

## NAG Library Chapter Contents

### F01 – Matrix Operations, Including Inversion

F01 Chapter Introduction – a description of the Chapter and an overview of the algorithms available

Routine Name	Mark of Introduction	Purpose
F01ABF	1	nagf_matop_real_symm_posdef_inv Inverse of real symmetric positive definite matrix using iterative refinement
F01ADF	2	nagf_matop_real_symm_posdef_inv_noref Inverse of real symmetric positive definite matrix
F01BLF	5	nagf_matop_real_gen_pseudinv Pseudo-inverse and rank of real $m$ by $n$ matrix ( $m \geq n$ )
F01BRF	7	nagf_matop_real_gen_sparse_lu $LU$ factorization of real sparse matrix
F01BSF	7	nagf_matop_real_gen_sparse_lu_reuse $LU$ factorization of real sparse matrix with known sparsity pattern
F01BUF	7	nagf_matop_real_symm_posdef_fac $ULDL^T U^T$ factorization of real symmetric positive definite band matrix
F01BVF	7	nagf_matop_real_symm_posdef_geneig Reduction to standard form, generalized real symmetric-definite banded eigenproblem
F01CKF	2	nagf_matop_real_gen_matmul Multiplication of real matrices
F01CRF	7	nagf_matop_real_gen_trans_inplace Transposition of a real matrix
F01CTF	14	nagf_matop_real_addsub Sum or difference of two real matrices, optional scaling and transposition
F01CWF	14	nagf_matop_complex_addsub Sum or difference of two complex matrices, optional scaling and transposition
F01ECF	22	nagf_matop_real_gen_matrix_exp Real matrix exponential
F01EDF	23	nagf_matop_real_symm_matrix_exp Real symmetric matrix exponential
F01EFF	23	nagf_matop_real_symm_matrix_fun Function of a real symmetric matrix
F01EJF	24	nagf_matop_real_gen_matrix_log Real matrix logarithm
F01EKF	24	nagf_matop_real_gen_matrix_fun_std Exponential, sine, cosine, sinh or cosh of a real matrix (Schur–Parlett algorithm)
F01ELF	24	nagf_matop_real_gen_matrix_fun_num Function of a real matrix (using numerical differentiation)
F01EMF	24	nagf_matop_real_gen_matrix_fun_usd Function of a real matrix (using user-supplied derivatives)
F01ENF	25	nagf_matop_real_gen_matrix_sqrt Real matrix square root
F01EPF	25	nagf_matop_real_tri_matrix_sqrt Real upper quasi-triangular matrix square root

F01EQF	25	nagf_matop_real_gen_matrix_pow General power of a real matrix
F01FCF	23	nagf_matop_complex_gen_matrix_exp Complex matrix exponential
F01FDF	23	nagf_matop_complex_herm_matrix_exp Complex Hermitian matrix exponential
F01FFF	23	nagf_matop_complex_herm_matrix_fun Function of a complex Hermitian matrix
F01FJF	24	nagf_matop_complex_gen_matrix_log Complex matrix logarithm
F01FKF	24	nagf_matop_complex_gen_matrix_fun_std Exponential, sine, cosine, sinh or cosh of a complex matrix (Schur–Parlett algorithm)
F01FLF	24	nagf_matop_complex_gen_matrix_fun_num Function of a complex matrix (using numerical differentiation)
F01FMF	24	nagf_matop_complex_gen_matrix_fun_usd Function of a complex matrix (using user-supplied derivatives)
F01FNF	25	nagf_matop_complex_gen_matrix_sqrt Complex matrix square root
F01FPF	25	nagf_matop_complex_tri_matrix_sqrt Complex upper triangular matrix square root
F01FQF	25	nagf_matop_complex_gen_matrix_pow General power of a complex matrix
F01GAF	24	nagf_matop_real_gen_matrix_actexp Action of a real matrix exponential on a real matrix
F01GBF	24	nagf_matop_real_gen_matrix_actexp_rcomm Action of a real matrix exponential on a real matrix (reverse communication)
F01HAF	24	nagf_matop_complex_gen_matrix_actexp Action of a complex matrix exponential on a complex matrix
F01HBF	24	nagf_matop_complex_gen_matrix_actexp_rcomm Action of a complex matrix exponential on a complex matrix (reverse communication)
F01JAF	24	nagf_matop_real_gen_matrix_cond_std Condition number for the exponential, logarithm, sine, cosine, sinh or cosh of a real matrix
F01JBF	24	nagf_matop_real_gen_matrix_cond_num Condition number for a function of a real matrix (using numerical differentiation)
F01JCF	24	nagf_matop_real_gen_matrix_cond_usd Condition number for a function of a real matrix (using user- supplied derivatives)
F01JDF	25	nagf_matop_real_gen_matrix_cond_sqrt Condition number for square root of real matrix
F01JEF	25	nagf_matop_real_gen_matrix_cond_pow Condition number for real matrix power
F01JFF	25	nagf_matop_real_gen_matrix_frcht_pow Fréchet derivative of real matrix power
F01JGF	25	nagf_matop_real_gen_matrix_cond_exp Condition number for real matrix exponential
F01JHF	25	nagf_matop_real_gen_matrix_frcht_exp Fréchet derivative of real matrix exponential
F01JJF	25	nagf_matop_real_gen_matrix_cond_log Condition number for real matrix logarithm
F01JKF	25	nagf_matop_real_gen_matrix_frcht_log Fréchet derivative of real matrix logarithm
F01KAF	24	nagf_matop_complex_gen_matrix_cond_std Condition number for the exponential, logarithm, sine, cosine, sinh or cosh of a complex matrix

