

# NAG Library Routine Document

## F06ZJF (ZTRSM)

**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

F06ZJF (ZTRSM) performs one of the matrix-matrix operations

$$\begin{aligned} B &\leftarrow \alpha A^{-1}B, & B &\leftarrow \alpha A^{-T}B, & B &\leftarrow \alpha A^{-H}B, \\ B &\leftarrow \alpha BA^{-1}, & B &\leftarrow \alpha BA^{-T} & \text{or} & B \leftarrow \alpha BA^{-H}, \end{aligned}$$

where  $A$  is a complex triangular matrix,  $B$  is an  $m$  by  $n$  complex matrix, and  $\alpha$  is a complex scalar.  $A^{-T}$  denotes  $(A^T)^{-1}$  or equivalently  $(A^{-1})^T$ ;  $A^{-H}$  denotes  $(A^H)^{-1}$  or equivalently  $(A^{-1})^H$ .

No test for singularity or near-singularity of  $A$  is included in this routine. Such tests must be performed before calling this routine.

### 2 Specification

SUBROUTINE F06ZJF (SIDE, UPLO, TRANSA, DIAG, M, N, ALPHA, A, LDA, B, LDB)

INTEGER M, N, LDA, LDB  
 COMPLEX (KIND=nag\_wp) ALPHA, A(LDA,\*), B(LDB,\*)  
 CHARACTER(1) SIDE, UPLO, TRANSA, DIAG

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

### 3 Description

None.

### 4 References

None.

### 5 Parameters

- 1: SIDE – CHARACTER(1) *Input*  
*On entry:* specifies whether  $B$  is operated on from the left or the right.  
 SIDE = 'L'  
      $B$  is pre-multiplied from the left.  
 SIDE = 'R'  
      $B$  is post-multiplied from the right.  
*Constraint:* SIDE = 'L' or 'R'.
- 2: UPLO – CHARACTER(1) *Input*  
*On entry:* specifies whether  $A$  is upper or lower triangular.  
 UPLO = 'U'  
      $A$  is upper triangular.

- UPLO = 'L'  
 $A$  is lower triangular.  
*Constraint:* UPLO = 'U' or 'L'.
- 3:    TRANSA – CHARACTER(1) *Input*  
*On entry:* specifies whether the operation involves  $A^{-1}$ ,  $A^{-T}$  or  $A^{-H}$ .  
 TRANSA = 'N'  
     The operation involves  $A^{-1}$ .  
 TRANSA = 'T'  
     The operation involves  $A^{-T}$ .  
 TRANSA = 'C'  
     The operation involves  $A^{-H}$ .  
*Constraint:* TRANSA = 'N', 'T' or 'C'.
- 4:    DIAG – CHARACTER(1) *Input*  
*On entry:* specifies whether  $A$  has nonunit or unit diagonal elements.  
 DIAG = 'N'  
     The diagonal elements are stored explicitly.  
 DIAG = 'U'  
     The diagonal elements are assumed to be 1, and are not referenced.  
*Constraint:* DIAG = 'N' or 'U'.
- 5:    M – INTEGER *Input*  
*On entry:*  $m$ , the number of rows of the matrix  $B$ ; the order of  $A$  if SIDE = 'L'.  
*Constraint:*  $M \geq 0$ .
- 6:    N – INTEGER *Input*  
*On entry:*  $n$ , the number of columns of the matrix  $B$ ; the order of  $A$  if SIDE = 'R'.  
*Constraint:*  $N \geq 0$ .
- 7:    ALPHA – COMPLEX (KIND=nag\_wp) *Input*  
*On entry:* the scalar  $\alpha$ .
- 8:    A(LDA,\*) – COMPLEX (KIND=nag\_wp) array *Input*  
**Note:** the second dimension of the array  $A$  must be at least  $\max(1, M)$  if SIDE = 'L' and at least  $\max(1, N)$  if SIDE = 'R'.  
*On entry:* the triangular matrix  $A$ ;  $A$  is  $m$  by  $m$  if SIDE = 'L', or  $n$  by  $n$  if SIDE = 'R'.  
     If UPLO = 'U',  $A$  is upper triangular and the elements of the array below the diagonal are not referenced.  
     If UPLO = 'L',  $A$  is lower triangular and the elements of the array above the diagonal are not referenced.  
     If DIAG = 'U', the diagonal elements of  $A$  are assumed to be 1, and are not referenced.
- 9:    LDA – INTEGER *Input*  
*On entry:* the first dimension of the array  $A$  as declared in the (sub)program from which F06ZJF (ZTRSM) is called.

*Constraints:*

if SIDE = 'L',  $LDA \geq \max(1, M)$ ;  
if SIDE = 'R',  $LDA \geq \max(1, N)$ .

10: B(LDB,\*) – COMPLEX (KIND=nag\_wp) array

*Input/Output*

**Note:** the second dimension of the array B must be at least  $\max(1, N)$ .

*On entry:* the  $m$  by  $n$  matrix  $B$ .

If ALPHA = 0, B need not be set.

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

11: LDB – INTEGER

*Input*

*On entry:* the first dimension of the array B as declared in the (sub)program from which F06ZJF (ZTRSM) is called.

*Constraint:*  $LDB \geq \max(1, M)$ .

## 6 Error Indicators and Warnings

None.

## 7 Accuracy

Not applicable.

## 8 Further Comments

None.

## 9 Example

None.

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