edittozero( ) — Edit matrix for roundoff error (zeros)

[Description](#)   [Syntax](#)   [Remarks and examples](#)   [Conformability](#)   [Diagnostics](#)   [Also see](#)

Description

These edit functions set elements of matrices to zero that are close to zero. edittozero(Z, *amt*) and _edittozero(Z, *amt*) set

$$Z_{ij} = 0 \qquad \text{if } |Z_{ij}| \leq |tol|$$

for Z real and set

$$\text{Re}(Z_{ij}) = 0 \qquad \text{if } |\text{Re}(Z_{ij})| \leq |tol|$$
$$\text{Im}(Z_{ij}) = 0 \qquad \text{if } |\text{Im}(Z_{ij})| \leq |tol|$$

for Z complex, where in both cases

   tol = abs(*amt*)*epsilon(sum(abs(Z))/(rows(Z)*cols(Z)))

edittozero() leaves Z unchanged and returns the edited matrix. _edittozero() edits Z in place.

edittozerotol(Z, *tol*) and _edittozerotol(Z, *tol*) do the same thing, except that *tol* is specified directly.

Syntax

numeric matrix	edittozero(*numeric matrix Z*, *real scalar amt*)
void	_edittozero(*numeric matrix Z*, *real scalar amt*)
numeric matrix	edittozerotol(*numeric matrix Z*, *real scalar tol*)
void	_edittozerotol(*numeric matrix Z*, *real scalar tol*)

Remarks and examples

Remarks are presented under the following headings:

> *Background*
> *Treatment of complex values*
> *Recommendations*

Background

Numerical roundoff error leads to, among other things, numbers that should be zero being small but not zero, and so it is sometimes desirable to reset those small numbers to zero.

The problem is in identifying those small numbers. Is 1e–14 small? Is 10,000? The answer is that, given some matrix, 1e–14 might not be small because most of the values in the matrix are around 1e–14, and the small values are 1e–28, and given some other matrix, 10,000 might indeed be small because most of the elements are around 1e+18.

`edittozero()` makes an attempt to determine what is small. `edittozerotol()` leaves that determination to you. In `edittozerotol(Z, tol)`, you specify *tol* and elements for which $|Z_{ij}| \leq tol$ are set to zero.

Using `edittozero(Z, amt)`, however, you specify *amt* and then *tol* is calculated for you based on the size of the elements in Z and *amt*, using the formula

$$tol = amt * \texttt{epsilon}(\textit{average value of } |Z_{ij}|)$$

`epsilon()` refers to machine precision, and `epsilon(x)` is the function that returns machine precision in units of x:

$$\texttt{epsilon}(x) = |x|*\texttt{epsilon(1)}$$

where `epsilon(1)` is approximately 2.22e–16 on most computers; see [M-5] **epsilon( )**.

Treatment of complex values

The formula

$$tol = amt * \texttt{epsilon}(\textit{average value of } |Z_{ij}|)$$

is used for both real and complex values. For complex, $|Z_{ij}|$ refers to the modulus (length) of the complex element.

However, rather than applying the reset rule

$$Z_{ij} = 0 \qquad \text{if } |Z_{ij}| \leq |tol|$$

as is done when Z is real, the reset rules are

$$\text{Re}(Z_{ij}) = 0 \qquad \text{if } |\text{Re}(Z_{ij})| \leq |tol|$$
$$\text{Im}(Z_{ij}) = 0 \qquad \text{if } |\text{Im}(Z_{ij})| \leq |tol|$$

The first rule, applied even for complex, may seem more appealing, but the use of the second has the advantage of mapping numbers close to being purely real or purely imaginary to purely real or purely imaginary results.

Recommendations

1. Minimal editing is performed by `edittozero(Z, 1)`. Values less than 2.22e–16 times the average would be set to zero.

2. It is often reasonable to code edittozero(Z, 1000), which sets to zero values less than 2.22e–13 times the average.

3. For a given calculation, the amount of roundoff error that arises with complex matrices (matrices with nonzero imaginary part) is greater than the amount that arises with real matrices (matrices with zero imaginary part even if stored as complex). That is because, in addition to all the usual sources of roundoff error, multiplication of complex values involves the addition operator, which introduces additional roundoff error. Hence, whatever is the appropriate value of *amt* or *tol* with real matrices, it is larger for complex matrices.

Conformability

edittozero(*Z*, *amt*):

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

_edittozero(*Z*, *amt*):

input:

Z:	$r \times c$
amt:	1×1

output:

Z:	$r \times c$

edittozerotol(*Z*, *tol*):

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

_edittozerotol(*Z*, *tol*):

input:

Z:	$r \times c$
tol:	1×1

output:

Z:	$r \times c$

Diagnostics

edittozero(*Z*, *amt*) and _edittozero(*Z*, *amt*) leave scalars unchanged because they base their calculation of the likely roundoff error on the average value of $|Z_{ij}|$.

Also see

[M-5] **edittoint( )** — Edit matrix for roundoff error (integers)

[M-4] **Manipulation** — Matrix manipulation

For suggested citations, see the FAQ on citing Stata documentation.