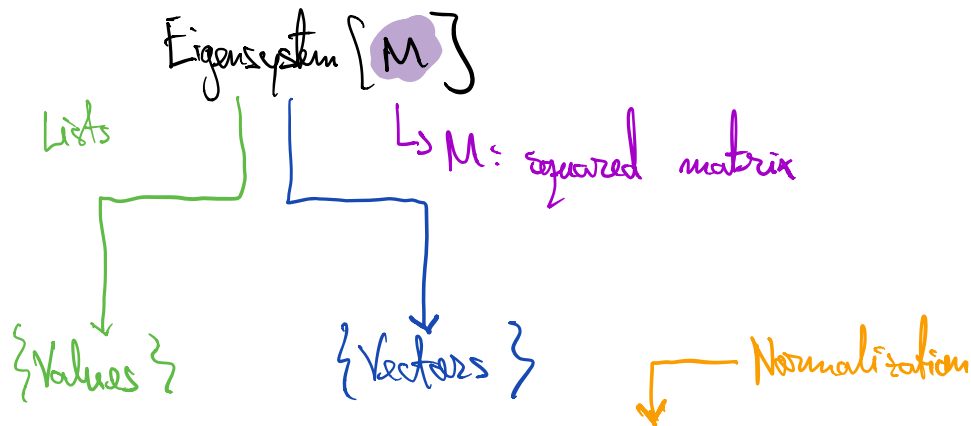


→ describe how the "Eigensystem" routine works:



- For exact or symbolic matrices m, the eigenvectors are not normalized.
- For approximate numerical matrices m, the eigenvectors are normalized.

Generalized equation for eigenvalues and eigenvectors:

$$M v^T = v^T \Lambda$$

$v \rightarrow$ vectors

$\Lambda \rightarrow$ diagonal matrix created from the list of eigenvalues

$$q1 = \begin{pmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{pmatrix} \boxed{M} (1)$$

In[17]:= Eigensystem[q1]

Out[17]:= {{4, -2, -2}, {{1, 1, 2}, {-1, 0, 1}, {1, 1, 0}}}

Eigenvalues

In[18]:= Eigensystem[q1][[1]]

Out[18]:= {4, -2, -2}

Eigenvectors

In[19]:= Eigensystem[q1][[2]]

Out[19]:= {{1, 1, 2}, {-1, 0, 1}, {1, 1, 0}}

v_1

v_2

v_3

In[20]:= Eigensystem[q1][[2]] // MatrixForm

Out[20]//MatrixForm=

$$\begin{pmatrix} \boxed{1} & \boxed{1} & \boxed{2} \\ \boxed{-1} & \boxed{0} & \boxed{1} \\ \boxed{1} & \boxed{1} & \boxed{0} \end{pmatrix} \begin{matrix} \xrightarrow{v_1} [v_{11} \ v_{12} \ v_{13}] \\ \xrightarrow{v_2} [v_{21} \ v_{22} \ v_{23}] \\ \xrightarrow{v_3} [v_{31} \ v_{32} \ v_{33}] \end{matrix}$$

In[22]:= Transpose[Eigensystem[q1][[2]]] // MatrixForm

Out[22]//MatrixForm=

$$\begin{pmatrix} 1 & -1 & 1 \\ 1 & 0 & 1 \\ 2 & 1 & 0 \end{pmatrix} \quad \boxed{V^T} \quad (2)$$

In[23]:= DiagonalMatrix[Eigensystem[q1][[1]]] // MatrixForm

Out[23]//MatrixForm=

$$\begin{pmatrix} 4 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -2 \end{pmatrix} \quad \boxed{\Lambda} \quad (3)$$

$$M V^T = V^T \Lambda$$

- test the symbolic calculation
- test numerical calculation