NAG Fortran Library Routine Document

F06HRF

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

F06HRF generates details of a complex elementary reflection (Householder matrix), P, such that

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

where P is unitary, α is a complex scalar, β is a real scalar, and x is an n element complex vector. P is given in the form

$$P=I-\gamma\begin{pmatrix}\zeta\\ z\end{pmatrix}\begin{pmatrix}\zeta & z^H\end{pmatrix},$$

where z is an n element complex vector, γ is a complex scalar such that $\mathrm{Re}\,\gamma=1$, and ζ is a real scalar. γ and ζ are returned in a single complex value $\theta=(\zeta,\mathrm{Im}\,\gamma)$. Thus $\zeta=\mathrm{Re}\,\theta$ and $\gamma=(1,\mathrm{Im}\,\theta)$.

If x is such that

$$\max(|\mathrm{Re}\,x_i|,|\mathrm{Im}\,x_i|)\leq\max(tol,\epsilon\max(|\mathrm{Re}\,\alpha|,|\mathrm{Im}\,\alpha|)),$$

where ϵ is the ***machine precision*** and tol is a user-supplied tolerance, then:

either θ is set to 0, in which case P can be taken to be the unit matrix;

or θ is set so that $\mathrm{Re}\,\theta\leq 0$ and $\theta\neq 0$, in which case

$$P=\begin{pmatrix}\theta & 0\\ 0 & I\end{pmatrix}.$$

Otherwise $1\leq\mathrm{Re}\,\theta\leq\sqrt{2}$.

2 Specification

```
SUBROUTINE F06HRF (N, ALPHA, X, INCX, TOL, THETA)
INTEGER              N, INCX
double precision     TOL
complex*16           ALPHA, X(*), THETA
```

3 Description

None.

4 References

None.

5 Parameters

1: N – INTEGER *Input*

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

2: ALPHA – ***complex*16*** *Input/Output*

On entry: the scalar α.

On exit: the scalar β.

3: X$(*)$ – ***complex*16*** array *Input/Output*

On entry: the vector x.

On exit: the vector z.

4: INCX – INTEGER *Input*

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

Constraint: INCX > 0.

5: TOL – ***double precision*** *Input*

On entry: the value tol.

6: THETA – ***complex*16*** *Output*

On exit: the value θ.

6 Error Indicators and Warnings

None.