

PACKAGE SPECIFICATION

HSL ARCHIVE

Warning: Subroutine EC08 performs functions which are adequately treated by routines in other standard subroutine libraries (for example, LAPACK). The use of this routine is not recommended, and it may be removed from future releases of this library.

1 SUMMARY

Finds all the eigenvalues and eigenvectors of a complex Hermitian tri-diagonal matrix, i.e. finds eigenvalues λ_i and eigenvectors \mathbf{x}_i , i=1,2,...,m which are the nontrivial solutions of

$$Ax = \lambda x$$

for a matrix of the form

$$\mathbf{A} = \begin{bmatrix} a_1 & b_2 & & & \\ \bar{b}_2 & a_2 & b_3 & & \\ & \bar{b}_3 & a_3 & b_4 & & \\ & & * & * & * & \\ & & & \bar{b}_{m-1} & a_{m-1} & b_m \\ & & & & \bar{b}_m & a_m \end{bmatrix}$$

where \bar{b}_i is assumed to be the complex conjugate of b_i , *j*=2,3,...,*m*.

ATTRIBUTES — Version: 1.0.0. Types: EC08C; EC08CD. Calls: EA08. Language: EC08CD uses COMPLEX*16. Original date: September 1971. Origin: S.Marlow, Harwell.

2 HOW TO USE THE PACKAGE

2.1 The argument list

The single precision version

CALL ECO8C(A, B, VALUE, X, M, IX, W)

The double precision version

CALL EC08CD(A, B, VALUE, X, M, IX, W)

- A is a COMPLEX (COMPLEX*16 in the D version) (see §2.2) array of length at least *m* which must be set by the user to the diagonal elements a_i , *i*=1,2,...,*m* of the matrix.
- B is a COMPLEX (COMPLEX*16 in the D version) (see §2.2) array of length at least *m* which the user must set to the upper off-diagonal elements b_i , *i*=2,3,...,*m* of the matrix as defined in §1. The lower off-diagonal elements \bar{b}_i are assumed to be the complex conjugates of the elements b_i , *i*=2,3,...,*m*.
- VALUE is a REAL (DOUBLE PRECISION in the D version) array of length at least *m* which will be set by the subroutine to the eigenvalues λ_i , *i*=1,2,...,*m*
- X is a COMPLEX (COMPLEX*16 in the D version) (see §2.2) array of dimension at least $m \times m$ (first dimension IX) in which the subroutine returns the eigenvectors. The components of the eigenvector \mathbf{x}_i corresponding to the eigenvalue λ_i (in VALUE(I)) are placed in X(J,I) for J=1,...,M. The eigenvectors are normalized so that $\mathbf{x}_i^T \bar{\mathbf{x}}_i = 1, i=1,2,...,m$.

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- M is an INTEGER variable which must be set by the user to *m* the order of the matrix.
- IX is an INTEGER variable which must be set by the user to the first dimension of the array X.
- W is a COMPLEX (COMPLEX*16 in the D version) (see §2.2) array of length at least 2m which is used by the subroutine as workspace.

2.2 The COMPLEX argument types

To conform to the Fortran 77 standard the array arguments listed as COMPLEX (COMPLEX*16 in the D version) in 2.1 should strictly be REAL (DOUBLE PRECISION in the D version) arrays with an extra first dimension of 2, e.g.

```
REAL A(2,10),B(2,10),X(2,8,8),W(2,20)
REAL VALUE(10)
____
CALL EC08C(A,B,VALUE,X,5,8,W)
```

Most implementations of Fortran allow such arguments to be passed in the more convenient form of COMPLEX (COMPLEX*16 in the D version).

3 GENERAL INFORMATION

Use of common:None.Workspace:See argument W.Other routines called directly:EA08C/CD.Input/output:None.Portability:EC08CD uses COMPLEX*16 facility.