ghessenbergd() — Generalized Hessenberg decomposition

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

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

\[ U' \times A \times V = H \]
\[ U' \times B \times V = R \]

where H is in upper Hessenberg form, R is upper triangular, and U and V are orthogonal matrices if A and 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

<table>
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<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>1.363736029</td>
<td>5.097381347</td>
<td>3.889763589</td>
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<tr>
<td>2</td>
<td>9.304479208</td>
<td>-8.594240253</td>
<td>-7.993282943</td>
<td>4.803411217</td>
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<tr>
<td>3</td>
<td>0</td>
<td>4.553169015</td>
<td>3.236266637</td>
<td>-2.147709419</td>
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<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>6.997043028</td>
<td>-3.524816722</td>
</tr>
</tbody>
</table>
Conformability

\texttt{ghessenbergd}(A, B, H, R, U, V):

\textit{input:}
\begin{itemize}
  \item \(A\): \(n \times n\)
  \item \(B\): \(n \times n\)
\end{itemize}

\textit{output:}
\begin{itemize}
  \item \(H\): \(n \times n\)
  \item \(R\): \(n \times n\)
  \item \(U\): \(n \times n\)
  \item \(V\): \(n \times n\)
\end{itemize}

\texttt{ghessenbergd}(A, B, U, V):

\textit{input:}
\begin{itemize}
  \item \(A\): \(n \times n\)
  \item \(B\): \(n \times n\)
\end{itemize}

\textit{output:}
\begin{itemize}
  \item \(A\): \(n \times n\)
  \item \(B\): \(n \times n\)
  \item \(U\): \(n \times n\)
  \item \(V\): \(n \times n\)
\end{itemize}

Diagnostics

\texttt{ghessenbergd}() aborts with error if \(A\) or \(B\) is a view.

\texttt{ghessenbergd}() and \texttt{ghessenbergd}() return missing results if \(A\) or \(B\) contains missing values.

Also see

[\texttt{LAPACK} — The LAPACK linear-algebra routines]

[\texttt{gschurd}() — Generalized Schur decomposition]

[\texttt{Matrix} — Matrix functions]