

# NAG Library Routine Document

## F06PEF (DSPMV)

**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

F06PEF (DSPMV) computes the matrix-vector product for a real symmetric matrix stored in packed form.

### 2 Specification

```
SUBROUTINE F06PEF (UPLO, N, ALPHA, AP, X, INCX, BETA, Y, INCY)
  INTEGER          N, INCX, INCY
  REAL (KIND=nag_wp) ALPHA, AP(*), X(*), BETA, Y(*)
  CHARACTER(1)    UPLO
```

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

### 3 Description

F06PEF (DSPMV) performs the matrix-vector operation

$$y \leftarrow \alpha Ax + \beta y,$$

where  $A$  is an  $n$  by  $n$  real symmetric matrix stored in packed form,  $x$  and  $y$  are  $n$ -element real vectors, and  $\alpha$  and  $\beta$  are real scalars.

### 4 References

None.

### 5 Parameters

- |    |   |              |
|----|---|--------------|
| 1: | UPLO – CHARACTER(1)   | <i>Input</i> |
|    | <i>On entry:</i> specifies whether the upper or lower triangular part of $A$ is stored. |              |
|    | UPLO = 'U'<br>The upper triangular part of $A$ is stored.                               |              |
|    | UPLO = 'L'<br>The lower triangular part of $A$ is stored.                               |              |
|    | <i>Constraint:</i> UPLO = 'U' or 'L'.   |              |
| 2: | N – INTEGER   | <i>Input</i> |
|    | <i>On entry:</i> $n$ , the order of the matrix $A$ .                                    |              |
|    | <i>Constraint:</i> $N \geq 0$ .   |              |
| 3: | ALPHA – REAL (KIND=nag_wp)  | <i>Input</i> |
|    | <i>On entry:</i> the scalar $\alpha$ .  |              |

- 4: AP(\*) – REAL (KIND=nag\_wp) array *Input*  
**Note:** the dimension of the array AP must be at least  $N \times (N + 1)/2$ .  
*On entry:* the  $n$  by  $n$  symmetric matrix  $A$ , packed by columns.  
 More precisely,  
     if UPLO = 'U', the upper triangle of  $A$  must be stored with element  $A_{ij}$  in  
     AP( $i + j(j - 1)/2$ ) for  $i \leq j$ ;  
     if UPLO = 'L', the lower triangle of  $A$  must be stored with element  $A_{ij}$  in  
     AP( $i + (2n - j)(j - 1)/2$ ) for  $i \geq j$ .
- 5: X(\*) – REAL (KIND=nag\_wp) array *Input*  
**Note:** the dimension of the array X must be at least  $\max(1, 1 + (N - 1) \times |\text{INCX}|)$ .  
*On entry:* the  $n$ -element vector  $x$ .  
 If INCX > 0,  $x_i$  must be stored in X( $1 + (i - 1) \times \text{INCX}$ ), for  $i = 1, 2, \dots, N$ .  
 If INCX < 0,  $x_i$  must be stored in X( $1 - (N - i) \times \text{INCX}$ ), for  $i = 1, 2, \dots, N$ .  
 Intermediate elements of X are not referenced.
- 6: INCX – INTEGER *Input*  
*On entry:* the increment in the subscripts of X between successive elements of  $x$ .  
*Constraint:* INCX  $\neq$  0.
- 7: BETA – REAL (KIND=nag\_wp) *Input*  
*On entry:* the scalar  $\beta$ .
- 8: Y(\*) – REAL (KIND=nag\_wp) array *Input/Output*  
**Note:** the dimension of the array Y must be at least  $\max(1, 1 + (N - 1) \times |\text{INCY}|)$ .  
*On entry:* the  $n$ -element vector  $y$ , if BETA = 0.0 Y need not be set.  
 If INCY > 0,  $y_i$  must be stored in Y( $1 + (i - 1) \times \text{INCY}$ ), for  $i = 1, 2, \dots, N$ .  
 If 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  $y$ .
- 9: 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.

## 7 Accuracy

Not applicable.

## 8 Parallelism and Performance

Not applicable.

## **9 Further Comments**

None.

## **10 Example**

None.

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