

### PACKAGE SPECIFICATION

HSL ARCHIVE

**Warning:** Subroutine EC12 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 of a tri-diagonal Hermitian matrix of order m, i.e. of the form

 $\begin{bmatrix} a_1 & b_2 + ic_2 & & & \\ b_2 - ic_2 & a_2 & b_3 + ic_3 & & \\ & b_3 - ic_3 & a_3 & b_4 + ic_4 & & \\ & & * & * & * & \\ & & & b_{m-1} - ic_{m-1} & a_{m-1} & b_m + ic_m \\ & & & & b_m - ic_m & a_m \end{bmatrix}$ 

where the elements  $a_i$ ,  $b_i$  and  $c_i$  are real.

A bisection method based upon the Sturm's sequences is used. The eigenvalues are returned in descending order of magnitude.

ATTRIBUTES — Version: 1.0.0. Types: EC12A; EC12AD. Original date: March 1965. Origin: E.J.York, Harwell.

## **2** HOW TO USE THE PACKAGE

#### 2.1 The argument list

The single precision version

CALL EC12A(A,B,C,X,M,W)

The double precision version

CALL EC12AD(A,B,C,X,M,W)

- A is a REAL (DOUBLE PRECISION in the D version) 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 REAL (DOUBLE PRECISION in the D version) array of length at least m which must be set by the user to the real parts  $b_i$ , i=2,3,...,m of the off-diagonal elements of the matrix. Note that B(1) is not set.
- C is a REAL (DOUBLE PRECISION in the D version) array of length at least m which must be set by the user to the imaginary parts  $c_i$ , i=2,3,...,m of the off-diagonal elements of the matrix as defined in §1. Note that C(1) is not set.
- X is a REAL (DOUBLE PRECISION in the D version) array of length at least *m* in which the subroutine will return the eigenvalues.
- M is an INTEGER variable which must be set by the user to m the order of the matrix. **Restriction:**  $m \ge 3$ .
- W is a REAL (DOUBLE PRECISION in the D version) array of length at least m which is used by the routine as workspace.

# **3** GENERAL INFORMATION

Use of common: None.

**Workspace:** m words in argument W.

Other routines called directly: None.

Input/output: None.

**Restrictions:**  $m \ge 3$ .

## 4 METHOD

A bisection method based on the Sturm sequence is used. Full accuracy in the computed eigenvalues is expected.