

NAG Fortran Library Routine Document

F06TVF

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

F06TVF transforms an n by n complex upper triangular matrix U with real diagonal elements, to an upper Hessenberg matrix H , by applying a given sequence of plane rotations from either the left or the right, in planes k_1 to k_2 ; H has real non-zero sub-diagonal elements $h_{k+1,k}$ for $k = k_1, k_1 + 1, \dots, k_2 - 1$ only.

If SIDE = 'L', the rotations are applied from the left:

$$H = PU, \quad \text{where} \quad P = P_{k_1} P_{k_1+1} \cdots P_{k_2-1}.$$

If SIDE = 'R', the rotations are applied from the right:

$$H = UP^H, \quad \text{where} \quad P = P_{k_2-1} \cdots P_{k_1+1} P_{k_1}.$$

In either case, P_k is a rotation in the $(k, k + 1)$ plane.

The 2 by 2 plane rotation part of P_k has the form

$$\begin{pmatrix} \bar{c}_k & s_k \\ -s_k & c_k \end{pmatrix}$$

with s_k real.

2 Specification

```
SUBROUTINE F06TVF (SIDE, N, K1, K2, C, S, A, LDA)
INTEGER           N, K1, K2, LDA
double precision S(*)
complex*16      C(*), A(LDA,*)
CHARACTER*1      SIDE
```

3 Description

None.

4 References

None.

5 Parameters

1: SIDE – CHARACTER*1 *Input*

On entry: specifies whether U is operated on from the left or the right, as follows:

if SIDE = 'L', U is pre-multiplied from the left;
if SIDE = 'R', U is post-multiplied from the right.

Constraint: SIDE = 'L' or 'R'.

2: N – INTEGER *Input*

On entry: n , the order of the matrices U and H .

Constraint: $N \geq 0$.

- 3: K1 – INTEGER *Input*
 4: K2 – INTEGER *Input*
On entry: the values k_1 and k_2 .
- 5: C(*) – **complex*16** array *Input*
On entry: C(k) must hold c_k , the cosine of the rotation P_k , for $k = k_1, \dots, k_2 - 1$.
- 6: S(*) – **double precision** array *Input/Output*
On entry: S(k) must hold s_k , the sine of the rotation P_k , for $k = k_1, \dots, k_2 - 1$.
On exit: S(k) holds $h_{k+1,k}$, the sub-diagonal element of H , for $k = k_1, \dots, k_2 - 1$.
- 7: A(LDA,*) – **complex*16** array *Input/Output*
Note: the second dimension of the array A must be at least $\max(1, N)$.
On entry: the n by n upper triangular matrix U . The imaginary parts of the diagonal elements must be zero.
On exit: the upper triangular part of the upper Hessenberg matrix H .
- 8: LDA – INTEGER *Input*
On entry: the first dimension of the array A as declared in the (sub)program from which F06TVF is called.
Constraint: $LDA \geq \max(1, N)$.

6 Error Indicators and Warnings

None.
