solve_tol( ) — Tolerance used by solvers and inverters

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.

Syntax

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

Remarks and examples

The tolerance used by many Mata solvers to solve AX = B and by many Mata inverters to obtain A⁻¹ is

\[ \text{eta} = s \times \frac{\text{trace(abs(Z))}}{n} \]

(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 ≥ . 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):

<table>
<thead>
<tr>
<th></th>
<th>Z:</th>
<th>usertol:</th>
<th>result:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r × c</td>
<td>1 × 1</td>
<td>1 × 1</td>
</tr>
</tbody>
</table>
Diagnostics

\texttt{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] \textbf{Utility} — Matrix utility functions