NAG Library Function Document

nag_zhe_norm (f16ucc)

1 Purpose

nag_zhe_norm (f16ucc) calculates the value of the 1-norm, the ∞-norm, the Frobenius norm or the maximum absolute value of the elements of a complex n by n Hermitian matrix.

2 Specification

```
#include <nag.h>
#include <nagf16.h>
```

```
void nag_zhe_norm (Nag_OrderType order, Nag_NormType norm,
     Nag_UploType uplo, Integer n, const Complex a[], Integer pda, double *r,
     NagError *fail)
```

3 Description

Given a complex n by n Hermitian matrix, A, nag_zhe_norm (f16ucc) calculates one of the values given by

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

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

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

or

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

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

4 References

Basic Linear Algebra Subprograms Technical (BLAST) Forum (2001) *Basic Linear Algebra Subprograms Technical (BLAST) Forum Standard* University of Tennessee, Knoxville, Tennessee http://www.netlib.org/blas/blast-forum/blas-report.pdf

5 Arguments

1: **order** – Nag_OrderType *Input*

On entry: the **order** argument 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 3.2.1.3 in the Essential Introduction for a more detailed explanation of the use of this argument.

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

2: **norm** – Nag_NormType *Input*

On entry: specifies the value to be returned.

norm = Nag_OneNorm
The 1-norm.

norm = Nag_InfNorm
The ∞-norm.

norm = Nag_FrobeniusNorm
The Frobenius (or Euclidean) norm.

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.

uplo = Nag_Upper
The upper triangular part of A is stored.

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.

If $n = 0$, then **n** is set to zero.

Constraint: $\mathbf{n} \geq 0$.

5: **a**[*dim*] – const Complex *Input*

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

On entry: the n by n Hermitian matrix A.

If **order** = Nag_ColMajor, A_{ij} is stored in $\mathbf{a}[(j-1) \times \mathbf{pda} + i - 1]$.

If **order** = Nag_RowMajor, A_{ij} is stored in $\mathbf{a}[(i-1) \times \mathbf{pda} + j - 1]$.

If **uplo** = Nag_Upper, the upper triangular part of A must be stored and the elements of the array below the diagonal are not referenced.

If **uplo** = Nag_Lower, the lower triangular part of A must be stored and the elements of the array above the diagonal are not referenced.

6: **pda** – Integer *Input*

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

Constraint: $\mathbf{pda} \geq \max(1, \mathbf{n})$.

7: **r** – double * *Output*

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

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

The NAG error argument (see Section 3.6 in the Essential Introduction).

6 Error Indicators and Warnings

NE_ALLOC_FAIL

Dynamic memory allocation failed.
See Section 3.2.1.2 in the Essential Introduction for further information.

NE_BAD_PARAM

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

NE_INT

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

NE_INT_2

On entry, $\mathbf{pda} = \langle value \rangle$, $\mathbf{n} = \langle value \rangle$.
Constraint: $\mathbf{pda} \geq \max(1, \mathbf{n})$.

NE_INTERNAL_ERROR

An unexpected error has been triggered by this function. Please contact NAG.
See Section 3.6.6 in the Essential Introduction for further information.

NE_NO_LICENCE

Your licence key may have expired or may not have been installed correctly.
See Section 3.6.5 in the Essential Introduction for further information.

7 Accuracy

The BLAS standard requires accurate implementations which avoid unnecessary over/underflow (see Section 2.7 of Basic Linear Algebra Subprograms Technical (BLAST) Forum (2001)).

8 Parallelism and Performance

Not applicable.

9 Further Comments

None.

10 Example

See Section 10 in nag_zpocon (f07fuc) and nag_zhecon (f07muc).