Numerical Analysis.

# Bisection Method

Date
Page

There are various method for solving a numerical Equation. These methods may not give exact roots. Every method insists upon finding a first approximation to the root of the given equation. The first method i.e Bisection method

This method is based on the principle that if a function $f(x)$ is continuous in the interval $[a, b]$ and $f(a)$ and $f(b)$ are of opposite signs, then there exists at least one root between a and b.

This method of solving a equation whether polynomial or transcendental, consists in locating the roots of the Equation $f(x) = 0$ between two numbers a and b such that $f(x)$ is continuous for $a < x < b$ and $f(a)$ & $f(b)$ are opposite signs so that the product $f(a) f(b) < 0$ i.e. the curve crosses the x-Axis between a and b. Then the desired root between them is approximately $x_1 = \frac{a+b}{2}$. If $f(x_1) = 0$ then $x_1$ is the correct root of $f(x) = 0$

On the other hand, if $f(x_1) \neq 0$, then the root either lies in the interval $(a, x_1)$ or $(x_1, b)$ where $x_1 = \frac{a+b}{2}$

a $\qquad\qquad$ b

$x_1 = \frac{a+b}{2}$

If $f(a)\,f(x_1) < 0$ then the root lies between $x = a$ and $x = x_1$, but if $f(x_1)\,f(b) < 0$, then the roots lies between $x_1$ and b

Let $x_2 = \frac{a+x_1}{2}$

If $f(a)$ and $f(x_2)$ are of opposite signs i.e if $f(a)\,f(x_2) < 0$ then the root lies between a and $x_2$.

If on the other hand, $f(x_1)$ and $f(b)$ are of opposite signs i.e $f(x_1) \cdot f(b) < 0$, then the root lies between $x_1$ and b. Then

Date

Page

we take $x_2 = \frac{x_1 + b}{2}$

Thus we go on bisecting the interval and repeating the process untill the root is obtained to desired accuracy.