F01KBF	24	nagf_matop_complex_gen_matrix_cond_num Condition number for a function of a complex matrix (using numerical differentiation)
F01KCF	24	nagf_matop_complex_gen_matrix_cond_usd Condition number for a function of a complex matrix (using user-supplied derivatives)
F01KDF	25	nagf_matop_complex_gen_matrix_cond_sqrt Condition number for square root of complex matrix
F01KEF	25	nagf_matop_complex_gen_matrix_cond_pow Condition number for complex matrix power
F01KFF	25	nagf_matop_complex_gen_matrix_frcht_pow Fréchet derivative of complex matrix power
F01KGF	25	nagf_matop_complex_gen_matrix_cond_exp Condition number for complex matrix exponential
F01KHF	25	nagf_matop_complex_gen_matrix_frcht_exp Fréchet derivative of complex matrix exponential
F01KJF	25	nagf_matop_complex_gen_matrix_cond_log Condition number for complex matrix logarithm
F01KKF	25	nagf_matop_complex_gen_matrix_frcht_log Fréchet derivative of complex matrix logarithm
F01LEF	11	nagf_matop_real_gen_tridiag_lu <i>LU</i> factorization of real tridiagonal matrix
F01LHF	13	nagf_matop_real_gen_blkdiag_lu <i>LU</i> factorization of real almost block diagonal matrix
F01MCF	8	nagf_matop_real_vband_posdef_fac <i>LDL<sup>T</sup></i> factorization of real symmetric positive definite variable-bandwidth matrix
F01QGF	14	nagf_matop_real_trapez_rq <i>RQ</i> factorization of real $m$ by $n$ upper trapezoidal matrix ( $m \leq n$ )
F01QJF	14	nagf_matop_real_gen_rq <i>RQ</i> factorization of real $m$ by $n$ matrix ( $m \leq n$ )
F01QKF	14	nagf_matop_real_gen_rq_formq Operations with orthogonal matrices, form rows of $Q$ , after <i>RQ</i> factorization by F01QJF
F01RGF	14	nagf_matop_complex_trapez_rq <i>RQ</i> factorization of complex $m$ by $n$ upper trapezoidal matrix ( $m \leq n$ )
F01RJF	14	nagf_matop_complex_gen_rq <i>RQ</i> factorization of complex $m$ by $n$ matrix ( $m \leq n$ )
F01RKF	14	nagf_matop_complex_gen_rq_formq Operations with unitary matrices, form rows of $Q$ , after <i>RQ</i> factorization by F01RJF
F01VAF (DTRTTP)	23	DTRTTP nagf_matop_dtrttp Copies a real triangular matrix from full format to packed format
F01VBF (ZTRTTP)	23	ZTRTTP nagf_matop_ztrttp Copies a complex triangular matrix from full format to packed format
F01VCF (DTPTTR)	23	DTPTTR nagf_matop_dtptr Copies a real triangular matrix from packed format to full format

F01VDF (ZTPPTR)	23	ZTPPTR nagf_matop_ztptr Copies a complex triangular matrix from packed format to full format
F01VEF (DTRTTF)	23	DTRTTF nagf_matop_dtrttf Copies a real triangular matrix from full format to Rectangular Full Packed format
F01VFF (ZTRTTF)	23	ZTRTTF nagf_matop_ztrttf Copies a complex triangular matrix from full format to Rectangular Full Packed format
F01VGF (DTFTTR)	23	DTFTTR nagf_matop_dtfttr Copies a real triangular matrix from Rectangular Full Packed format to full format
F01VHF (ZFTTTR)	23	ZFTTTR nagf_matop_zfttr Copies a complex triangular matrix from Rectangular Full Packed format to full format
F01VJF (DTPPTF)	23	DTPPTF nagf_matop_dptptf Copies a real triangular matrix from packed format to Rectangular Full Packed format
F01VKF (ZTPPTF)	23	ZTPPTF nagf_matop_zptptf Copies a complex triangular matrix from packed format to Rectangular Full Packed format
F01VLF (DTFTTP)	23	DTFTTP nagf_matop_dtfttp Copies a real triangular matrix from Rectangular Full Packed format to packed format
F01VMF (ZFTTTP)	23	ZFTTTP nagf_matop_zfttpt Copies a complex triangular matrix from Rectangular Full Packed format to packed format
F01ZAF	14	nagf_matop_real_tri_pack Convert real matrix between packed triangular and square storage formats
F01ZBF	14	nagf_matop_complex_tri_pack Convert complex matrix between packed triangular and square storage formats
F01ZCF	14	nagf_matop_real_band_pack Convert real matrix between packed banded and rectangular storage formats
F01ZDF	14	nagf_matop_complex_band_pack Convert complex matrix between packed banded and rectangular storage formats

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