NAG Library Routine Document

F06HQF

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

F06HQF generates a sequence of complex plane rotations.

2 Specification

```
SUBROUTINE F06HQF (PIVOT, DIRECT, N, ALPHA, X, INCX, C, S)
INTEGER                 N, INCX
REAL (KIND=nag_wp)      C(N)
COMPLEX (KIND=nag_wp) ALPHA, X(*), S(N)
CHARACTER(1)            PIVOT, DIRECT
```

3 Description

F06HQF generates the parameters of a complex unitary matrix P, of order $n+1$, chosen so as to set to zero the elements of a supplied n-element complex vector x.

If PIVOT = 'F' and DIRECT = 'F', or if PIVOT = 'V' and DIRECT = 'B',

$$P\begin{pmatrix}\alpha\\ x\end{pmatrix} = \begin{pmatrix}\beta\\ 0\end{pmatrix};$$

If PIVOT = 'F' and DIRECT = 'B', or if PIVOT = 'V' and DIRECT = 'F',

$$P\begin{pmatrix}x\\ \alpha\end{pmatrix} = \begin{pmatrix}0\\ \beta\end{pmatrix}.$$

Here α and β are complex scalars.

P is represented as a sequence of n plane rotations P_k, as specified by PIVOT and DIRECT; P_k is chosen to annihilate x_k, and its 2 by 2 plane rotation part has the form

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

with c_k real. The tangent of the rotation, t_k, is overwritten on x_k.

4 References

None.

5 Arguments

1: PIVOT – CHARACTER(1) *Input*

On entry: specifies the plane rotated by P_k.

PIVOT = 'V' (variable pivot)
P_k rotates the $(k, k+1)$ plane.

PIVOT = 'F' (fixed pivot)
P_k rotates the $(1, k+1)$ plane if DIRECT = 'F', or the $(k, n+1)$ plane if DIRECT = 'B'.

Constraint: PIVOT = 'V' or 'F'.

2: DIRECT – CHARACTER(1) *Input*

On entry: specifies the sequence direction.

DIRECT = 'F' (forward sequence)
$P = P_n \cdots P_2 P_1$.

DIRECT = 'B' (backward sequence)
$P = P_1 P_2 \cdots P_n$.

Constraint: DIRECT = 'F' or 'B'.

3: N – INTEGER *Input*

On entry: n, the number of elements in x.

4: ALPHA – COMPLEX (KIND=nag_wp) *Input/Output*

On entry: the scalar α.

On exit: the scalar β.

5: X($*$) – COMPLEX (KIND=nag_wp) array *Input/Output*

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

On entry: the n-element vector x. x_i must be stored in $\mathrm{X}(1 + (i-1) \times \mathrm{INCX})$, for $i = 1, 2, \ldots, \mathrm{N}$.

Intermediate elements of X are not referenced.

On exit: the referenced elements are overwritten by details of the plane rotations.

6: INCX – INTEGER *Input*

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

Constraint: INCX > 0.

7: C(N) – REAL (KIND=nag_wp) array *Output*

On exit: the values c_k, the cosines of the rotations.

8: S(N) – COMPLEX (KIND=nag_wp) array *Output*

On exit: the values s_k, the sines of the rotations.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Parallelism and Performance

F06HQF is not threaded in any implementation.

9 Further Comments

None.

10 Example

None.