

NAG Library Routine Document

F06FRF

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

F06FRF generates a real elementary reflection in the NAG (as opposed to LINPACK) style.

2 Specification

```
SUBROUTINE F06FRF (N, ALPHA, X, INCX, TOL, ZETA)
  INTEGER          N, INCX
  REAL (KIND=nag_wp) ALPHA, X(*), TOL, ZETA
```

3 Description

F06FRF generates details of a real elementary reflection (Householder matrix), P , such that

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

where P is orthogonal, α and β are real scalars, and x is an n -element real vector.

P is given in the form

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

where z is an n -element real vector and ζ is a real scalar.

If x is such that

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

where ϵ is the *machine precision* and tol is a user-supplied tolerance, then ζ is set to 0, and P can be taken to be the unit matrix. Otherwise $1 \leq \zeta \leq \sqrt{2}$.

4 References

None.

5 Arguments

- | | | |
|----|--|---------------------|
| 1: | N – INTEGER | <i>Input</i> |
| | <i>On entry:</i> n , the number of elements in x and z . | |
| 2: | ALPHA – REAL (KIND=nag_wp) | <i>Input/Output</i> |
| | <i>On entry:</i> the scalar α . | |
| | <i>On exit:</i> the scalar β . | |

- 3: X(*) – REAL (KIND=nag_wp) array *Input/Output*
Note: the dimension of the array X must be at least $\max(1, 1 + (N - 1) \times \text{INCX})$.
On entry: the n -element vector x . x_i must be stored in $X(1 + (i - 1) \times \text{INCX})$, for $i = 1, 2, \dots, N$.
 Intermediate elements of X are not referenced.
On exit: the referenced elements are overwritten by details of the real elementary reflection.
- 4: INCX – INTEGER *Input*
On entry: the increment in the subscripts of X between successive elements of x .
Constraint: $\text{INCX} > 0$.
- 5: TOL – REAL (KIND=nag_wp) *Input*
On entry: the value tol .
- 6: ZETA – REAL (KIND=nag_wp) *Output*
On exit: the scalar ζ .

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Parallelism and Performance

F06FRF makes calls to BLAS and/or LAPACK routines, which may be threaded within the vendor library used by this implementation. Consult the documentation for the vendor library for further information.

Please consult the X06 Chapter Introduction for information on how to control and interrogate the OpenMP environment used within this routine. Please also consult the Users' Note for your implementation for any additional implementation-specific information.

9 Further Comments

None.

10 Example

None.
