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NAG Library Routine Document

F06PGF (DTBMV)

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Note: before using this routine, please read the Users' Note for your implementation to check the interpretation of **bold italicised** terms and other implementation-dependent details.

1 Purpose

F06PGF (DTBMV) computes the matrix-vector product for a real triangular band matrix or its transpose.

2 Specification

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SUBROUTINE F06PGF (UPLO, TRANS, DIAG, N, K, A, LDA, X, INCX)

INTEGER           N, K, LDA, INCX
REAL (KIND=nag_wp) A(LDA,*), X(*)
CHARACTER(1)      UPLO, TRANS, DIAG
```

The routine may be called by its BLAS name **dtbmv**.

3 Description

F06PGF (DTBMV) performs one of the matrix-vector operations

$$x \leftarrow Ax \quad \text{or} \quad x \leftarrow A^{\mathrm{T}}x,$$

where A is an n by n real triangular band matrix with k subdiagonals or superdiagonals, and x is an n-element real vector.

4 References

None.

5 Parameters

1:    UPLO – CHARACTER(1)   *Input*

 On entry: specifies whether A is upper or lower triangular.

 UPLO = 'U'
  A is upper triangular.

 UPLO = 'L'
  A is lower triangular.

 Constraint: UPLO = 'U' or 'L'.

2:    TRANS – CHARACTER(1)   *Input*

 On entry: specifies the operation to be performed.

 TRANS = 'N'
  $x \leftarrow Ax$.

 TRANS = 'T' or 'C'
  $x \leftarrow A^{\mathrm{T}}x$.

 Constraint: TRANS = 'N', 'T' or 'C'.

3: DIAG – CHARACTER(1) *Input*

On entry: specifies whether A has nonunit or unit diagonal elements.

DIAG = 'N'
   The diagonal elements are stored explicitly.

DIAG = 'U'
   The diagonal elements are assumed to be 1, and are not referenced.

Constraint: DIAG = 'N' or 'U'.

4: N – INTEGER *Input*

On entry: n, the order of the matrix A.

Constraint: N $\geq$ 0.

5: K – INTEGER *Input*

On entry: k, the number of subdiagonals or superdiagonals of the matrix A.

Constraint: K $\geq$ 0.

6: A(LDA, $*$) – REAL (KIND=nag_wp) array *Input*

Note: the second dimension of the array A must be at least N.

On entry: the n by n triangular band matrix A

The matrix is stored in rows 1 to $k + 1$, more precisely,

   if UPLO = 'U', the elements of the upper triangle of A within the band must be stored with element A_{ij} in A($k + 1 + i - j, j$) for $\max(1, j - k) \leq i \leq j$;

   if UPLO = 'L', the elements of the lower triangle of A within the band must be stored with element A_{ij} in A($1 + i - j, j$) for $j \leq i \leq \min(n, j + k)$.

If DIAG = 'U', the diagonal elements of A are assumed to be 1, and are not referenced.

7: LDA – INTEGER *Input*

On entry: the first dimension of the array A as declared in the (sub)program from which F06PGF (DTBMV) is called.

Constraint: LDA $\geq$ K + 1.

8: X($*$) – REAL (KIND=nag_wp) array *Input/Output*

Note: the dimension of the array X must be at least $\max(1, 1 + (\text{N} - 1) \times |\text{INCX}|)$.

On entry: the n-element vector x.

If INCX > 0, x_i must be stored in X($1 + (i - 1) \times \text{INCX}$), for $i = 1, 2, \ldots, \text{N}$.

If INCX < 0, x_i must be stored in X($1 - (\text{N} - i) \times \text{INCX}$), for $i = 1, 2, \ldots, \text{N}$.

On exit: the updated vector x stored in the array elements used to supply the original vector x.

9: INCX – INTEGER *Input*

On entry: the increment in the subscripts of X between successive elements of x.

Constraint: INCX $\neq$ 0.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Parallelism and Performance

Not applicable.

9 Further Comments

None.

10 Example

None.