

ghessenbergd() — Generalized Hessenberg decomposition

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Description

`ghessenbergd(A, B, H, R, U, V)` computes the generalized Hessenberg decomposition of two general, real or complex, square matrices, A and B , returning the [upper Hessenberg form](#) matrix in H , the upper triangular matrix in R , and the orthogonal (unitary) matrices in U and V .

`_ghessenbergd(A, B, U, V)` mirrors `ghessenbergd()`, the difference being that it returns H in A and R in B .

`_ghessenbergd_la()` is the interface into the LAPACK routines used to implement the above function; see [\[M-1\] LAPACK](#). Its direct use is not recommended.

Syntax

```
void ghessenbergd(numeric matrix A, B, H, R, U, V)
```

```
void _ghessenbergd(numeric matrix A, B, U, V)
```

Remarks and examples

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The generalized Hessenberg decomposition of two square, numeric matrices (\mathbf{A} and \mathbf{B}) can be written as

$$\mathbf{U}' \times \mathbf{A} \times \mathbf{V} = \mathbf{H}$$

$$\mathbf{U}' \times \mathbf{B} \times \mathbf{V} = \mathbf{R}$$

where \mathbf{H} is in upper Hessenberg form, \mathbf{R} is upper triangular, and \mathbf{U} and \mathbf{V} are orthogonal matrices if \mathbf{A} and \mathbf{B} are real or are unitary matrices otherwise.

In the example below, we define A and B , obtain the generalized Hessenberg decomposition, and list H and Q .

```
: A = (6, 2, 8, -1\ -3, -4, -6, 4\ 0, 8, 4, 1\ -8, -7, -3, 5)
: B = (8, 0, -8, -1\ -6, -2, -6, -1\ -7, -6, 2, -6\ 1, -7, 9, 2)
: ghessenbergd(A, B, H=., R=., U=., V=.)
: H
```

	1	2	3	4
1	-4.735680169	1.363736029	5.097381347	3.889763589
2	9.304479208	-8.594240253	-7.993282943	4.803411217
3	0	4.553169015	3.236266637	-2.147709419
4	0	0	6.997043028	-3.524816722

: R	1	2	3	4
1	-12.24744871	-1.089095534	-1.848528639	-5.398470103
2	0	-5.872766311	8.891361089	3.86967647
3	0	0	9.056748937	1.366322731
4	0	0	0	8.357135399

Conformability

`ghessenbergd(A, B, H, R, U, V):`

input:

A: $n \times n$

B: $n \times n$

output:

H: $n \times n$

R: $n \times n$

U: $n \times n$

V: $n \times n$

`_ghessenbergd(A, B, U, V):`

input:

A: $n \times n$

B: $n \times n$

output:

A: $n \times n$

B: $n \times n$

U: $n \times n$

V: $n \times n$

Diagnostics

`_ghessenbergd()` aborts with error if *A* or *B* is a view.

`ghessenbergd()` and `_ghessenbergd()` return missing results if *A* or *B* contains missing values.

Also see

[M-1] **LAPACK** — The LAPACK linear-algebra routines

[M-5] **gschurd()** — Generalized Schur decomposition

[M-4] **matrix** — Matrix functions