

NAG Toolbox for MATLAB

f08ft

1 Purpose

f08ft generates the complex unitary matrix Q , which was determined by f08fs when reducing a Hermitian matrix to tridiagonal form.

2 Syntax

```
[a, info] = f08ft(uplo, a, tau, 'n', n)
```

3 Description

f08ft is intended to be used after a call to f08fs, which reduces a complex Hermitian matrix A to real symmetric tridiagonal form T by a unitary similarity transformation: $A = QTQ^H$. f08fs represents the unitary 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 f08fs.

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

2: **a(lda,*)** – complex array

The first dimension of the array **a** must be at least $\max(1, \mathbf{n})$

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

Details of the vectors which define the elementary reflectors, as returned by f08fs.

3: **tau(*)** – complex array

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

Further details of the elementary reflectors, as returned by f08fs.

5.2 Optional Input Parameters

1: **n** – int32 scalar

Default: The second dimension of the array **a**.

n , the order of the matrix Q .

Constraint: $\mathbf{n} \geq 0$.

5.3 Input Parameters Omitted from the MATLAB Interface

lda, work, lwork

5.4 Output Parameters

1: **a(lda,*)** – complex array

The first dimension of the array **a** must be at least $\max(1, \mathbf{n})$

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

The n by n unitary 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: **a**, 4: **lda**, 5: **tau**, 6: **work**, 7: **lwork**, 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 unitary matrix by a matrix E such that

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

where ϵ is the *machine precision*.

8 Further Comments

The total number of real floating-point operations is approximately $\frac{16}{3}n^3$.

The real analogue of this function is f08ff.

9 Example

```
uplo = 'L';
a = [complex(-2.28, +0), complex(0, +0), complex(0, +0), complex(0, +0);
      complex(-4.33845594653213, +0), complex(-0.1284569816493291, +0),
      complex(0, +0), complex(0, +0);
      complex(0.3278606760921924, -0.1251226092264437), complex(-
      2.022594578622617, ...
      +0), complex(-0.1665932537524081, +0), complex(0, +0);
      complex(-0.1412565637506947, -0.366636483973957), complex(-
      0.308321908008089, ...
      +0.1763226364726777), complex(-1.802322978338735, +0), complex(-
      1.924949764598263, +0)];
tau = [complex(1.410284216766754, +0.4679084045148932);
       complex(1.302420369434775, +0.7853320742529579);
       complex(1.093973715923082, -0.9955746786231597)];
[aOut, info] = f08ft(uplo, a, tau)
```

aOut =				
1.0000	0	0	0	
0.3781i	0	-0.4103 - 0.4679i	0.0689 + 0.1780i	0.6583 +
0.2592i	0	-0.5209 + 0.0230i	-0.2576 - 0.7356i	-0.2313 +
0.5465i	0	0.0277 + 0.5832i	0.5956 - 0.0379i	0.0657 +
info =	0			
