalues of real symmetric tridiagonal matrix, root-free variant of the QL or QR algorithm
F08JGF	16	DPTEQR Computes all eigenvalues and eigenvectors of real symmetric positive-definite tridiagonal matrix, reduced from real symmetric positive-definite matrix
F08JHF	21	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 Selected eigenvalues of real symmetric tridiagonal matrix by bisection
F08JKF	16	DSTEIN Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in real array
F08JLF	21	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 All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from complex Hermitian matrix, using the implicit QL or QR algorithm
F08JUF	16	ZPTEQR Computes all eigenvalues and eigenvectors of real symmetric positive-definite tridiagonal matrix, reduced from complex Hermitian positive-definite matrix
F08JVF	21	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 Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in complex array

F08JYF	21	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 Computes the minimum-norm solution to a real linear least-squares problem using singular value decomposition
F08KBF	21	DGESVD Computes the singular value decomposition of a real matrix, optionally computing the left and/or right singular vectors
F08KCF	21	DGELSD Computes the minimum-norm solution to a real linear least-squares problem using singular value decomposition (divide-and-conquer)
F08KDF	21	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 Orthogonal reduction of real general rectangular matrix to bidiagonal form
F08KFF	16	DORGBR Generate orthogonal transformation matrices from reduction to bidiagonal form determined by F08KEF (DGEBRD)
F08KGF	16	DORMBR Apply orthogonal transformations from reduction to bidiagonal form determined by F08KEF (DGEBRD)
F08KNF	21	ZGELSS Computes the minimum-norm solution to a complex linear least-squares problem using singular value decomposition
F08KPF	21	ZGESVD Computes the singular value decomposition of a complex matrix, optionally computing the left and/or right singular vectors
F08KQF	21	ZGELSD Computes the minimum-norm solution to a complex linear least-squares problem using singular value decomposition (divide-and-conquer)
F08KRF	21	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 Unitary reduction of complex general rectangular matrix to bidiagonal form
F08KTF	16	ZUNGBR Generate unitary transformation matrices from reduction to bidiagonal form determined by F08KSF (ZGEBRD)
F08KUF	16	ZUNMBR Apply unitary transformations from reduction to bidiagonal form determined by F08KSF (ZGEBRD)
F08LEF	19	DGBBRD Reduction of real rectangular band matrix to upper bidiagonal form
F08LSF	19	ZGBBRD Reduction of complex rectangular band matrix to upper bidiagonal form

F08MDF	21	DBDSDC Computes the singular value decomposition of a real bidiagonal matrix, optionally computing the singular vectors (divide-and-conquer)
F08MEF	16	DBDSQR SVD of real bidiagonal matrix reduced from real general matrix
F08MSF	16	ZBDSQR SVD of real bidiagonal matrix reduced from complex general matrix
F08NAF	21	DGEEV Computes all eigenvalues and, optionally, left and/or right eigenvectors of a real nonsymmetric matrix
F08NBF	21	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 Orthogonal reduction of real general matrix to upper Hessenberg form
F08NFF	16	DORGHR Generate orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (DGEHRD)
F08NGF	16	DORMHR Apply orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (DGEHRD)
F08NHF	16	DGEBAL Balance real general matrix
F08NJF	16	DGEBAK Transform eigenvectors of real balanced matrix to those of original matrix supplied to F08NHF (DGEBAL)
F08NNF	21	ZGEEV Computes all eigenvalues and, optionally, left and/or right eigenvectors of a complex nonsymmetric matrix
F08NPF	21	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 Unitary reduction of complex general matrix to upper Hessenberg form
F08NTF	16	ZUNGHR Generate unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (ZGEHRD)
F08NUF	16	ZUNMHR Apply unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (ZGEHRD)
F08NVF	16	ZGEBAL Balance complex general matrix
F08NWF	16	ZGEBAK Transform eigenvectors of complex balanced matrix to those of original matrix supplied to F08NVF (ZGEBAL)

