NAG Toolbox for MATLAB

f08nj

1 Purpose

f08nj transforms eigenvectors of a balanced matrix to those of the original real nonsymmetric matrix.

2 Syntax

```
[v, info] = f08nj(job, side, ilo, ihi, scale, v, 'n', n, 'm', m)
```

3 Description

f08nj is intended to be used after a real nonsymmetric matrix A has been balanced by f08nh, and eigenvectors of the balanced matrix A''_{22} have subsequently been computed.

For a description of balancing, see the document for f08nh. 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 function 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

5.1 Compulsory Input Parameters

1: **job – string**

This **must** be the same parameter **job** as supplied to f08nh.

Constraint: **job** = 'N', 'P', 'S' or 'B'.

2: **side – string**

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: **ilo – int32 scalar**

4: **ihi – int32 scalar**

The values i_{lo} and i_{hi}, as returned by f08nh.

Constraints:

if $\mathbf{n} > 0$, $1 \leq \mathbf{ilo} \leq \mathbf{ihi} \leq \mathbf{n}$;
if $\mathbf{n} = 0$, $\mathbf{ilo} = 1$ and $\mathbf{ihi} = 0$.

5: **scale**$(*)$ **– double array**

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

Details of the permutations and/or the scaling factors used to balance the original real nonsymmetric matrix, as returned by f08nh.

6: **v**(**ldv,**$*$) **– double array**

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

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

The matrix of left or right eigenvectors to be transformed.

5.2 Optional Input Parameters

1: **n – int32 scalar**

Default: The first dimension of the array **v**.

n, the number of rows of the matrix of eigenvectors.

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

2: **m – int32 scalar**

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

m, the number of columns of the matrix of eigenvectors.

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

5.3 Input Parameters Omitted from the MATLAB Interface

ldv

5.4 Output Parameters

1: **v**(**ldv,**$*$) **– double array**

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

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

The transformed eigenvectors.

2: **info – int32 scalar**

info $= 0$ unless the function detects an error (see Section 6).

6 Error Indicators and Warnings

info $= -i$

If **info** $= -i$, parameter i had an illegal value on entry. The parameters are numbered as follows:

1: **job**, 2: **side**, 3: **n**, 4: **ilo**, 5: **ihi**, 6: **scale**, 7: **m**, 8: **v**, 9: **ldv**, 10: **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 errors are negligible.

8 Further Comments

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

The complex analogue of this function is f08nw.

9 Example

```
job = 'Both';
side = 'Right';
ilo = int32(2);
ihi = int32(4);
scale = [3;
     8;
     8;
     1];
v = [1, -0.4314180584465899, -0.9999999999999999, -1;
     0, 1, -0.247654150974541, 0.08591655381643525;
     0, -0.4910063736255747, -0.146105421622948, -0.4768657196218895;
     0, -0.8751224464247366, -0.1307439268438695, 0.236243720668051];
[vOut, info] = f08nj(job, side, ilo, ihi, scale, v)
```

```
vOut =
         0   -3.9281   -1.1688   -3.8149
         0    8.0000   -1.9812    0.6873
    1.0000   -0.4314   -1.0000   -1.0000
         0   -0.8751   -0.1307    0.2362
info =
           0
```