

NAG Library Routine Document

F06QSF

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

F06QSF performs a QR or RQ factorization (as a sequence of plane rotations) of a real upper spiked matrix.

2 Specification

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SUBROUTINE F06QSF (SIDE, N, K1, K2, C, S, A, LDA)
INTEGER          N, K1, K2, LDA
REAL (KIND=nag_wp) C(K2-1), S(*), A(LDA,*)
CHARACTER(1)    SIDE
```

3 Description

F06QSF transforms an n by n real upper spiked matrix H to upper triangular form R by applying a real orthogonal matrix P from the left or the right. P is formed as a sequence of plane rotations in planes k_1 to k_2 .

If $SIDE = 'L'$, H is assumed to have a row spike, with nonzero elements $h_{k_2,k}$, for $k = k_1, \dots, k_2 - 1$. The rotations are applied from the left:

$$PH = R,$$

where $P = P_{k_2-1} \cdots P_{k_1+1} P_{k_1}$ and P_k is a rotation in the (k, k_2) plane.

If $SIDE = 'R'$, H is assumed to have a column spike, with nonzero elements h_{k+1,k_1} , for $k = k_1, \dots, k_2 - 1$. The rotations are applied from the right:

$$HP^T = R,$$

where $P = P_{k_1} P_{k_1+1} \cdots P_{k_2-1}$ and P_k is a rotation in the $(k_1, k+1)$ plane.

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

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

4 References

None.

5 Parameters

- 1: $SIDE$ – CHARACTER(1) *Input*
On entry: specifies whether H is operated on from the left or the right.
 $SIDE = 'L'$
 H is pre-multiplied from the left.
 $SIDE = 'R'$
 H is post-multiplied from the right.
Constraint: $SIDE = 'L'$ or $'R'$.

- 2: N – INTEGER *Input*
On entry: n , the order of the matrix H .
Constraint: $N \geq 0$.
- 3: K1 – INTEGER *Input*
 4: K2 – INTEGER *Input*
On entry: the values k_1 and k_2 .
 If $K1 < 1$ or $K2 \leq K1$ or $K2 > N$, an immediate return is effected.
- 5: C(K2 – 1) – REAL (KIND=nag_wp) array *Output*
On exit: $C(k)$ holds c_k , the cosine of the rotation P_k , for $k = k_1, \dots, k_2 - 1$.
- 6: S(*) – REAL (KIND=nag_wp) array *Input/Output*
Note: the dimension of the array S must be at least $K2 - K1$.
On entry: the nonzero elements of the spike of H : $S(k)$ must hold $h_{k_2,k}$ if $SIDE = 'L'$, and h_{k+1,k_1} if $SIDE = 'R'$, for $k = k_1, \dots, k_2 - 1$.
On exit: $S(k)$ holds s_k , the sine of the rotation P_k , for $k = k_1, \dots, k_2 - 1$.
- 7: A(LDA,*) – REAL (KIND=nag_wp) array *Input/Output*
Note: the second dimension of the array A must be at least N.
On entry: the upper triangular part of the n by n upper spiked matrix H .
On exit: the upper triangular matrix R .
- 8: LDA – INTEGER *Input*
On entry: the first dimension of the array A as declared in the (sub)program from which F06QSF is called.
Constraint: $LDA \geq \max(1, N)$.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

None.