

NAG Toolbox for MATLAB

f08jl

1 Purpose

f08jl computes all the eigenvalues and, optionally, all the eigenvectors of a real n by n symmetric tridiagonal matrix.

2 Syntax

```
[d, e, m, w, z, isuppz, info] = f08jl(jobz, range, d, e, vl, vu, il, iu,
    abstol, 'n', n)
```

3 Description

f08jl computes all the eigenvalues, and optionally the eigenvectors, of a real symmetric tridiagonal matrix T . That is, the function computes the spectral factorization of T given by

$$T = ZAZ^T,$$

where A is a diagonal matrix whose diagonal elements are the eigenvalues, λ_i , of T and Z is an orthogonal matrix whose columns are the eigenvectors, z_i , of T . Thus

$$Tz_i = \lambda_i z_i, \quad i = 1, 2, \dots, n.$$

This function uses the **dqds** and the **Relatively Robust Representation** algorithms to compute the eigenvalues and eigenvectors respectively; see for example Parlett and Dhillon 2000 and Dhillon and Parlett 2004 for further details. f08jl can usually compute all the eigenvalues and eigenvectors in $O(n^2)$ floating point operations and so, for large matrices, is often considerably faster than the other symmetric tridiagonal functions in this chapter when all the eigenvectors are required, particularly so compared to those functions that are based on the QR algorithm.

In the future this function may be extended to allow for the computation of selected eigenvalues and eigenvectors.

4 References

Anderson E, Bai Z, Bischof C, Blackford S, Demmel J, Dongarra J J, Du Croz J J, Greenbaum A, Hammarling S, McKenney A and Sorensen D 1999 *LAPACK Users' Guide* (3rd Edition) SIAM, Philadelphia URL: <http://www.netlib.org/lapack/lug>

Barlow J and Demmel J W 1990 Computing accurate eigensystems of scaled diagonally dominant matrices *SIAM J. Numer. Anal.* **27** 762–791

Dhillon I S and Parlett B N 2004 Orthogonal eigenvectors and relative gaps. *SIAM J. Appl. Math.* **25** 858–899

Parlett B N and Dhillon I S 2000 Relatively robust representations of symmetric tridiagonals *Linear Algebra Appl.* **309** 121–151

5 Parameters

5.1 Compulsory Input Parameters

1: **jobz** – string

If **jobz** = 'N', compute eigenvalues only.

If **jobz** = 'V', compute eigenvalues and eigenvectors.

Constraint: **jobz** = 'N' or 'V'.