Title

cholesky( ) — Cholesky square-root decomposition

Description

`cholesky(`*A*`)` returns the Cholesky decomposition G of symmetric (Hermitian), positive-definite matrix A. `cholesky()` returns a lower-triangular matrix of missing values if A is not positive definite.

`_cholesky(`*A*`)` does the same thing, except that it overwrites A with the Cholesky result.

Syntax

numeric matrix `cholesky(`*numeric matrix A*`)`

void `_cholesky(`*numeric matrix A*`)`

Remarks and examples

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The Cholesky decomposition G of a symmetric, positive-definite matrix A is

$$A = GG'$$

where G is lower triangular. When A is complex, A must be Hermitian, and G', of course, is the conjugate transpose of G.

Decomposition is performed via [M-1] **LAPACK**.

Conformability

`cholesky(`*A*`)`:

A: $n \times n$
result: $n \times n$

`_cholesky(`*A*`)`:

input:
A: $n \times n$
output:
A: $n \times n$

Diagnostics

`cholesky()` returns a lower-triangular matrix of missing values if A contains missing values or if A is not positive definite.

`_cholesky(A)` overwrites A with a lower-triangular matrix of missing values if A contains missing values or if A is not positive definite.

Both functions use the elements from the lower triangle of A without checking whether A is symmetric or, in the complex case, Hermitian.

André-Louis Cholesky (1875–1918) was born near Bordeaux in France. He studied at the Ecole Polytechnique and then joined the French army. Cholesky served in Tunisia and Algeria and then worked in the Geodesic Section of the Army Geographic Service, where he invented his now-famous method. In the war of 1914–1918, he served in the Vosges and in Romania but after returning to the Western front was fatally wounded. Cholesky's method was written up posthumously by one of his fellow officers but attracted little attention until the 1940s.

Reference

Chabert, J.-L., É. Barbin, J. Borowczyk, M. Guillemot, and A. Michel-Pajus. 1999. *A History of Algorithms: From the Pebble to the Microchip.* Trans. C. Weeks. Berlin: Springer.

Also see

[M-5] **ldl( )** — Bunch–Kaufman decomposition

[M-5] **lud( )** — LU decomposition

[M-4] **Matrix** — Matrix functions