NAG Fortran Library Routine Document

F06QQF

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

F06QQF performs the factorization

$$\begin{pmatrix} U \\ \alpha x^T \end{pmatrix} = Q \begin{pmatrix} R \\ 0 \end{pmatrix}$$

where U and R are n by n real upper triangular matrices, x is an n element real vector, α is a real scalar, and Q is a real orthogonal matrix.

Q is formed as a sequence of plane rotations

$$Q^T = Q_n \cdots Q_2 Q_1$$

where Q_k is a rotation in the $(k, n+1)$ plane, chosen to annihilate x_k.

The 2 by 2 plane rotation part of Q_k has the form

$$\begin{pmatrix} c_k & s_k \\ -s_k & c_k \end{pmatrix}.$$

2 Specification

```
SUBROUTINE F06QQF (N, ALPHA, X, INCX, A, LDA, C, S)
INTEGER             N, INCX, LDA
double precision    ALPHA, X(*), A(LDA,*), C(*), S(*)
```

3 Description

None.

4 References

None.

5 Parameters

1: N – INTEGER *Input*

On entry: n, the order of the matrices U and R.

Constraint: $\mathrm{N} \geq 0$.

2: ALPHA – ***double precision*** *Input*

On entry: the scalar α.

3: X$(*)$ – ***double precision*** array *Input/Output*

On entry: the vector x.

On exit: the tangents of the rotations Q_k, for $k = 1, 2, \ldots, n$.

4: INCX – INTEGER *Input*

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

Constraint: INCX > 0.

5: A(LDA,$*$) – ***double precision*** array *Input/Output*

Note: the second dimension of the array A must be at least $\max(1, \mathrm{N})$.

On entry: the n by n upper triangular matrix U.

On exit: the upper triangular matrix R.

6: LDA – INTEGER *Input*

On entry: the first dimension of the array A as declared in the (sub)program from which F06QQF is called.

Constraint: LDA $\geq \max(1, \mathrm{N})$.

7: C($*$) – ***double precision*** array *Output*

On exit: the values c_k, the cosines of the rotations Q_k, for $k = 1, \ldots, n$.

8: S($*$) – ***double precision*** array *Output*

On exit: the values s_k, the sines of the rotations Q_k, for $k = 1, \ldots, n$.

6 Error Indicators and Warnings

None.