

NAG Library Routine Document

F06PBF (DGBMV)

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

F06PBF (DGBMV) computes the matrix-vector product for a real general band matrix or its transpose.

2 Specification

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SUBROUTINE F06PBF (TRANS, M, N, KL, KU, ALPHA, A, LDA, X, INCX, BETA, Y, &
                  INCY)
INTEGER          M, N, KL, KU, LDA, INCX, INCY
REAL (KIND=nag_wp) ALPHA, A(LDA,*), X(*), BETA, Y(*)
CHARACTER(1)    TRANS
```

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

3 Description

F06PBF (DGBMV) performs one of the matrix-vector operations

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

where A is an m by n real band matrix with k_l subdiagonals and k_u superdiagonals, x and y are real vectors, and α and β are real scalars.

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

4 References

None.

5 Parameters

- 1: TRANS – CHARACTER(1) *Input*
On entry: specifies the operation to be performed.
 TRANS = 'N'
 $y \leftarrow \alpha Ax + \beta y.$
 TRANS = 'T' or 'C'
 $y \leftarrow \alpha A^T x + \beta y.$
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 subdiagonals within the band of A .
Constraint: $KL \geq 0$.
- 5: KU – INTEGER *Input*
On entry: k_u , the number of superdiagonals within the band of A .
Constraint: $KU \geq 0$.
- 6: ALPHA – REAL (KIND=nag_wp) *Input*
On entry: the scalar α .
- 7: A(LDA,*) – REAL (KIND=nag_wp) array *Input*
Note: the second dimension of the array A must be at least N .
On entry: the m by n band matrix A .
The matrix is stored in rows 1 to $k_l + k_u + 1$, more precisely, the element A_{ij} must be stored in

$$A(k_u + 1 + i - j, j) \quad \text{for } \max(1, j - k_u) \leq i \leq \min(m, j + k_l).$$
- 8: LDA – INTEGER *Input*
On entry: the first dimension of the array A as declared in the (sub)program from which F06PBF (DGBMV) is called.
Constraint: $LDA \geq KL + KU + 1$.
- 9: X(*) – REAL (KIND=nag_wp) array *Input*
Note: the dimension of the array X must be at least $\max(1, 1 + (N - 1) \times |\text{INCX}|)$ if $\text{TRANS} = 'N'$ and at least $\max(1, 1 + (M - 1) \times |\text{INCX}|)$ if $\text{TRANS} = 'T'$ or $'C'$.
On entry: the vector x .
If $\text{TRANS} = 'N'$,
 if $\text{INCX} > 0$, x_i must be stored in $X(1 + (i - 1) \times \text{INCX})$, for $i = 1, 2, \dots, N$;
 if $\text{INCX} < 0$, x_i must be stored in $X(1 - (N - i) \times \text{INCX})$, for $i = 1, 2, \dots, N$.
If $\text{TRANS} = 'T'$ or $'C'$,
 if $\text{INCX} > 0$, x_i must be stored in $X(1 + (i - 1) \times \text{INCX})$, for $i = 1, 2, \dots, M$;
 if $\text{INCX} < 0$, x_i must be stored in $X(1 - (M - i) \times \text{INCX})$, for $i = 1, 2, \dots, M$.
- 10: INCX – INTEGER *Input*
On entry: the increment in the subscripts of X between successive elements of x .
Constraint: $\text{INCX} \neq 0$.
- 11: BETA – REAL (KIND=nag_wp) *Input*
On entry: the scalar β .
- 12: Y(*) – REAL (KIND=nag_wp) array *Input/Output*
Note: the dimension of the array Y must be at least $\max(1, 1 + (M - 1) \times |\text{INCY}|)$ if $\text{TRANS} = 'N'$ and at least $\max(1, 1 + (N - 1) \times |\text{INCY}|)$ if $\text{TRANS} = 'T'$ or $'C'$.
On entry: the vector y , if $\text{BETA} = 0.0$, Y need not be set.
If $\text{TRANS} = 'N'$,

if $\text{INCY} > 0$, y_i must be stored in $Y(1 + (i - 1) \times \text{INCY})$, for $i = 1, 2, \dots, M$;

if $\text{INCY} < 0$, y_i must be stored in $Y(1 - (M - i) \times \text{INCY})$, for $i = 1, 2, \dots, M$.

If $\text{TRANS} = 'T'$ or $'C'$,

if $\text{INCY} > 0$, y_i must be stored in $Y(1 + (i - 1) \times \text{INCY})$, for $i = 1, 2, \dots, N$;

if $\text{INCY} < 0$, y_i must be stored in $Y(1 - (N - i) \times \text{INCY})$, for $i = 1, 2, \dots, N$.

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

13: $\text{INCY} - \text{INTEGER}$

Input

On entry: the increment in the subscripts of Y between successive elements of y .

Constraint: $\text{INCY} \neq 0$.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Parallelism and Performance

Not applicable.

9 Further Comments

None.

10 Example

None.
