NAG C Library Function Document

nag_zhp_norm (f16udc)

1 Purpose

nag_zhp_norm (f16udc) 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 matrix, stored in packed form.

2 Specification

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

\[
\|A\|_1 = \max_j \sum_{i=1}^{n} |a_{ij}|, \\
\|A\|_\infty = \max_i \sum_{j=1}^{n} |a_{ij}|, \\
\|A\|_F = \left( \sum_{i=1}^{n} \sum_{j=1}^{n} |a_{ij}|^2 \right)^{1/2}, \\
\max_{i,j} |a_{ij}|.
\]

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

4 References


5 Parameters

1: \texttt{order} – Nag_OrderType \hspace{1cm} \textit{Input}

\textit{On entry}: the \texttt{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 \texttt{order = Nag_RowMajor}. See Section 2.2.1.4 of the Essential Introduction for a more detailed explanation of the use of this parameter.

\textit{Constraint}: \texttt{order = Nag_RowMajor} or \texttt{Nag_ColMajor}.

2: \texttt{norm} – Nag_NormType \hspace{1cm} \textit{Input}

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

- if \texttt{norm = Nag_OneNorm}, the 1-norm;
- if \texttt{norm = Nag_InfNorm}, the infinity-norm;
- if \texttt{norm = Nag_FrobeniusNorm}, the Frobenius (or Euclidean) norm;
if \( \text{norm} = \text{Nag\_MaxNorm} \), the value \( \max_{i,j} |a_{ij}| \) (not a norm).

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

3: \( \text{uplo} \) – Nag\_UploType

\textit{Input}

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

- if \( \text{uplo} = \text{Nag\_Upper} \), the upper triangular part of \( A \) is stored;
- if \( \text{uplo} = \text{Nag\_Lower} \), the lower triangular part of \( A \) is stored.

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

4: \( n \) – Integer

\textit{Input}

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

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

5: \( \text{ap}[\text{dim}] \) – const Complex

\textit{Input}

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

\textit{On entry:} the \( n \) by \( n \) Hermitian matrix \( A \), packed by rows or columns. The storage of elements \( a_{ij} \) depends on the \( \text{order} \) and \( \text{uplo} \) parameters as follows:

- if \( \text{order} = \text{Nag\_ColMajor} \) and \( \text{uplo} = \text{Nag\_Upper} \),
  \( a_{ij} \) is stored in \( \text{ap}[(j - 1) \times j/2 + i - 1] \), for \( i \leq j \);
- if \( \text{order} = \text{Nag\_ColMajor} \) and \( \text{uplo} = \text{Nag\_Lower} \),
  \( a_{ij} \) is stored in \( \text{ap}[(2n - j) \times (j - 1)/2 + i - 1] \), for \( i \geq j \);
- if \( \text{order} = \text{Nag\_RowMajor} \) and \( \text{uplo} = \text{Nag\_Upper} \),
  \( a_{ij} \) is stored in \( \text{ap}[(2n - i) \times (i - 1)/2 + j - 1] \), for \( i \leq j \);
- if \( \text{order} = \text{Nag\_RowMajor} \) and \( \text{uplo} = \text{Nag\_Lower} \),
  \( a_{ij} \) is stored in \( \text{ap}[(i - 1) \times i/2 + j - 1] \), for \( i \geq j \).

6: \( r \) – double *

\textit{Output}

\textit{On exit:} the value of the norm specified by \( \text{norm} \).

7: \( \text{fail} \) – NagError *

\textit{Input/Output}

The NAG error parameter (see the Essential Introduction).

6 \ Error Indicators and Warnings

**NE\_INT**

On entry, \( n = (\text{value}) \).

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

**NE\_BAD\_PARAM**

On entry, parameter \( (\text{value}) \) 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 documents for nag_zppcon (f07guc) and nag_zhpcon (f07puc).