

# NAG Library Routine Document

## F06SPF (ZHER)

**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

F06SPF (ZHER) computes the rank-1 update of a complex Hermitian matrix.

### 2 Specification

```
SUBROUTINE F06SPF (UPLO, N, ALPHA, X, INCX, A, LDA)
  INTEGER          N, INCX, LDA
  REAL (KIND=nag_wp) ALPHA
  COMPLEX (KIND=nag_wp) X(*), A(LDA,*)
  CHARACTER(1)    UPLO
```

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

### 3 Description

F06SPF (ZHER) performs the Hermitian rank-1 update operation

$$A \leftarrow \alpha x x^H + A,$$

where  $A$  is an  $n$  by  $n$  complex Hermitian matrix,  $x$  is an  $n$ -element complex vector, and  $\alpha$  is a real scalar.

### 4 References

None.

### 5 Arguments

- |    |   |              |
|----|---|--------------|
| 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: X(\*) – COMPLEX (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  $\text{INCX} > 0$ ,  $x_i$  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  $i = 1, 2, \dots, N$ .  
 Intermediate elements of X are not referenced.
- 5: INCX – INTEGER *Input*  
*On entry:* the increment in the subscripts of X between successive elements of  $x$ .  
*Constraint:*  $\text{INCX} \neq 0$ .
- 6: A(LDA,\*) – COMPLEX (KIND=nag\_wp) array *Input/Output*  
**Note:** the second dimension of the array A must be at least  $\max(1, N)$ .  
*On entry:* the  $n$  by  $n$  Hermitian matrix  $A$ .  
     If  $\text{UPLO} = 'U'$ , the upper triangular part of  $A$  must be stored and the elements of the array below the diagonal are not referenced.  
     If  $\text{UPLO} = 'L'$ , the lower triangular part of  $A$  must be stored and the elements of the array above the diagonal are not referenced.  
*On exit:* the updated matrix  $A$ . The imaginary parts of the diagonal elements are set to zero.
- 7: LDA – INTEGER *Input*  
*On entry:* the first dimension of the array A as declared in the (sub)program from which F06SPF (ZHER) is called.  
*Constraint:*  $\text{LDA} \geq \max(1, N)$ .

## 6 Error Indicators and Warnings

None.

## 7 Accuracy

Not applicable.

## 8 Parallelism and Performance

F06SPF (ZHER) is not threaded in any implementation.

## 9 Further Comments

None.

## 10 Example

None.

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