NAG Library Function Document

nag_zhp_norm (f16udc)

1 Purpose

nag_zhp_norm (f16udc) 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, stored in packed form.

2 Specification

```
#include <nag.h>
#include <nagf16.h>
void nag_zhp_norm (Nag_OrderType order, Nag_NormType norm,
     Nag_UploType uplo, Integer n, const Complex ap[], double *r,
     NagError *fail)
```

3 Description

Given a complex n by n Hermitian matrix, A, in packed storage, nag_zhp_norm (f16udc) 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 2.3.1.3 in How to Use the NAG Library and its Documentation 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 $\max_{i,j} \left|a_{ij}\right|$ (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: **ap**[dim] – const Complex *Input*

Note: the dimension, *dim*, of the array **ap** must be at least $\max(1, \mathbf{n} \times (\mathbf{n}+1)/2)$.

On entry: the n by n Hermitian matrix A, packed by rows or columns.

The storage of elements A_{ij} depends on the **order** and **uplo** arguments as follows:

if **order** = Nag_ColMajor and **uplo** = Nag_Upper,
A_{ij} is stored in **ap**$[(j-1) \times j/2 + i - 1]$, for $i \leq j$;
if **order** = Nag_ColMajor and **uplo** = Nag_Lower,
A_{ij} is stored in **ap**$[(2n-j) \times (j-1)/2 + i - 1]$, for $i \geq j$;
if **order** = Nag_RowMajor and **uplo** = Nag_Upper,
A_{ij} is stored in **ap**$[(2n-i) \times (i-1)/2 + j - 1]$, for $i \leq j$;
if **order** = Nag_RowMajor and **uplo** = Nag_Lower,
A_{ij} is stored in **ap**$[(i-1) \times i/2 + j - 1]$, for $i \geq j$.

6: **r** – double * *Output*

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

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

The NAG error argument (see Section 2.7 in How to Use the NAG Library and its Documentation).

6 Error Indicators and Warnings

NE_ALLOC_FAIL

Dynamic memory allocation failed.
See Section 2.3.1.2 in How to Use the NAG Library and its Documentation for further information.

NE_BAD_PARAM

On entry, argument ⟨*value*⟩ had an illegal value.

NE_INT

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

NE_INTERNAL_ERROR

An unexpected error has been triggered by this function. Please contact NAG.
See Section 2.7.6 in How to Use the NAG Library and its Documentation for further information.

NE_NO_LICENCE

Your licence key may have expired or may not have been installed correctly.
See Section 2.7.5 in How to Use the NAG Library and its Documentation 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

nag_zhp_norm (f16udc) is not threaded in any implementation.

9 Further Comments

None.

10 Example

See Section 10 in nag_zppcon (f07guc) and nag_zhpcon (f07puc).