MATRIX EIGENVECTORS

PURPOSE

Compute the eigenvector of a matrix.

DESCRIPTION

A vector v is an eigenvector (or characteristic vector) of matrix A belonging to eigenvalue (or characteristic value) λ if

$$Av = \lambda v \qquad \qquad \textbf{(EQ 4-67)}$$

or

$$(\lambda I - A)v = 0 \qquad \qquad \textbf{(EQ 4-68)}$$

The eigenvalues are the solutions to the characteristic equation (det(λI-A)). The corresponding eigenvectors are computed by substituting the value of λ in the formula λI-A and solving for v.

SYNTAX

LET \<mat2\> = MATRIX EIGENVECTORS \<mat1\>   \<SUBSET/EXCEPT/FOR qualification\>
where \<mat1\> is a matrix for which the eigenvectors are to be computed;
        \<mat2\> is a matrix where the resulting eigenvectors are saved;
and where the \<SUBSET/EXCEPT/FOR qualification\> is optional and rarely used in this context.

EXAMPLES

LET C = MATRIX EIGENVECTORS A

NOTE 1

If the matrix is symmetric, the eigenvectors are all real. If the matrix is not symmetric, the eigenvectors may be either real or complex. DATAPLOT handles this by putting the real components in the first N (where N is the number of rows in the matrix) rows of the returned matrix and the corresponding complex components in rows N+1 through 2*N. If you prefer to have the real and complex components in separate variables, do something like the following:

        LET E = MATRIX EIGENVECTORS M
        LET N2 = SIZE E
        LET N = N2/2
        LET N1 = N + 1
        LOOP FOR K = 1 1 N
                LET EC^K = E^K
                LET ER^K = E^K
                RETAIN ER^K FOR I = 1 1 N
                RETAIN EC^K FOR I = N1 1 M
        END OF LOOP

NOTE 2

The matrix must have the same number of rows and columns. In addition, the matrix must be symmetric. An error message is printed if this is not the case.

DEFAULT

None

SYNONYMS

EIGENVECTORS for MATRIX EIGENVECTORS

RELATED COMMANDS

MATRIX EIGENVALUES	=	Compute the matrix eigenvalues.
MATRIX SOLUTION	=	Solve a system of linear equations.
CORRELATION MATRIX	=	Compute the correlation matrix of a matrix.
VARIANCE-COVA MATRIX	=	Compute the variance-covariance matrix of a matrix.
PRINCIPAL COMPONENTS	=	Compute the principal components of a matrix.
SINGULAR VALUES	=	Compute the singular values of a matrix.

| SINGULAR VALUE DECOM | = | Compute the singular value decomposition of a matrix. |
| SINGULAR VALUE FACT | = | Compute the singular value factorization of a matrix. |

REFERENCE
Any standard text on linear algebra.

APPLICATIONS
Linear Algebra

IMPLEMENTATION DATE
87/10 (conversion to LINPACK routines and extended to non-symmetric case 93/8)

PROGRAM
READ MATRIX X
16 16 19 21 20
14 17 15 22 18
24 23 21 24 20
18 17 16 15 20
18 11 9 18 7
END OF DATA
LET A = MATRIX EIGENVECTORS X
PRINT A

The following output is generated.

```
            MATRIX A        --        10 ROWS
                            --         5 COLUMNS


VARIABLES--A1              A2              A3              A4              A5

 -0.4610988E+00 -0.2890210E+00 -0.2074865E+00  0.3708473E+00 -0.4802032E+00
 -0.4271721E+00 -0.6997953E-01  0.4392265E+00 -0.7197565E+00 -0.5153834E+00
 -0.5650310E+00  0.1263528E+00 -0.7103317E+00 -0.3762714E+00  0.3271196E+00
 -0.4278066E+00 -0.4837376E+00  0.1669072E+00  0.1428697E+00  0.7436255E+00
 -0.3203644E+00  0.8142700E+00  0.2584709E+00  0.5016652E+00 -0.1593600E+00
  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00
  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00
  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00
  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00
  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00  0.0000000E+00
```