NAG Fortran Library Routine Document

F08NJF (SGEBAK/DGEBAK)

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

F08NJF (SGEBAK/DGEBAK) transforms eigenvectors of a balanced matrix to those of the original real nonsymmetric matrix.

2 Specification

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SUBROUTINE F08NJF(JOB, SIDE, N, ILO, IHI, SCALE, M, V, LDV, INFO)
ENTRY      sgebak (JOB, SIDE, N, ILO, IHI, SCALE, M, V, LDV, INFO)
INTEGER            N, ILO, IHI, M, LDV, INFO
real               SCALE(*), V(LDV,*)
CHARACTER*1        JOB, SIDE
```

The ENTRY statement enables the routine to be called by its LAPACK name.

3 Description

This routine is intended to be used after a real nonsymmetric matrix A has been balanced by F08NHF (SGEBAL/DGEBAL), and eigenvectors of the balanced matrix A''_{22} have subsequently been computed.

For a description of balancing, see the document for F08NHF (SGEBAL/DGEBAL). The balanced matrix A'' is obtained as $A'' = DPAP^TD^{-1}$, where P is a permutation matrix and D is a diagonal scaling matrix. This routine transforms left or right eigenvectors as follows:

if x is a right eigenvector of A'', $P^TD^{-1}x$ is a right eigenvector of A;

if y is a left eigenvector of A'', P^TDy is a left eigenvector of A.

4 References

None.

5 Parameters

1: JOB – CHARACTER*1 *Input*

On entry: this **must** be the same parameter JOB as supplied to F08NHF (SGEBAL/DGEBAL).

Constraint: JOB = 'N', 'P', 'S' or 'B'.

2: SIDE – CHARACTER*1 *Input*

On entry: indicates whether left or right eigenvectors are to be transformed, as follows:

if SIDE = 'L', left eigenvectors are transformed;

if SIDE = 'R', right eigenvectors are transformed.

Constraint: SIDE = 'L' or 'R'.

3: N – INTEGER *Input*

On entry: n, the number of rows of the matrix of eigenvectors.

Constraint: N $\geq$ 0.

4: ILO – INTEGER *Input*
5: IHI – INTEGER *Input*

On entry: the values i_{lo} and i_{hi}, as returned by F08NHF (SGEBAL/DGEBAL).

Constraints:

$1 \leq \text{ILO} \leq \text{IHI} \leq \text{N}$ if $\text{N} > 0$,
$\text{ILO} = 1$ and $\text{IHI} = 0$ if $\text{N} = 0$.

6: SCALE(*) – ***real*** array *Input*

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

On entry: details of the permutations and/or the scaling factors used to balance the original real nonsymmetric matrix, as returned by F08NHF (SGEBAL/DGEBAL).

7: M – INTEGER *Input*

On entry: m, the number of columns of the matrix of eigenvectors.

Constraint: $\text{M} \geq 0$.

8: V(LDV,*) – ***real*** array *Input/Output*

Note: the second dimension of the array V must be at least $\max(1, \text{M})$.

On entry: the matrix of left or right eigenvectors to be transformed.

On exit: the transformed eigenvectors.

9: LDV – INTEGER *Input*

On entry: the first dimension of the array V as declared in the (sub)program from which F08NJF (SGEBAK/DGEBAK) is called.

Constraint: $\text{LDV} \geq \max(1, \text{N})$.

10: INFO – INTEGER *Output*

On exit: $\text{INFO} = 0$ unless the routine detects an error (see Section 6).

6 Error Indicators and Warnings

$\text{INFO} < 0$

If $\text{INFO} = -i$, the ith parameter had an illegal value. An explanatory message is output, and execution of the program is terminated.

7 Accuracy

The errors are negligible.

8 Further Comments

The total number of floating-point operations is approximately proportional to nm.

The complex analogue of this routine is F08NWF (CGEBAK/ZGEBAK).

9 Example

See Section 9 of the document for F08NHF (SGEBAL/DGEBAL).