Title

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solve_tol( ) — Tolerance used by solvers and inverters

Syntax

real scalar `solve_tol(`*numeric matrix Z*`,` *real scalar usertol*`)`

Description

`solve_tol(`Z`,` *usertol*`)` returns the tolerance used by many Mata solvers to solve $AX = B$ and by many Mata inverters to obtain A^{-1}. *usertol* is the tolerance specified by the user or is missing value if the user did not specify a tolerance.

Remarks and examples

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The tolerance used by many Mata solvers to solve $AX = B$ and by many Mata inverters to obtain A^{-1} is

$$eta = s * \frac{\texttt{trace(abs(}Z\texttt{))}}{n} \tag{1}$$

where $s =$ 1e–13 or a value specified by the user, n is the `min(rows(`Z`), cols(`Z`))`, and Z is a matrix related to A, usually by some form of decomposition, but could be A itself (for instance, if A were triangular). See, for instance, [M-5] **solvelower( )** and [M-5] **cholsolve( )**.

When *usertol* > 0 and *usertol* $<$ `.` is specified, `solvetol()` returns *eta* calculated with $s =$ *usertol*.

When *usertol* ≤ 0 is specified, `solvetol()` returns $-$*usertol*.

When *usertol* $\geq$ `.` is specified, `solvetol()` returns a default result, calculated as

1. If external real scalar `_solvetolerance` does not exist, as is usually the case, the value of *eta* is returned using $s =$ 1e–13.
2. If external real scalar `_solvetolerance` does exist,
    a. If `_solvetolerance` > 0, the value of *eta* is returned using $s =$ `solvetolerance`.
    b. If `_solvetolerance` ≤ 0, $-$`_solvetolerance` is returned.

Conformability

`solve_tol(`Z`,` *usertol*`)`:

Z:	$r \times c$
usertol:	1×1
result:	1×1

Diagnostics

`solve_tol(`*Z*`,` *usertol*`)` skips over missing values in *Z* in calculating (1); *n* is defined as the number of nonmissing elements on the diagonal.

Also see

[M-4] **utility** — Matrix utility functions