NAG C Library Function Document

nag_dsy_norm (f16rcc)

1 Purpose

nag_dsy_norm (f16rcc) calculates the value of the 1-norm, the infinity-norm, the Frobenius norm, or the maximum absolute value of the elements, of a real \( n \times n \) symmetric matrix.

2 Specification

```c
void nag_dsy_norm (Nag_OrderType order, Nag_NormType norm, Nag_UploType uplo,
                Integer n, const double a[], Integer pda, double *r, NagError *fail)
```

3 Description

Given a real \( n \times n \) symmetric matrix, \( A \), nag_dsy_norm (f16rcc) 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: `order` – Nag_OrderType

*Input*

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

*Input*

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 `norm = Nag_MaxNorm`, the value \( \max_{i,j} |a_{ij}| \) (not a norm).

Constraint: `norm = Nag_OneNorm, Nag_InfNorm, Nag_FrobeniusNorm` or `Nag_MaxNorm`. 
3: \texttt{uplo} – Nag_UploType \hspace{1cm} \textit{Input}

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

- if \texttt{uplo} = Nag_Upper, the upper triangular part of \(A\) is stored;
- if \texttt{uplo} = Nag_Lower, the lower triangular part of \(A\) is stored.

\textit{Constraint}: \texttt{uplo} = Nag_Upper or Nag_Lower.

4: \texttt{n} – Integer \hspace{1cm} \textit{Input}

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

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

5: \texttt{a[dim]} – const double \hspace{1cm} \textit{Input}

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

If \texttt{order} = Nag_ColMajor, the \((i,j)\)th element of the matrix \(A\) is stored in \(a[(j-1) \times pda + i - 1]\) and if \texttt{order} = Nag_RowMajor, the \((i,j)\)th element of the matrix \(A\) is stored in \(a[(i-1) \times pda + j - 1]\).

\textit{On entry}: the \(n\) by \(n\) symmetric matrix \(A\). If \texttt{uplo} = Nag_Upper, the upper triangle of \(A\) must be stored and the elements of the array below the diagonal are not referenced; if \texttt{uplo} = Nag_Lower, the lower triangle of \(A\) must be stored and the elements of the array above the diagonal are not referenced.

6: \texttt{pda} – Integer \hspace{1cm} \textit{Input}

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

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

7: \texttt{r} – double * \hspace{1cm} \textit{Output}

\textit{On exit}: the value of the norm specified by \texttt{norm}.

8: \texttt{fail} – NagError * \hspace{1cm} \textit{Input/Output}

The NAG error parameter (see the Essential Introduction).

6 \hspace{0.5cm} \textbf{Error Indicators and Warnings}

\textbf{NE_INT}

On entry, \(n = (value)\).

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

On entry, \(pda = (value)\).

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

\textbf{NE_BAD_PARAM}

On entry, parameter \((value)\) had an illegal value.

7 \hspace{0.5cm} \textbf{Accuracy}

The BLAS standard requires accurate implementations which avoid unnecessary over/underflow (see section 2.7 of The BLAS Technical Forum Standard (2001)).

8 \hspace{0.5cm} \textbf{Further Comments}

None.
9 Example

See Section 9 of the documents for nag_dpocon (f07fge) and nag_dsycon (f07mge).