NUMERICAL METHOD

ASSIGNMENT

on

Advantages and Disadvantages of
Bisection Method, False Position Method and Newton Raphson Method

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Bisection Method

The bisection method is a root-finding method that applies to any continuous functions for which one knows two values with opposite signs. The method consists of repeatedly bisecting the interval defined by these values and then selecting the subinterval in which the function changes sign, and therefore must contain a root. It is a very simple and robust method, but it is also relatively slow. Because of this, it is often used to obtain a rough approximation to a solution which is then used as a starting point for more rapidly converging methods. The method is also called the interval halving method, the binary search method, or the dichotomy method.

Advantages:

- Slow convergence.
- If one of the initial guesses is close to the root, the convergence is slower
- The bisection method is always convergent. Since the method brackets the root, the method is guaranteed to converge.
- As the iterations are conducted, the interval gets halved. So one can guaranteed the error in the solution of the equation.
- It is easy to find root.
- It is so much simple.

Disadvantages:

- It requires the derivatives of, if complicated then this method will tend to fail.
- It requires very accurate initial value or initial guess.
- Function and its derivatives should be continuous on the range you search for root in it.
- The convergence of bisection method is slow as it is simply based on halving the interval.

- If one of the initial guesses is closer to the root it will take larger number of iterations to reach the root.

False position method

The false-position method is a modification on the bisection method: if it is known that the root lies on [a, b], then it is reasonable that we can approximate the function on the interval by interpolating the points (a, f(a)) and (b, f(b)). So, it is an algorithm for finding roots which retains the prior estimate for which the function value has opposite sign from the function value at the current best estimate of the root.

Advantages

- It always converges.
- It doesn't require the derivative
- It is quick method.

Disadvantages

- One of the interval definitions can get struck.
- It may slowdown an unfavorable situation.

Newton Raphson Method

Newton's method, also known as the Newton–Raphson method, named after Isaac Newton and Joseph Raphson, is a root-finding algorithm which produces successively better approximations to the roots (or zeroes) of a real-valued function. The most basic version starts with a single-variable function f defined for a real variable x, the function's derivative f ', and an initial

guess x0 for a root of f. The Newton-Raphson method is a way to quickly find a good approximation for the root valued function.

Advantages

- One of the fastest convergences to the root.
- Converges on the root quadratic.
- Near a root, the number of significant digits approximately doubles with each step.
- This leads to the ability of the Newton-Raphson Method to “polish” a root from another convergences technique.
- Easy to convert to multiple dimensions.
- Can be used to “polish” a root found by other methods.

Disadvantages

- Must find the derivative
- Poor global convergence properties
- Dependent on initial guess :
    - May be too far from local root
    - May encounter a zero derivative
    - May loop indefinitely.