

Warning: Subroutine MC14 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

Transforms an n by n real matrix **A** to an **upper Hessenberg** matrix having the same eigenvalues as **A**.

Transformations of the form $\mathbf{I} - \alpha \mathbf{u}\mathbf{u}^T$ are used, see J.H. Wilkinson and C. Reinsch, 'Handbook for Automatic Computation – Linear Algebra', Springer-Verlag.

There is an option for specifying **A** as a submatrix of a larger matrix.

ATTRIBUTES — **Version:** 1.0.0. **Types:** MC14A; MC14AD. **Calls:** FD05. **Original date:** June 1973. **Origin:** ORTHES from the above reference, modified for Harwell by S.Marlow.

2 HOW TO USE THE PACKAGE

2.1 The argument lists

There are two entry points:

Transforming a submatrix

The single precision version

```
CALL MC14A(A,N,IA,W,LL,LU)
```

The double precision version

```
CALL MC14AD(A,N,IA,W,LL,LU)
```

Transforming a complete matrix

The single precision version

```
CALL MC14B(A,N,IA,W)
```

The double precision version

```
CALL MC14BD(A,N,IA,W)
```

A is a REAL (DOUBLE PRECISION in the D version) two dimensional array containing the elements of the matrix. Only the submatrix of order $LU-LL+1$ bounded by the diagonal elements $A(LL,LL)$ and $A(LU,LU)$ is reduced to upper Hessenberg form (which overwrites the original submatrix). The part below the subdiagonal will contain information regarding the transformation.

N is an INTEGER and is set by the user to n the order of the matrix.

IA is INTEGER and is set by the user to the first dimension of the array **A**. $IA \geq n$.

W is a REAL (DOUBLE PRECISION in the D version) one-dimensional array of length **N** which will contain the remaining information of the transformation.

LL and **LU** are INTEGER and are set by the user to indicate the submatrix of **A** to be reduced. The submatrix starts at

$A(LL, LL)$ and finishes at $A(LU, LU)$ and is of order $LU-LL+1$.

2.2 Labelled common

The arguments of labelled common are default by BLOCK DATA. If the user wishes to change their values then the COMMON statement which follows should be included and the appropriate values reset.

```
COMMON/MC14C/LP
```

LP is an INTEGER (default 6) and refers to the stream number on which diagnostic messages appear. To suppress these messages set LP to 0.

3 GENERAL INFORMATION

Use of common: a common block MC14C/CD is used (see Section 2.2).

Workspace: none.

Other routines called directly: calls FD05.

Input/output: diagnostic printing (see Section 2.2).

4 METHOD

The submatrix of the general matrix is reduced to upper Hessenberg form by orthogonal transformation. The Hessenberg form overwriting the submatrix. Details of the transformation are stored in the remaining triangle of the submatrix (below the subdiagonal) and in the array W . See Handbook for Automatic Computation, Linear Algebra, J.H. Wilkinson, C. Reinsch, Springer-Verlag.