NAG Library Routine Document

F06SGF (ZTBMV)

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

F06SGF (ZTBMV) computes the matrix-vector product for a complex triangular band matrix, its transpose or its conjugate transpose.

2 Specification

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SUBROUTINE F06SGF (UPLO, TRANS, DIAG, N, K, A, LDA, X, INCX)

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

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

3 Description

F06SGF (ZTBMV) performs one of the matrix-vector operations

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

where A is an n by n complex triangular band matrix with k subdiagonals or superdiagonals, and x is an n-element complex 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'
    $x \leftarrow A^{\mathrm{T}}x$.

TRANS = 'C'
    $x \leftarrow A^{\mathrm{H}}x$.

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, $*$) – COMPLEX (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 F06SGF (ZTBMV) is called.

   Constraint: LDA $\geq$ K + 1.

8:   X($*$) – COMPLEX (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 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.