

NAG Library Routine Document

F06TWF

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

F06TWF transforms a complex upper triangular matrix to an upper spiked matrix by applying a given sequence of plane rotations.

2 Specification

```
SUBROUTINE F06TWF(SIDE, N, K1, K2, C, S, A, LDA)
INTEGER          N, K1, K2, LDA
double precision C(*)
complex*16      S(*), A(LDA,*)
CHARACTER*1      SIDE
```

3 Description

F06TWF transforms an n by n complex upper triangular matrix U with real diagonal elements, to an upper spiked 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 diagonal elements except where the spike joins the diagonal.

If $SIDE = 'L'$, H has a row spike, with nonzero elements $h_{k_2,k}$, for $k = k_1, k_1 + 1, \dots, k_2 - 1$. The rotations are applied from the left:

$$H = PU,$$

where $P = P_{k_1} P_{k_1+1} \cdots P_{k_2-1}$ and P_k is a rotation in the (k, k_2) plane.

If $SIDE = 'R'$, H has a column spike, with nonzero elements h_{k+1,k_1} , for $k = k_1, k_1 + 1, \dots, k_2 - 1$. The rotations are applied from the right:

$$HP^H = R,$$

where $P = P_{k_2-1} \cdots P_{k_1+1} P_{k_1}$ and P_k is a rotation in the $(k_1, k+1)$ plane.

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

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

with c_k real.

4 References

None.

5 Parameters

1: $SIDE$ – CHARACTER*1

Input

On entry: specifies whether U is operated on from the left or the right.

$SIDE = 'L'$

U is pre-multiplied from the left.

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 .
 If $K1 < 1$ or $K2 \leq K1$ or $K2 > N$, an immediate return is effected.
- 5: C(*) – **double precision** array *Input*
Note: the dimension of the array C must be at least $K2 - K1$.
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(*) – **complex*16** array *Input/Output*
Note: the dimension of the array S must be at least $K2 - K1$.
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 a nonzero element of the spike of H : $h_{k_2,k}$ if SIDE = 'L', or h_{k+1,k_1} if SIDE = 'R', for $k = k_1, k_1 + 1, \dots, k_2 - 1$.
- 7: A(LDA,*) – **complex*16** array *Input/Output*
Note: the second dimension of the array A must be at least 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 spiked matrix H . The imaginary parts of the diagonal elements are set to zero, except for the (k_2, k_2) element if SIDE = 'L', or the (k_1, k_1) element if SIDE = 'R'.
- 8: LDA – INTEGER *Input*
On entry: the first dimension of the array A as declared in the (sub)program from which F06TWF is called.
 Constraint: $LDA \geq \max(1, N)$.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

None.
