

# NAG Library Routine Document

## F06ZFF (ZTRMM)

**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

F06ZFF (ZTRMM) performs one of the matrix-matrix operations

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

where  $B$  is an  $m$  by  $n$  complex matrix,  $A$  is a complex triangular matrix, and  $\alpha$  is a complex scalar.

### 2 Specification

```
SUBROUTINE F06ZFF (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 *ztrmm*.

### 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  $A$ ,  $A^T$  or  $A^H$ .  
TRANSA = 'N'  
    The operation involves  $A$ .  
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 F06ZFF (ZTRMM) 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 F06ZFF (ZTRMM) is called.  
*Constraint:*  $LDB \geq \max(1, M)$ .

## 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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