NAG Fortran 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 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 non-zero elements $h_{k_2,k}$ for $k = k_1, k_1+1, \ldots, k_2-1$. The rotations are applied from the left:

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

and P_k is a rotation in the (k, k_2) plane.

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

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

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.

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

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: $\mathrm{N} \geq 0$.

3: K1 – INTEGER *Input*
4: K2 – INTEGER *Input*

On entry: the values k_1 and k_2.

5: C$(*)$ – ***double precision*** array *Input*

On entry: C(k) must hold c_k, the cosine of the rotation P_k, for $k = k_1, \ldots, k_2 - 1$.

6: S$(*)$ – ***complex*16*** array *Input/Output*

On entry: S(k) must hold s_k, the sine of the rotation P_k, for $k = k_1, \ldots, k_2 - 1$.

On exit: S(k) holds a non-zero element of the spike of H: $h_{k_2,k}$ if SIDE = 'L', or h_{k+1,k_1} if SIDE = 'R', for $k = k_1, k_1 + 1, \ldots, k_2 - 1$.

7: A(LDA,$*$) – ***complex*16*** array *Input/Output*

Note: the second dimension of the array A must be at least $\max(1, \mathrm{N})$.

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: $\mathrm{LDA} \geq \max(1, \mathrm{N})$.

6 Error Indicators and Warnings

None.