F08PAF	21	DGEES Computes for real square nonsymmetric matrix, the eigenvalues, the real Schur form, and, optionally, the matrix of Schur vectors
F08PBF	21	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 Computes the eigenvalues and Schur factorization of real upper Hessenberg matrix reduced from real general matrix
F08PKF	16	DHSEIN Selected right and/or left eigenvectors of real upper Hessenberg matrix by inverse iteration
F08PNF	21	ZGEES Computes for complex square nonsymmetric matrix, the eigenvalues, the Schur form, and, optionally, the matrix of Schur vectors
F08PPF	21	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 Computes the eigenvalues and Schur factorization of complex upper Hessenberg matrix reduced from complex general matrix
F08PXF	16	ZHSEIN Selected right and/or left eigenvectors of complex upper Hessenberg matrix by inverse iteration
F08QFF	16	DTREXC Reorder Schur factorization of real matrix using orthogonal similarity transformation
F08QGF	16	DTRSEN Reorder Schur factorization of real matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
F08QHF	16	DTRSYL Solve real Sylvester matrix equation $AX + XB = C$, A and B are upper quasi-triangular or transposes
F08QKF	16	DTREVC Left and right eigenvectors of real upper quasi-triangular matrix
F08QLF	16	DTRSNA Estimates of sensitivities of selected eigenvalues and eigenvectors of real upper quasi-triangular matrix
F08QTF	16	ZTREXC Reorder Schur factorization of complex matrix using unitary similarity transformation
F08QUF	16	ZTRSEN Reorder Schur factorization of complex matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
F08QVF	16	ZTRSYL Solve complex Sylvester matrix equation $AX + XB = C$, A and B are upper triangular or conjugate-transposes

F08QXF	16	ZTREVC Left and right eigenvectors of complex upper triangular matrix
F08QYF	16	ZTRSNA Estimates of sensitivities of selected eigenvalues and eigenvectors of complex upper triangular matrix
F08SAF	21	DSYGV Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
F08SBF	21	DSYGVX Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem
F08SCF	21	DSYGVD Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem (divide-and-conquer)
F08SEF	16	DSYGST Reduction to standard form of real symmetric-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $B Ax = \lambda x$, B factorized by F07FDF (DPOTRF)
F08SNF	21	ZHEGV Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem
F08SPF	21	ZHEGVX Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem
F08SQF	21	ZHEGVD Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem (divide-and-conquer)
F08SSF	16	ZHEGST Reduction to standard form of complex Hermitian-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $B Ax = \lambda x$, B factorized by F07FRF (ZPOTRF)
F08TAF	21	DSPGV Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage
F08TBF	21	DSPGVX Computes selected eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage
F08TCF	21	DSPGVD Computes all the eigenvalues, and optionally, the eigenvectors of a real generalized symmetric-definite eigenproblem, packed storage (divide-and-conquer)
F08TEF	16	DSPGST Reduction to standard form of real symmetric-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $B Ax = \lambda x$, packed storage, B factorized by F07GDF (DPPTRF)
F08TNF	21	ZHPGV Computes all the eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage
F08TPF	21	ZHPGVX Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage

