

# NAG Library Routine Document

## F06ZWF (ZSYR2K)

**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

F06ZWF (ZSYR2K) performs one of the symmetric rank- $2k$  update operations

$$C \leftarrow \alpha AB^T + \alpha BA^T + \beta C \quad \text{or} \quad C \leftarrow \alpha A^T B + \alpha B^T A + \beta C,$$

where  $A$  and  $B$  are complex matrices,  $C$  is an  $n$  by  $n$  complex symmetric matrix, and  $\alpha$  and  $\beta$  are complex scalars.

### 2 Specification

SUBROUTINE F06ZWF (UPLO, TRANS, N, K, ALPHA, A, LDA, B, LDB, BETA, C, &  
LDC)

INTEGER N, K, LDA, LDB, LDC  
COMPLEX (KIND=nag\_wp) ALPHA, A(LDA,\*), B(LDB,\*), BETA, C(LDC,\*)  
CHARACTER(1) UPLO, TRANS

The routine may be called by its BLAS name *zsy $2k$* .

### 3 Description

None.

### 4 References

None.

### 5 Arguments

1: UPLO – CHARACTER(1) *Input*

*On entry:* specifies whether the upper or lower triangular part of  $C$  is stored.

UPLO = 'U'

The upper triangular part of  $C$  is stored.

UPLO = 'L'

The lower triangular part of  $C$  is stored.

*Constraint:* UPLO = 'U' or 'L'.

2: TRANS – CHARACTER(1) *Input*

*On entry:* specifies the operation to be performed.

TRANS = 'N'

$$C \leftarrow \alpha AB^T + \alpha BA^T + \beta C.$$

TRANS = 'T'

$$C \leftarrow \alpha A^T B + \alpha B^T A + \beta C.$$

*Constraint:* TRANS = 'N' or 'T'.

- 3: N – INTEGER *Input*  
*On entry:*  $n$ , the order of the matrix  $C$ ; the number of rows of  $A$  and  $B$  if TRANS = 'N', or the number of columns of  $A$  and  $B$  if TRANS = 'T'.  
*Constraint:*  $N \geq 0$ .
- 4: K – INTEGER *Input*  
*On entry:*  $k$ , the number of columns of  $A$  and  $B$  if TRANS = 'N', or the number of rows of  $A$  and  $B$  if TRANS = 'T'.  
*Constraint:*  $K \geq 0$ .
- 5: ALPHA – COMPLEX (KIND=nag\_wp) *Input*  
*On entry:* the scalar  $\alpha$ .
- 6: A(LDA,\*) – COMPLEX (KIND=nag\_wp) array *Input*  
**Note:** the second dimension of the array  $A$  must be at least  $\max(1, K)$  if TRANS = 'N' and at least  $\max(1, N)$  if TRANS = 'T'.  
*On entry:* the matrix  $A$ ;  $A$  is  $n$  by  $k$  if TRANS = 'N', or  $k$  by  $n$  if TRANS = 'T'.
- 7: LDA – INTEGER *Input*  
*On entry:* the first dimension of the array  $A$  as declared in the (sub)program from which F06ZWF (ZSYR2K) is called.  
*Constraints:*  
     if TRANS = 'N',  $LDA \geq \max(1, N)$ ;  
     if TRANS = 'T',  $LDA \geq \max(1, K)$ .
- 8: B(LDB,\*) – COMPLEX (KIND=nag\_wp) array *Input*  
**Note:** the second dimension of the array  $B$  must be at least  $\max(1, K)$  if TRANS = 'N' and at least  $\max(1, N)$  if TRANS = 'T'.  
*On entry:* the matrix  $B$ ;  $B$  is  $n$  by  $k$  if TRANS = 'N', or  $k$  by  $n$  if TRANS = 'T'.
- 9: LDB – INTEGER *Input*  
*On entry:* the first dimension of the array  $B$  as declared in the (sub)program from which F06ZWF (ZSYR2K) is called.  
*Constraints:*  
     if TRANS = 'N',  $LDB \geq \max(1, N)$ ;  
     if TRANS = 'T',  $LDB \geq \max(1, K)$ .
- 10: BETA – COMPLEX (KIND=nag\_wp) *Input*  
*On entry:* the scalar  $\beta$ .
- 11: C(LDC,\*) – COMPLEX (KIND=nag\_wp) array *Input/Output*  
**Note:** the second dimension of the array  $C$  must be at least  $\max(1, N)$ .  
*On entry:* the  $n$  by  $n$  symmetric matrix  $C$ .  
     If UPLO = 'U', the upper triangular part of  $C$  must be stored and the elements of the array below the diagonal are not referenced.  
     If UPLO = 'L', the lower triangular part of  $C$  must be stored and the elements of the array above the diagonal are not referenced.

*On exit:* the updated matrix  $C$ .

12: LDC – INTEGER

*Input*

*On entry:* the first dimension of the array  $C$  as declared in the (sub)program from which F06ZWF (ZSYR2K) is called.

*Constraint:*  $LDC \geq \max(1, N)$ .

## 6 Error Indicators and Warnings

None.

## 7 Accuracy

Not applicable.

## 8 Parallelism and Performance

F06ZWF (ZSYR2K) is threaded by NAG for parallel execution in multithreaded implementations of the NAG Library.

F06ZWF (ZSYR2K) makes calls to BLAS and/or LAPACK routines, which may be threaded within the vendor library used by this implementation. Consult the documentation for the vendor library for further information.

Please consult the X06 Chapter Introduction for information on how to control and interrogate the OpenMP environment used within this routine. Please also consult the Users' Note for your implementation for any additional implementation-specific information.

## 9 Further Comments

None.

## 10 Example

None.

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