

NAG Library Routine Document

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

2 Specification

```
SUBROUTINE F08NJF (JOB, SIDE, N, ILO, IHI, SCALE, M, V, LDV, INFO)
```

```
INTEGER          N, ILO, IHI, M, LDV, INFO
REAL (KIND=nag_wp) SCALE(*), V(LDV,*)
CHARACTER(1)     JOB, SIDE
```

The routine may be called by its LAPACK name *dgebak*.

3 Description

F08NJF (DGEBAK) is intended to be used after a real nonsymmetric matrix A has been balanced by F08NHF (DGEBAL), and eigenvectors of the balanced matrix A''_{22} have subsequently been computed.

For a description of balancing, see the document for F08NHF (DGEBAL). The balanced matrix A'' is obtained as $A'' = DPAP^T D^{-1}$, 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'' , $P^T D^{-1}x$ is a right eigenvector of A ;

if y is a left eigenvector of A'' , $P^T D y$ 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 (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.
 SIDE = 'L'
 The left eigenvectors are transformed.
 SIDE = 'R'
 The 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 (DGEBAI).
Constraints:
if $N > 0$, $1 \leq ILO \leq IHI \leq N$;
if $N = 0$, $ILO = 1$ and $IHI = 0$.
- 6: SCALE(*) – REAL (KIND=nag_wp) array *Input*
Note: the dimension of the array SCALE must be at least $\max(1, N)$.
On entry: details of the permutations and/or the scaling factors used to balance the original real nonsymmetric matrix, as returned by F08NHF (DGEBAI).
- 7: M – INTEGER *Input*
On entry: m , the number of columns of the matrix of eigenvectors.
Constraint: $M \geq 0$.
- 8: V(LDV,*) – REAL (KIND=nag_wp) array *Input/Output*
Note: the second dimension of the array V must be at least $\max(1, M)$.
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 (DGEBAI) is called.
Constraint: $LDV \geq \max(1, N)$.
- 10: INFO – INTEGER *Output*
On exit: $INFO = 0$ unless the routine detects an error (see Section 6).

6 Error Indicators and Warnings

INFO < 0

If $INFO = -i$, argument i 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 (ZGEBAK).

9 Example

See Section 9 in F08NHF (DGEBAL).
