luinv() — Square matrix inversion

Description

luinv(A) and luinv(A, tol) return the inverse of real or complex, square matrix A.

_luinv(A) and _luinv(A, tol) do the same thing except that, rather than returning the inverse matrix, they overwrite the original matrix A with the inverse.

In all cases, optional argument tol specifies the tolerance for determining singularity; see Remarks and examples below.

_luinv_la(A, b) is the interface to the [M-1] LAPACK routines that do the work. The output b is a real scalar, which is 1 if the LAPACK routine used a blocked algorithm and 0 otherwise.

Syntax

numeric matrix   luinv(numeric matrix A)
numeric matrix   luinv(numeric matrix A, real scalar tol)
void             _luinv(numeric matrix A)
void             _luinv(numeric matrix A, real scalar tol)
real scalar      _luinv_la(numeric matrix A, b)

Remarks and examples

These routines calculate the inverse of A. The inverse matrix $A^{-1}$ of A satisfies the conditions

$$AA^{-1} = I$$
$$A^{-1}A = I$$


luinv(A) is logically equivalent to lusolve(A, I(rows(A))); see [M-5] lusolve() for details and for use of the optional tol argument.
Conformability

\texttt{luinv(A, tol)}:

\begin{align*}
A &: \quad n \times n \\
tol &: \quad 1 \times 1 \quad \text{(optional)} \\
result &: \quad n \times n
\end{align*}

\texttt{luinv\_la(A, b)}:

\begin{align*}
input:\quad A &: \quad n \times n \\
tol &: \quad 1 \times 1 \quad \text{(optional)} \\
output:\quad A &: \quad n \times n
\end{align*}

\texttt{luinv\_la(A, b)}:

\begin{align*}
input:\quad A &: \quad n \times n \\
output:\quad A &: \quad n \times n \\
b &: \quad 1 \times 1 \\
result &: \quad 1 \times 1
\end{align*}

Diagnostics

The inverse returned by these functions is real if \( A \) is real and is complex if \( A \) is complex. If you use these functions with a singular matrix, returned will be a matrix of missing values. The determination of singularity is made relative to \( tol \). See \textit{Tolerance} under \textit{Remarks and examples} in \cite{lusolve} for details.

\texttt{luinv(A)} and \texttt{luinv(A)} return a matrix containing missing if \( A \) contains missing values.

\texttt{luinv(A)} aborts with error if \( A \) is a view.

\texttt{luinv\_la(A, b)} should not be used directly; use \texttt{luinv()}.

See \cite{lusolve} and \cite{Tolerance} for information on the optional \( tol \) argument.

Also see

\cite{cholinv} — Symmetric, positive-definite matrix inversion  
\cite{invsym} — Symmetric real matrix inversion  
\cite{lud} — LU decomposition  
\cite{lusolve} — Solve \( AX=B \) for \( X \) using LU decomposition  
\cite{pinv} — Moore–Penrose pseudoinverse  
\cite{qrinv} — Generalized inverse of matrix via QR decomposition  
\cite{Matrix} — Matrix functions  
\cite{Solvers} — Functions to solve \( AX=B \) and to obtain \( A \) inverse