

# NAG Library Routine Document

## F06SLF (ZTPSV)

**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

F06SLF (ZTPSV) solves a complex triangular system of equations, stored in packed form, with a single right hand side.

### 2 Specification

SUBROUTINE F06SLF (UPLO, TRANS, DIAG, N, AP, X, INCX)

INTEGER N, INCX  
 COMPLEX (KIND=nag\_wp) AP(\*), X(\*)  
 CHARACTER(1) UPLO, TRANS, DIAG

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

### 3 Description

F06SLF (ZTPSV) performs one of the matrix-vector operations

$$x \leftarrow A^{-1}x, \quad x \leftarrow A^{-T}x \quad \text{or} \quad x \leftarrow A^{-H}x,$$

where  $A$  is an  $n$  by  $n$  complex triangular matrix, stored in packed form, and  $x$  is an  $n$ -element complex vector.  $A^{-T}$  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.

### 4 References

None.

### 5 Arguments

1: 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'.

2: TRANS – CHARACTER(1) *Input*

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

TRANS = 'N'

$x \leftarrow A^{-1}x$ .

TRANS = 'T'

$x \leftarrow A^{-T}x$ .

TRANS = 'C'  
 $x \leftarrow A^{-H}x.$

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

3: 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'.

4: N – INTEGER *Input*

*On entry:*  $n$ , the order of the matrix  $A$ .

*Constraint:*  $N \geq 0$ .

5: AP(\*) – COMPLEX (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  $n$  triangular 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  $i \geq j$ .

If DIAG = 'U', the diagonal elements of  $A$  are assumed to be 1, and are not referenced; the same storage scheme is used whether DIAG = 'N' or 'U'.

6: X(\*) – COMPLEX (KIND=nag\_wp) array *Input/Output*

**Note:** the dimension of the array X must be at least  $\max(1, 1 + (N - 1) \times |\text{INCX}|)$ .

*On entry:* the 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  $i = 1, 2, \dots, N$ .

*On exit:* the updated vector  $x$  stored in the array elements used to supply the original vector  $x$ .

7: INCX – INTEGER *Input*

*On entry:* the increment in the subscripts of X between successive elements of  $x$ .

*Constraint:* INCX  $\neq 0$ .

## 6 Error Indicators and Warnings

None.

## 7 Accuracy

Not applicable.

## **8 Parallelism and Performance**

F06SLF (ZTPSV) is not threaded in any implementation.

## **9 Further Comments**

None.

## **10 Example**

None.

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