

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

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

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

If x is such that

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

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 $\text{Re } \theta \leq 0$ and $\theta \neq 0$, in which case

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

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

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 .

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|----|--|---------------------|
| 2: | ALPHA – <i>complex*16</i>
<i>On entry:</i> the scalar α .
<i>On exit:</i> the scalar β . | <i>Input/Output</i> |
| 3: | X(*) – <i>complex*16</i> array
<i>On entry:</i> the vector x .
<i>On exit:</i> the vector z . | <i>Input/Output</i> |
| 4: | INCX – INTEGER
<i>On entry:</i> the increment in the subscripts of X between successive elements of x .
<i>Constraint:</i> INCX > 0. | <i>Input</i> |
| 5: | TOL – <i>double precision</i>
<i>On entry:</i> the value tol . | <i>Input</i> |
| 6: | THETA – <i>complex*16</i>
<i>On exit:</i> the value θ . | <i>Output</i> |

6 Error Indicators and Warnings

None.
