Pitfalls of the Complex-Step Method

There Are Some Complex-Step Pitfalls You Should be Aware of

While the complex-step method is straightforward to apply, there are a couple things to look out for [MSA03]:

- need to redefine `min`, `max`, and `abs`
- some trig and inverse trig functions may need to be redefined
- in Matlab, use the `transpose` function or the `.'` operator for transposing vectors and matrices, otherwise you get the conjugate transpose.

Example of a Complex-Step Gotcha: the absolute value function

In many programming languages, `abs` is defined as the modulus of the complex number, i.e. $|z| = \sqrt{x^2 + y^2}$.

Example of a Complex-Step Gotcha: the absolute value function (cont.)

```
1      function cabs(z)
2        % complexified version of the absolute value
3        if real(z) >= 0
4          return z
5        else
6          return -z
7        end
8      end
```

References

Joaquim R. R. A. Martins, Peter Sturdza, and Juan J. Alonso, *The complex-step derivative approximation*, ACM Transactions on Mathematical Software **29** (2003), no. 3, 245–262.