**conj() — Complex conjugate**

### Description

`conj(Z)` returns the elementwise complex conjugate of `Z`, that is, `conj(a+bi) = a - bi`. `conj()` may be used with real or complex matrices. If `Z` is real, `Z` is returned unmodified.

`_conj(A)` replaces `A` with `conj(A)`. Coding `_conj(A)` is equivalent to coding `A = conj(A)`, except that less memory is used.

### Syntax

```plaintext
numeric matrix   conj(numeric matrix Z)
void             _conj(numeric matrix A)
```

### Remarks and examples

Given an `m x n` matrix `Z`, `conj(Z)` returns an `m x n` matrix; it does not return the transpose. To obtain the conjugate transpose matrix, also known as the adjoint matrix, adjugate matrix, Hermitian adjoin, or Hermitian transpose, code

```
Z'
```

See [M-2] `op_transpose`.

A matrix equal to its conjugate transpose is called Hermitian or self-adjoint, although in this manual, we often use the term symmetric.

### Conformability

- **`conj(Z)`**:
  - `Z`: `r x c`
  - **result**: `r x c`

- **`_conj(A)`**:
  - **input**: `A`: `r x c`
  - **output**: `A`: `r x c`
Diagnostics

\( \text{conj}(Z) \) returns a real matrix if \( Z \) is real and a complex matrix if \( Z \) is complex.

\( \text{conj}(Z) \), if \( Z \) is real, returns \( Z \) itself and not a copy. This makes \( \text{conj}() \) execute instantly when applied to real matrices.

\( \_\text{conj}(A) \) does nothing if \( A \) is real (and hence, does not abort if \( A \) is a view).

Also see

[M-5] \_\text{transpose}() — Transposition in place

[M-4] \text{Scalar} — Scalar mathematical functions