**Householder package**

Orthogonalization using a Householder Matrix

A = RQ

Householder transformations are a matrix A, consisting of n vectors c1,…,cn as its columns, to factorize it into an orthogonal matrix Q and an upper triangular matrix R. The basis of the transforming is the reflection operation through a plane H:

The selection of v for the reflection of a vector a, being a column of the matrix A, is supposed to fulfill the criterion:

To fulfill this requirement, v = a sign () for where e1 is a column of an Identity matrix that has the shape of A.

The class Householder extracts the vector v from the matrix A and performs the QR decomposition. The reflection of a through a plane spanned by v is performed by the class Reflection.

The initial matrix A is decomposed into its vectors a1, a1, …, an, corresponding vectors v are identified to build the transformation matrix H, that is used for the column wise transformation of A until it becomes R, introducing zeros in each column. The transpose of Q, the orthogonal matrix, is the result of the dot product H(n-1) to H1.