

NAG Toolbox for MATLAB

f08gf

1 Purpose

f08gf generates the real orthogonal matrix Q , which was determined by f08ge when reducing a symmetric matrix to tridiagonal form.

2 Syntax

```
[q, info] = f08gf(uplo, n, ap, tau)
```

3 Description

f08gf is intended to be used after a call to f08ge, which reduces a real symmetric matrix A to symmetric tridiagonal form T by an orthogonal similarity transformation: $A = QTQ^T$. f08ge represents the orthogonal matrix Q as a product of $n - 1$ elementary reflectors.

This function may be used to generate Q explicitly as a square matrix.

4 References

Golub G H and Van Loan C F 1996 *Matrix Computations* (3rd Edition) Johns Hopkins University Press, Baltimore

5 Parameters

5.1 Compulsory Input Parameters

1: **uplo** – string

This **must** be the same parameter **uplo** as supplied to f08ge.

Constraint: **uplo** = 'U' or 'L'.

2: **n** – int32 scalar

n , the order of the matrix Q .

Constraint: $n \geq 0$.

3: **ap**(*) – double array

Note: the dimension of the array **ap** must be at least $\max(1, n \times (n + 1)/2)$.

Details of the vectors which define the elementary reflectors, as returned by f08ge.

4: **tau**(*) – double array

Note: the dimension of the array **tau** must be at least $\max(1, n - 1)$.

Further details of the elementary reflectors, as returned by f08ge.

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

ldq, work

5.4 Output Parameters

1: **q(ldq,*)** – double array

The first dimension of the array **q** must be at least $\max(1, n)$

The second dimension of the array must be at least $\max(1, n)$

The n by n orthogonal matrix Q .

2: **info** – int32 scalar

info = 0 unless the function detects an error (see Section 6).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

info = $-i$

If **info** = $-i$, parameter i had an illegal value on entry. The parameters are numbered as follows:

1: **uplo**, 2: **n**, 3: **ap**, 4: **tau**, 5: **q**, 6: **ldq**, 7: **work**, 8: **info**.

It is possible that **info** refers to a parameter that is omitted from the MATLAB interface. This usually indicates that an error in one of the other input parameters has caused an incorrect value to be inferred.

7 Accuracy

The computed matrix Q differs from an exactly orthogonal matrix by a matrix E such that

$$\|E\|_2 = O(\epsilon),$$

where ϵ is the *machine precision*.

8 Further Comments

The total number of floating-point operations is approximately $\frac{4}{3}n^3$.

The complex analogue of this function is f08gt.

9 Example

```
uplo = 'L';
n = int32(4);
ap = [2.07;
      -5.825753170191817;
      0.4331793442217867;
      -0.1186086299654892;
      1.474093708197552;
      2.624045178795586;
      0.8062881532775791;
      -0.6491595075457843;
      0.9162727563219193;
      -1.694934200651768];
tau = [1.664291789738249;
      1.212047324162142;
      0];
[q, info] = f08gf(uplo, n, ap, tau)

q =
    1.0000         0         0         0
         0   -0.6643   -0.0400    0.7464
```

info =	0	-0.7209	-0.2294	-0.6539
	0	0.1974	-0.9725	0.1235
	0			
