

NAG 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 a complex elementary reflection.

2 Specification

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

3 Description

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

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*
Note: the dimension of the array X must be at least $\max(1, 1 + (N - 1)|\text{INCX}|)$.
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: $\text{INCX} > 0$.
- 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.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

None.
