

NAG C Library Chapter Introduction

f16 – NAG Interface to BLAS

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1 Scope of the Chapter

This chapter is concerned with basic linear algebra functions which perform elementary algebraic operations involving vectors and matrices.

2 Background to the Problems

The functions in this chapter follow the specification of The BLAS Technical Forum Standard (2001). They are called extensively as auxiliaries by functions in other chapters of the NAG Library, especially in the linear algebra chapters. They are intended to be useful building-blocks for users of the Library who are developing their own applications.

The functions fall into three main groups: (1) scalar and vector operations, also referred to as Level-1 BLAS; (2) matrix-vector operations or Level-2 BLAS; (3) matrix operations which includes single matrix operations (Level-2 BLAS), matrix-matrix operations (Level-3 BLAS) and data movement operations on matrices. The terminology reflects the number of operations involved, so for example a Level-2 function involves $O(n^2)$ operations, for vectors and matrices of order n .

In many implementations of the NAG Library, the functions in this chapter serve as interfaces to an efficient machine-specific implementation of the BLAS, usually provided by the vendor of the machine. Such implementations are stringently tested before being used with the NAG Library, to ensure that they correctly meet the specifications of the BLAS, and that they return the desired accuracy.

3 Recommendations on Choice and Use of Available Functions

The functions in this chapter make available only some of the Basic Linear Algebra Subprograms which carry out the low level operations required by linear algebra applications. These will not normally be needed by the general user. The purpose of each function is described by its individual document.

It should be noted that, in some cases, The BLAS Technical Forum Standard (2001) extends the functionality of earlier BLAS specifications. For example, `nag_daxpy` (f06ecc) carrying out the operation

$$y \leftarrow \alpha x + y$$

is replaced by `nag_daxpby` (f16ecc) which performs the operation

$$y \leftarrow \alpha x + \beta y.$$

The operator arguments **diag**, **norm**, **order**, **side**, **trans** and **uplo** are defined as enumeration types.

The **order** argument allows for 2D arrays to be supplied in either row or column ordering. The precise meaning of this for the packed and banded matrix storage schemes which are used by some of the functions in this chapter is described in the f07 and f08 Chapter Introductions.

Invalid values of arguments cause an error message to be returned via the NAG error handler **fail**.

4 Index

Matrix operations:

Complex matrices,

matrix copy,

complex rectangular matrix `nag_zge_copy` (f16tfc)

complex triangular matrix `nag_ztr_copy` (f16tec)

real triangular matrix `nag_dtr_copy` (f16qec)

matrix initialization,

complex triangular matrix `nag_ztr_load` (f16tgc)

real triangular matrix `nag_dtr_load` (f16qgc)

rectangular matrix `nag_zge_load` (f16thc)

matrix-matrix product,

one matrix Hermitian `nag_zhemm` (f16zcc)

one matrix symmetric `nag_zsymm` (f16ztc)

triangular matrix `nag_ztrmm` (f16zfc)

two rectangular matrices	nag_zgemm (f16zac)
rank-2k update,	
of a Hermitian matrix	nag_zher2k (f16zrc)
of a symmetric matrix	nag_zsyr2k (f16zwc)
rank-k update,	
of a Hermitian matrix	nag_zherk (f16zpc)
of a symmetric matrix	nag_zsyrk (f16zuc)
solution of triangular systems of equations	nag_ztrsm (f16zjc)
Real matrices,	
matrix copy	nag_dge_copy (f16qfc)
matrix initialization,	
rectangular	nag_dge_load (f16qhc)
matrix-matrix product,	
one matrix symmetric	nag_dsymm (f16ycc)
one matrix triangular	nag_dtrmm (f16yfc)
rectangular matrices	nag_dgemm (f16yac)
rank-2k update of a symmetric matrix	nag_dsyr2k (f16yrc)
rank-k update of a symmetric matrix	nag_dsyrk (f16ypc)
solution of triangular systems of equations	nag_dtrsm (f16yjc)
Matrix-vector operations:	
Complex matrix and vector(s),	
compute a norm or the element of largest absolute value,	
band matrix	nag_zgb_norm (f16ubc)
general matrix	nag_zge_norm (f16uac)
Hermitian band matrix	nag_zhb_norm (f16uec)
Hermitian matrix	nag_zhe_norm (f16ucc)
Hermitian matrix, packed form	nag_zhp_norm (f16udc)
symmetric matrix	nag_zsy_norm (f16ufc)
symmetric matrix, packed form	nag_zsp_norm (f16ugc)
matrix-vector product,	
Hermitian band matrix	nag_zhbm (f16sdc)
Hermitian matrix	nag_zhemv (f16scc)
Hermitian packed matrix	nag_zhpmv (f16sec)
rectangular band matrix	nag_zgbmv (f16sbc)
rectangular matrix	nag_zgemv (f16sac)
symmetric matrix	nag_zsymv (f16tac)
symmetric packed matrix	nag_zspmv (f16tcc)
triangular band matrix	nag_ztbmv (f16sgc)
triangular matrix	nag_ztrmv (f16sfc)
triangular packed matrix	nag_ztpmv (f16shc)
rank-1 update,	
Hermitian matrix	nag_zher (f16spc)
Hermitian packed matrix	nag_zhpr (f16sqc)
rectangular matrix, unconjugated vector	nag_zger (f16smc)
rank-2 update,	
Hermitian matrix	nag_zher2 (f16src)
Hermitian packed matrix	nag_zhpr2 (f16ssc)
solution of a system of equations,	
triangular band matrix	nag_ztbsv (f16skc)
triangular matrix	nag_ztrsv (f16sjc)
triangular packed matrix	nag_ztpsv (f16slc)
Real matrix and vector(s),	
compute a norm or the element of largest absolute value,	
band matrix	nag_dgb_norm (f16rbc)
general matrix	nag_dge_norm (f16rac)
symmetric band matrix	nag_dsb_norm (f16rec)
symmetric matrix	nag_dsy_norm (f16rcc)
symmetric matrix, packed form	nag_dsp_norm (f16rdc)

matrix-vector product,	
rectangular band matrix	nag_dgbmv (f16pbc)
rectangular matrix	nag_dgemv (f16pac)
symmetric band matrix	nag_dsbbmv (f16pdc)
symmetric matrix	nag_dsymv (f16pcc)
symmetric packed matrix	nag_dspmv (f16pec)
triangular band matrix	nag_dtbmv (f16pgc)
triangular matrix	nag_dtrmv (f16pfc)
triangular packed matrix	nag_dtpmv (f16phc)
rank-1 update,	
rectangular matrix	nag_dger (f16pmc)
symmetric matrix	nag_dsyv (f16ppc)
symmetric packed matrix	nag_dspr (f16pqc)
rank-2 update,	
symmetric matrix	nag_dsyv2 (f16prc)
symmetric packed matrix	nag_dspr2 (f16psc)
solution of a system of equations,	
triangular matrix	nag_dtrsv (f16pjc)
solution of system of equations,	
triangular band matrix	nag_dtbv (f16pkc)
triangular packed matrix	nag_dtpv (f16plc)
Scalar and Vector operations:	
Complex vector(s),	
broadcast a scalar into a vector	nag_zload (f16hbc)
Integer vector(s),	
broadcast a scalar into a vector	nag_ild (f16dbc)
Real vector(s),	
broadcast a scalar into a vector	nag_dload (f16fbc)
scale and add two vectors	nag_daxpy (f16ecc)

5 Functions Withdrawn or Scheduled for Withdrawal

None.

6 References

The BLAS Technical Forum Standard (2001) www.netlib.org/blas/blast-forum
