MATLAB's `fzero` Function

A Quick Review

fzero

fzero

Root of nonlinear function

Syntax

```
x = fzero(fun,x0)
x = fzero(fun,x0,options)

x = fzero(problem)

[x,fval,exitflag,output] = fzero( __ )
```

Not necessary

Description

`x = fzero(fun,x0)` tries to find a point `x` where `fun(x) = 0`. This solution is where `fun(x)` changes sign—`fzero` cannot find a root of a function such as `x^2`.

fzero

fun — Function to solve
function handle | function name

Function to solve, specified as a handle to a scalar-valued function or the name of such a function. `fun` accepts a scalar `x` and returns a scalar `fun(x)`.

`fzero` solves `fun(x) = 0`. To solve an equation `fun(x) = c(x)`, instead solve `fun2(x) = fun(x) - c(x) = 0`.

To include extra parameters in your function, see the example Root of Function with Extra Parameter and the section Parameterizing Functions.

Example: `'sin'`

Example: `@myFunction`

Example: `@(x)(x-a)^5 - 3*x + a - 1`

"$f(x) = 0$" form!

fzero

x0 — Initial value
scalar | 2-element vector

Initial value, specified as a real scalar or a 2-element real vector.

- Scalar — `fzero` begins at `x0` and tries to locate a point `x1` where `fun(x1)` has the opposite sign of `fun(x0)`. Then `fzero` iteratively shrinks the interval where `fun` changes sign to reach a solution.
- 2-element vector — `fzero` checks that `fun(x0(1))` and `fun(x0(2))` have opposite signs, and errors if they do not. It then iteratively shrinks the interval where `fun` changes sign to reach a solution. An interval `x0` must be finite; it cannot contain `±Inf`.

Tip

Calling `fzero` with an interval (`x0` with two elements) is often faster than calling it with a scalar `x0`.

Example: 3

Example: [2,17]

Just like bisection!

Manning Equation

- Manning Equation:

$$\mathrm{Q} = \frac{\sqrt{S}(BH)^{5/3}}{n(B+2H)^{2/3}}$$

- Find H given S, B, n, and Q.

- Rewrite this in "$f(x) = 0$ form":

$$0 = \frac{\sqrt{S}(BH)^{5/3}}{n(B+2H)^{2/3}} - Q$$