

# NAG Fortran Library Routine Document

## F06SBF (ZGBMV)

**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

F06SBF (ZGBMV) performs one of the matrix-vector operations

$$y \leftarrow \alpha Ax + \beta y, \quad y \leftarrow \alpha A^T x + \beta y \quad \text{or} \quad y \leftarrow \alpha A^H x + \beta y$$

where  $A$  is an  $m$  by  $n$  complex band matrix with  $k_l$  sub-diagonals and  $k_u$  super-diagonals,  $x$  and  $y$  are complex vectors, and  $\alpha$  and  $\beta$  are complex scalars.

If  $m = 0$  or  $n = 0$ , no operation is performed.

### 2 Specification

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SUBROUTINE F06SBF (TRANS, M, N, KL, KU, ALPHA, A, LDA, X, INCX, BETA, Y,
1              INCY)
      INTEGER          M, N, KL, KU, LDA, INCX, INCY
      complex*16      ALPHA, A(LDA,*), X(*), BETA, Y(*)
      CHARACTER*1     TRANS

```

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

### 3 Description

None.

### 4 References

None.

### 5 Parameters

- 1: TRANS – CHARACTER\*1 *Input*  
*On entry:* specifies the operation to be performed as follows:  
     if TRANS = 'N',  $y \leftarrow \alpha Ax + \beta y$ ;  
     if TRANS = 'T',  $y \leftarrow \alpha A^T x + \beta y$ ;  
     if TRANS = 'C',  $y \leftarrow \alpha A^H x + \beta y$ .  
*Constraint:* TRANS = 'N', 'T' or 'C'.
- 2: M – INTEGER *Input*  
*On entry:*  $m$ , the number of rows of the matrix  $A$ .  
*Constraint:*  $M \geq 0$ .
- 3: N – INTEGER *Input*  
*On entry:*  $n$ , the number of columns of the matrix  $A$ .  
*Constraint:*  $N \geq 0$ .

- 4: KL – INTEGER *Input*  
*On entry:*  $k_l$ , the number of sub-diagonals within the band of  $A$ .  
*Constraint:*  $KL \geq 0$ .
- 5: KU – INTEGER *Input*  
*On entry:*  $k_u$ , the number of super-diagonals within the band of  $A$ .  
*Constraint:*  $KU \geq 0$ .
- 6: ALPHA – ***complex\*16*** *Input*  
*On entry:* the scalar  $\alpha$ .
- 7: A(LDA,\*) – ***complex\*16*** array *Input*  
**Note:** the second dimension of the array  $A$  must be at least  $\max(1, N)$ .  
*On entry:* the  $m$  by  $n$  band matrix  $A$ , stored in rows 1 to  $k_l + k_u + 1$ . More precisely,  $a_{ij}$  must be stored in  $A(k_u + i - j + 1, j)$  for  $\max(j - k_u, 1) \leq i \leq \min(j + k_l, m)$ .
- 8: LDA – INTEGER *Input*  
*On entry:* the first dimension of the array  $A$  as declared in the (sub)program from which F06SBF (ZGBMV) is called.  
*Constraint:*  $LDA \geq KL + KU + 1$ .
- 9: X(\*) – ***complex\*16*** array *Input*  
*On entry:* the vector  $x$ , of length  $n$  if TRANS = 'N', or of length  $m$  if TRANS = 'T' or 'C'.
- 10: INCX – INTEGER *Input*  
*On entry:* the increment in the subscripts of  $X$  between successive elements of  $x$ .  
*Constraint:*  $INCX \neq 0$ .
- 11: BETA – ***complex\*16*** *Input*  
*On entry:* the scalar  $\beta$ .
- 12: Y(\*) – ***complex\*16*** array *Input/Output*  
*On entry:* the vector  $y$ , of length  $m$  if TRANS = 'N', or of length  $n$  if TRANS = 'T' or 'C'. If BETA = 0,  $Y$  need not be set.  
*On exit:* the updated vector  $y$ .
- 13: INCY – INTEGER *Input*  
*On entry:* the increment in the subscripts of  $Y$  between successive elements of  $y$ .  
*Constraint:*  $INCY \neq 0$ .

## 6 Error Indicators and Warnings

None.

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