NAG C Library Function Document

nag_zhb_norm (f16uec)

1 Purpose

nag_zhb_norm (f16uec) calculates the value of the 1-norm, the infinity-norm, the Frobenius norm, or the maximum absolute value of the elements, of a complex n by n Hermitian band matrix.

2 Specification

```
void nag_zhb_norm (Nag_OrderType order, Nag_NormType norm, Nag_UploType uplo,
     Integer n, Integer k, const Complex ab[], Integer pdab, double *r,
     NagError *fail)
```

3 Description

Given a complex n by n Hermitian band matrix, A, nag_zhb_norm (f16uec) calculates one of the values given by

$$||A||_1 = \max_j \sum_{i=1}^{n} |a_{ij}|,$$

$$||A||_\infty = \max_i \sum_{j=1}^{n} |a_{ij}|,$$

$$||A||_F = \left(\sum_{i=1}^{n} \sum_{j=1}^{n} |a_{ij}|^2 \right)^{1/2},$$

$$\max_{i,j} |a_{ij}|.$$

Note that, since A is symmetric, $||A||_1 = ||A||_\infty$.

4 References

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

5 Parameters

1: **order** – Nag_OrderType *Input*

On entry: the **order** parameter specifies the two-dimensional storage scheme being used, i.e., row-major ordering or column-major ordering. C language defined storage is specified by **order** = **Nag_RowMajor**. See Section 2.2.1.4 of the Essential Introduction for a more detailed explanation of the use of this parameter.

Constraint: **order** = **Nag_RowMajor** or **Nag_ColMajor**.

2: **norm** – Nag_NormType *Input*

On entry: specifies the value to be returned:

if **norm** = **Nag_OneNorm**, the 1-norm;

if **norm** = **Nag_InfNorm**, the infinity-norm;

if **norm** = **Nag_FrobeniusNorm**, the Frobenius (or Euclidean) norm;

if **norm** = **Nag_MaxNorm**, the value $\max_{i,j} |a_{ij}|$ (not a norm).

Constraint: **norm** = **Nag_OneNorm**, **Nag_InfNorm**, **Nag_FrobeniusNorm** or **Nag_MaxNorm**.

3: **uplo** – Nag_UploType *Input*

On entry: specifies whether the upper or lower triangular part of A is stored as follows:

if **uplo** = **Nag_Upper**, the upper triangular part of A is stored;

if **uplo** = **Nag_Lower**, the lower triangular part of A is stored.

Constraint: **uplo** = **Nag_Upper** or **Nag_Lower**.

4: **n** – Integer *Input*

On entry: n, the order of the matrix A.

Constraint: **n** ≥ 0.

5: **k** – Integer *Input*

On entry: k, the number of sub-diagonals or super-diagonals of the matrix A.

Constraint: **k** ≥ 0.

6: **ab**[dim] – const Complex *Input*

Note: the dimension, dim, of the array **ab** must be at least $\max(1, \textbf{pdab} \times \textbf{n})$.

On entry: the n by n Hermitian band matrix A. This is stored as a notional two-dimensional array with row elements or column elements stored contiguously. The storage of elements a_{ij} depends on the **order** and **uplo** parameters as follows:

if **order** = **Nag_ColMajor** and **uplo** = **Nag_Upper**,
a_{ij} is stored in **ab**$[k + i - j + (j-1) \times \textbf{pdab}]$, for $j = 1, \ldots, n$ and
$i = \max(1, j-k), \ldots, j$;

if **order** = **Nag_ColMajor** and **uplo** = **Nag_Lower**,
a_{ij} is stored in **ab**$[i - j + (j-1) \times \textbf{pdab}]$, for $j = 1, \ldots, n$ and
$i = j, \ldots, \min(n, j+k)$;

if **order** = **Nag_RowMajor** and **uplo** = **Nag_Upper**,
a_{ij} is stored in **ab**$[j - i + (i-1) \times \textbf{pdab}]$, for $i = 1, \ldots, n$ and
$j = i, \ldots, \min(n, i+k)$;

if **order** = **Nag_RowMajor** and **uplo** = **Nag_Lower**,
a_{ij} is stored in **ab**$[k + j - i + (i-1) \times \textbf{pdab}]$, for $i = 1, \ldots, n$ and
$j = \max(1, i-k), \ldots, i$.

7: **pdab** – Integer *Input*

On entry: the stride separating row or column elements (depending on the value of **order**) of the matrix A in the array **ab**.

Constraints:

if **order** = **Nag_ColMajor**, **pdab** $\geq$ **k** $+ 1$;
if **order** = **Nag_RowMajor**, **pdab** $\geq \max(1,$ **n**$)$.

8: **r** – double * *Output*

On exit: the value of the norm specified by **norm**.

9: **fail** – NagError * *Input/Output*

The NAG error parameter (see the Essential Introduction).

6 Error Indicators and Warnings

NE_INT

On entry, $\mathbf{n} = \langle value \rangle$.
Constraint: $\mathbf{n} \geq 0$.

On entry, $\mathbf{k} = \langle value \rangle$.
Constraint: $\mathbf{k} \geq 0$.

On entry, $\mathbf{pdab} = \langle value \rangle$.
Constraint: $\mathbf{pdab} \geq \mathbf{k} + 1$.

NE_BAD_PARAM

On entry, parameter $\langle value \rangle$ had an illegal value.

7 Accuracy

The BLAS standard requires accurate implementations which avoid unnecessary over/underflow (see section 2.7 of The BLAS Technical Forum Standard (2001)).

8 Further Comments

None.

9 Example

See Section 9 of the document for nag_zpbcon (f07huc).