Secant Method

Although the Newton-Raphson method is very powerfull to solve non-linear equations, evaluating of the function derivative is the major difficulty of this method. To overcome this deficiency, the secant method starts the iteration by employing two starting points and approximates the function derivative by evaluating of the slope of the line passing through these points. The secant method has been shown in Fig. 1. As it is illustrated in Fig. 1, the new guess of the root of the function *f(x)* can be found as follows:

$$x_{i+1} = x_i - \frac{(x_{i-1} - x_i) f(x_i)}{f(x_{i-1}) - f(x_i)}$$

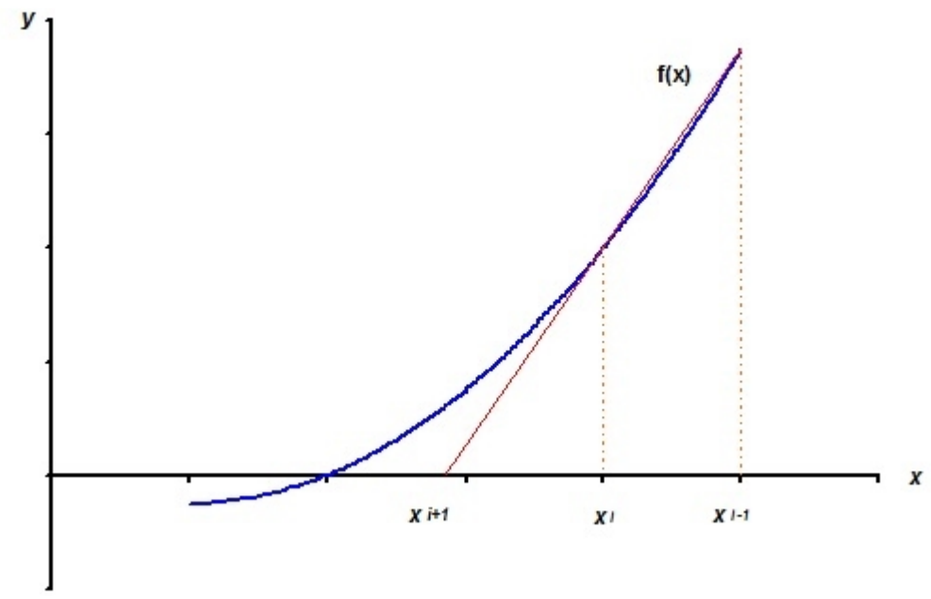

Fig. 1. The secant method

In the first glance, the secant method may be seemed similar to linear interpolation method, but there is a major difference between these two methods. In the secant method, it is not necessary that two starting points to be in opposite sign. Therefore, the secant method is not a kind of bracketing method but an open method. This major difference causes the secant method to be possibly divergent in some cases, but when this method is convergent, the convergent speed of this method is better than linear interpolation method in most of the problems.
The algorithm of the secant method can be written as follows:

Step 1: Choose two starting points x_0 and x_1.

Step 2: Let

$$x_2 = x_1 - \frac{(x_0 - x_1) f(x_1)}{f(x_0) - f(x_1)}.$$

Step 3: if $|x_2-x_1|<e$ then let *root* = x_2, else $x_0 = x_1$; $x_1 = x_2$; go to step 2.

Step 4: End.

e: Acceptable approximated error.

Roots of Equations

(Source Code in C++)

- **Bisection Method**
- **Linear Interpolation Method**
- **Modified Methods**
- **Newton-Raphson Method**
- **One point Interpolation Method**
- **Secant Method**