NAG Library Function Document

nag_dsp_norm (f16rdc)

1 Purpose

nag_dsp_norm (f16rdc) calculates the value of the 1-norm, the \( \infty \)-norm, the Frobenius norm or the maximum absolute value of the elements of a real \( n \) by \( n \) symmetric matrix, stored in packed form.

2 Specification

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

void nag_dsp_norm (Nag_OrderType order, Nag_NormType norm,
                    Nag_UploType uplo, Integer n, const double ap[], double *r,
                    NagError *fail)
```

3 Description

Given a real \( n \) by \( n \) symmetric matrix, \( A \), in packed storage, nag_dsp_norm (f16rdc) 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: \hspace{1em} **order** -- Nag_OrderType

   \hspace{1em} Input

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

- norm = Nag_OneNorm  
The 1-norm.
- norm = Nag_InfNorm   
The $\infty$-norm.
- norm = Nag_FrobeniusNorm  
The Frobenius (or Euclidean) norm.
- norm = Nag_MaxNorm  
The value $\max_{ij} |a_{ij}|$ (not a norm).

Constraint: norm = Nag_OneNorm, Nag_InfNorm, Nag_FrobeniusNorm or Nag_MaxNorm.

3: uplo – Nag_UploType  
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  
On entry: $n$, the order of the matrix $A$.

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

Constraint: n $\geq 0$.

5: ap[dim] – const double  
On entry: the dimension, dim, of the array ap must be at least $\max(1, n \times (n+1)/2)$.

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

6: r – double *  
On exit: the value of the norm specified by norm.

7: fail – NagError *  
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 = <value>.
Constraint: n \geq 0.

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_dppcon (f07gge) and nag_dspcon (f07pgc).