NAG Library Routine Document

F08NWF (ZGEBAK)

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

F08NWF (ZGEBAK) transforms eigenvectors of a balanced matrix to those of the original complex general matrix.

2 Specification

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SUBROUTINE F08NWF (JOB, SIDE, N, ILO, IHI, SCALE, M, V, LDV, INFO)

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

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

3 Description

F08NWF (ZGEBAK) is intended to be used after a complex general matrix A has been balanced by F08NVF (ZGEBAL), and eigenvectors of the balanced matrix A''_{22} have subsequently been computed.

For a description of balancing, see the document for F08NVF (ZGEBAL). The balanced matrix A'' is obtained as $A'' = DPAP^{\mathrm{T}}D^{-1}$, 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'', $P^{\mathrm{T}}D^{-1}x$ is a right eigenvector of A;

if y is a left eigenvector of A'', $P^{\mathrm{T}}Dy$ 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 F08NVF (ZGEBAL).

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: $\mathrm{N} \geq 0$.

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

On entry: the values i_{lo} and i_{hi}, as returned by F08NVF (ZGEBAL).

Constraints:

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

6: SCALE$(*)$ – REAL (KIND=nag_wp) array *Input*

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

On entry: details of the permutations and/or the scaling factors used to balance the original complex general matrix, as returned by F08NVF (ZGEBAL).

7: M – INTEGER *Input*

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

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

8: V(LDV,$*$) – COMPLEX (KIND=nag_wp) array *Input/Output*

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

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 F08NWF (ZGEBAK) is called.

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

10: INFO – INTEGER *Output*

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

6 Error Indicators and Warnings

$\mathrm{INFO} < 0$

If $\mathrm{INFO} = -i$, 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 real floating point operations is approximately proportional to nm.

The real analogue of this routine is F08NJF (DGEBAK).

9 Example

See Section 9 in F08NVF (ZGEBAL).