NAG C Library Function Document

nag_zsp_norm (f16ugc)

1 Purpose

nag_zsp_norm (f16ugc) 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 \(n\) symmetric matrix, stored in packed form.

2 Specification

```c
void nag_zsp_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 \(n\) symmetric matrix, \(A\), in packed storage, nag_zsp_norm (f16ugc) 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  
   
   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  
   
   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 \( \text{norm} = \text{Nag\_MaxNorm} \), the value \( \max_{i,j} |a_{ij}| \) (not a norm).

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

3: \( \text{uplo} \) – Nag\_UploType  
*Input*  
*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.

**Constraint:** \( \text{uplo} = \text{Nag\_Upper} \) or \text{Nag\_Lower}.

4: \( n \) – Integer  
*Input*  
*On entry:* \( n \), the order of the matrix \( A \).

**Constraint:** \( n \geq 0 \).

5: \( \text{ap[dim]} \) – const Complex  
*Input*  
**Note:** the dimension, \( \text{dim} \), of the array \( \text{ap} \) must be at least \( \max(1, n \times (n + 1)/2) \).

*On entry:* the \( n \) by \( n \) symmetric 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 *  
*Output*  
*On exit:* the value of the norm specified by \( \text{norm} \).

7: \( \text{fail} \) – NagError *  
*Input/Output*  
The NAG error parameter (see the Essential Introduction).

6  **Error Indicators and Warnings**

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

**NE\_BAD\_PARAM**  
On entry, parameter \( \langle \text{value} \rangle \) 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_zspcon (f07qec).