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


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
\textbf{order} = \text{Nag\_RowMajor}. See Section 3.2.1.3 in the Essential Introduction for a more detailed explanation of the use of this argument.

\textit{Constraint: order} = \text{Nag\_RowMajor} or \text{Nag\_ColMajor}.

2: \textbf{norm} – \text{Nag\_NormType} \hspace{1cm} \text{Input}

\textit{On entry:} specifies the value to be returned.

\textbf{norm} = \text{Nag\_OneNorm} \\
\hspace{1cm} The 1-norm.

\textbf{norm} = \text{Nag\_InfNorm} \\
\hspace{1cm} The \inf\text{-}norm.

\textbf{norm} = \text{Nag\_FrobeniusNorm} \\
\hspace{1cm} The Frobenius (or Euclidean) norm.

\textbf{norm} = \text{Nag\_MaxNorm} \\
\hspace{1cm} The value \max_{i,j} |a_{ij}| (not a norm).

\textit{Constraint: norm} = \text{Nag\_OneNorm}, \text{Nag\_InfNorm}, \text{Nag\_FrobeniusNorm} or \text{Nag\_MaxNorm}.

3: \textbf{uplo} – \text{Nag\_UploType} \hspace{1cm} \text{Input}

\textit{On entry:} specifies whether the upper or lower triangular part of \(A\) is stored.

\textbf{uplo} = \text{Nag\_Upper} \\
\hspace{1cm} The upper triangular part of \(A\) is stored.

\textbf{uplo} = \text{Nag\_Lower} \\
\hspace{1cm} The lower triangular part of \(A\) is stored.

\textit{Constraint: uplo} = \text{Nag\_Upper} or \text{Nag\_Lower}.

4: \textbf{n} – \text{Integer} \hspace{1cm} \text{Input}

\textit{On entry:} \(n\), the order of the matrix \(A\).

If \(n = 0\), then \(n\) is set to zero.

\textit{Constraint: n} \(\geq 0\).

5: \textbf{a[dim]} – const \text{Complex} \hspace{1cm} \text{Input}

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

\textit{On entry:} the \(n\) by \(n\) Hermitian matrix \(A\).

If \textbf{order} = \text{Nag\_ColMajor}, \(A_{ij}\) is stored in \(a[(j-1) \times \text{pda} + i - 1]\).

If \textbf{order} = \text{Nag\_RowMajor}, \(A_{ij}\) is stored in \(a[(i-1) \times \text{pda} + j - 1]\).

If \textbf{uplo} = \text{Nag\_Upper}, the upper triangular part of \(A\) must be stored and the elements of the array below the diagonal are not referenced.

If \textbf{uplo} = \text{Nag\_Lower}, the lower triangular part of \(A\) must be stored and the elements of the array above the diagonal are not referenced.

6: \textbf{pda} – \text{Integer} \hspace{1cm} \text{Input}

\textit{On entry:} the stride separating row or column elements (depending on the value of \textbf{order}) of the matrix \(A\) in the array \(a\).

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

7: \textbf{r} – double * \hspace{1cm} \text{Output}

\textit{On exit:} the value of the norm specified by \textbf{norm}.
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 value had an illegal value.

NE_INT
On entry, \( n = \langle \text{value} \rangle \).
Constraint: \( n \geq 0. \)

NE_INT_2
On entry, \( \text{pda} = \langle \text{value} \rangle, \ n = \langle \text{value} \rangle. \)
Constraint: \( \text{pda} \geq \max(1, n). \)

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).