C( ) — Make complex

Description

C(A) returns A converted to complex. C(A) returns A if A is already complex. If A is real, C(A) returns \( A+0i \)—A cast up to complex. Coding C(A) is thus how you ensure that the matrix is treated as complex.

C(R, I) returns the complex matrix \( R+Ii \) and is faster than the alternative \( R + I: *1i \).

Syntax

\[
\begin{align*}
\text{complex matrix} & \quad C(\text{numeric matrix } A) \\
\text{complex matrix} & \quad C(\text{real matrix } R, \text{ real matrix } I)
\end{align*}
\]

Remarks and examples

Many of Mata’s functions are overloaded, meaning they return a real when given real arguments and a complex when given complex arguments. Given real arguments, if the result cannot be expressed as a real, missing value is returned. Thus \( \text{sqrt}(-1) \) evaluates to missing, whereas \( \text{sqrt}(-1+0i) \) is \( 1i \).

\( C() \) is the fast way to make arguments that might be real into complex. You can code

\[
\text{result} = \text{sqrt}(C(x))
\]

If \( x \) already is complex, \( C() \) does nothing; if \( x \) is real, \( C(x) \) returns the complex equivalent.

The two-argument version of \( C() \) is less frequently used. \( C(R, I) \) is literally equivalent to \( R : + I*1i \), meaning that \( R \) and \( I \) need only be c-conformable.

For instance, \( C(1, (1,2,3)) \) evaluates to \( (1+1i, 1+2i, 1+3i) \).

Conformability

\( C(A) \):

\[
\begin{align*}
A: & \quad r \times c \\
\text{result}: & \quad r \times c
\end{align*}
\]

\( C(R, I) \):

\[
\begin{align*}
R: & \quad r_1 \times c_1 \\
I: & \quad r_2 \times c_2, \quad R \text{ and } I \text{ c-conformable} \\
\text{result}: & \quad \text{max}(r_1, r_2) \times \text{max}(c_1, c_2)
\end{align*}
\]
Diagnostics

C(Z), if Z is complex, literally returns Z and not a copy of Z. This makes execution of C() applied to complex arguments instant.

In C(R, I), the i,j element of the result will be missing anywhere R[i,j] or I[i,j] is missing. For instance, C((1,3,.) , (.,2,4)) results in (., 3+2i, .). If R[i,j] and I[i,j] are both missing, then the R[i,j] value will be used; for example, C(.a, .b) results in .a.

Also see

[M-5] Re( ) — Extract real or imaginary part
[M-4] Scalar — Scalar mathematical functions
[M-4] Utility — Matrix utility functions