F08TQF	21	ZHPGVD Computes selected eigenvalues, and optionally, the eigenvectors of a complex generalized Hermitian-definite eigenproblem, packed storage (divide-and-conquer)
F08TSF	16	ZHPGST Reduction to standard form of complex Hermitian-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $B Ax = \lambda x$, packed storage, B factorized by F07GRF (ZPPTRF)
F08UAF	21	DSBGV Computes all the eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
F08UBF	21	DSBGVX Computes selected eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem
F08UCF	21	DSBGVD Computes all the eigenvalues, and optionally, the eigenvectors of a real banded generalized symmetric-definite eigenproblem (divide-and-conquer)
F08UEF	19	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 Computes a split Cholesky factorization of real symmetric positive-definite band matrix A
F08UNF	21	ZHBGV Computes all the eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem
F08UPF	21	ZHBGVX Computes selected eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem
F08UQF	21	ZHBGVD Computes all the eigenvalues, and optionally, the eigenvectors of a complex banded generalized Hermitian-definite eigenproblem (divide-and-conquer)
F08USF	19	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 Computes a split Cholesky factorization of complex Hermitian positive-definite band matrix A
F08VAF	21	DGGSVD Computes the generalized singular value decomposition of a real matrix pair
F08VEF	21	DGGSVP Computes orthogonal matrices as processing steps for computing the generalized singular value decomposition of a real matrix pair
F08VNF	21	ZGGSVD Computes the generalized singular value decomposition of a complex matrix pair
F08VSF	21	ZGGSVP Computes orthogonal matrices as processing steps for computing the generalized singular value decomposition of a complex matrix pair

F08WAF	21	DGGEV Computes, for a real nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
F08WBF	21	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 Orthogonal reduction of a pair of real general matrices to generalized upper Hessenberg form
F08WHF	20	DGGBAL Balance a pair of real general matrices
F08WJF	20	DGGBAK Transform eigenvectors of a pair of real balanced matrices to those of original matrix pair supplied to F08WHF (DGGBAL)
F08WNF	21	ZGGEV Computes, for a complex nonsymmetric matrix pair, the generalized eigenvalues, and optionally, the left and/or right generalized eigenvectors
F08WPF	21	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 Unitary reduction of a pair of complex general matrices to generalized upper Hessenberg form
F08WVF	20	ZGGBAL Balance a pair of complex general matrices
F08WWF	20	ZGGBAK Transform eigenvectors of a pair of complex balanced matrices to those of original matrix pair supplied to F08WVF (ZGGBAL)
F08XAF	21	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 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 Eigenvalues and generalized Schur factorization of real generalized upper Hessenberg form reduced from a pair of real general matrices
F08XNF	21	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 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 Eigenvalues and generalized Schur factorization of complex generalized upper Hessenberg form reduced from a pair of complex general matrices
F08YEF	21	DTGSJA Computes the generalized singular value decomposition of a real upper triangular (or trapezoidal) matrix pair
F08YFF	21	DTGEXC Reorders the generalized real Schur decomposition of a real matrix pair using an orthogonal equivalence transformation
F08YGF	21	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 Solves the real-valued generalized Sylvester equation
F08YKF	20	DTGEVC Left and right eigenvectors of a pair of real upper quasi-triangular matrices
F08YLF	21	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 Computes the generalized singular value decomposition of a complex upper triangular (or trapezoidal) matrix pair
F08YTF	21	ZTGEXC Reorders the generalized Schur decomposition of a complex matrix pair using an unitary equivalence transformation
F08YUF	21	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 Solves the complex generalized Sylvester equation
F08YXF	20	ZTGEVC Left and right eigenvectors of a pair of complex upper triangular matrices
F08YYF	21	ZTGSNA Estimates reciprocal condition numbers for specified eigenvalues and/or eigenvectors of a complex matrix pair in generalized Schur canonical form
F08ZAF	21	DGGLSE Solves the real linear equality-constrained least-squares (LSE) problem
F08ZBF	21	DGGGLM Solves a real general Gauss–Markov linear model (GLM) problem
F08ZEF	21	DGGQRF Computes a generalized QR factorization of a real matrix pair

F08ZFF	21	DGGRQF Computes a generalized RQ factorization of a real matrix pair
F08ZNF	21	ZGGLSE Solves the complex linear equality-constrained least-squares (LSE) problem
F08ZPF	21	ZGGGLM Solves a complex general Gauss–Markov linear model (GLM) problem
F08ZSF	21	ZGGQRF Computes a generalized QR factorization of a complex matrix pair
F08ZTF	21	ZGGRQF Computes a generalized RQ factorization of a complex matrix pair
