© DEC 2019 | IRE Journals | Volume 3 Issue 6 | ISSN: 2456-8880

Role of Bisection Method

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Abstract -- the bisection method is the basic method of finding a root. As cycles are conducted, the period of time (or space) gets halved. So method is to come together to a root of "g" if "g" is a continuous function at a period of time (or space) [a,b] and f(a) and f(b) should have opposite sign. In this paper we have explained the role of bisection method. It is watched/followed that scientists and engineers are often faced with the job of finding out the roots of equations and the basic method is divide in bisection method but it is (compared to something else) slow.

I. INTRODUCTION

In Mathematics, the bisection technique is a straightforward method to find the numerical solutions to an unknown equation in. Among all the numerical technique, the bisection method is the simplest one to solve the nonphysical equation. In this paper, we will discuss the bisection method with solved problems. The bisection technique is used to find the roots of a polynomial equation. Separates the interval and subdivides the interval in which the root of the equation lies. The principle behind this technique is the intermediate theorem for continuous function. It works by narrowing the space between the positive and negative intervals until it closes in on the correct answer. This method narrows the space by taking the average of the positive and negative interval. It is a simple method, and it is very slow. The bisection method is also known as interval halving technique, root-finding technique.

Let, consider a continuous function “g” which is defined on the closed interval [a, b], is given with g(a) and g(b) of different signs. Then by intermediate theorem, there exists a point x belong to (a, b) for which g(x) =0.

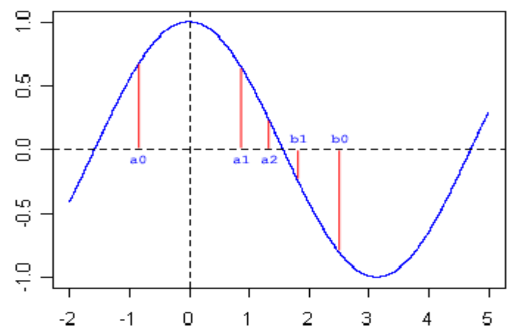

Fig 1

II. BISECTION METHOD ALGORITHM

Follow the below procedure to get the solution for the continuous function:

For any continuous function g(x),

- Find two points, say a and b such that a < b and g(a)* g(b) < 0
- Find the midpoint of a and b, say “h”
- h is the root of the given function if g(h) = 0; else follow the next step
- Divide the interval [a, b]
- If g(h)*g(b) <0, let a = h
- Else if g(h) *g(a), let b = h
- Repeat above three steps until g(h) = 0.

The bisection method is an approximation technique to find the root of the given equation by repeatedly dividing the interval. This method will divide the interval until the resulting interval is found, which is extremely small.

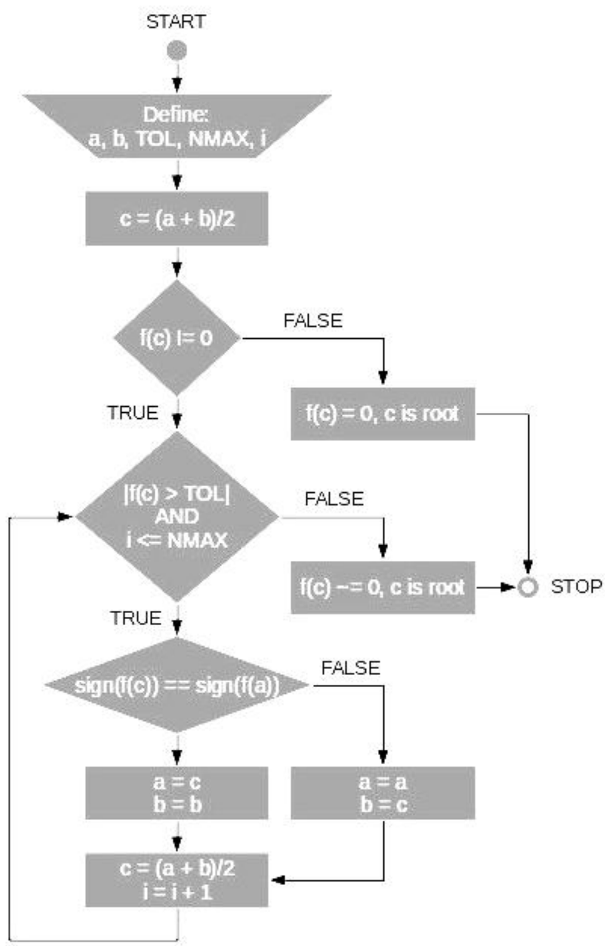

Fig. 2

Example:
Find the root of y^3 – y = 1 by using Bisection Method.

Solution:
Let us assume that the root of y^3 – y – 1=0 lies between (1,2)

Here, g(1) = negative and g(2) = positive.

Hence root lies between (1,2) for first approximation,
y0 = (1+2)/2 = 1.5
g(y0) = g(1.5) = positive

Hence root lies between (1,1.5)
y1 = (1+1.5)/2 = 1.25
g(y1) = g(1.25) = negative

Hence root lies between (1.25,1.5)
y2 = (1.25+1.5)/2 = 1.375
g(y2) = g(1.375) = positive

Hence root lies between (1.25,1.375)
y3 = (1.25+1.375)/2 = 1.3125
g(y3) = g(1.3125) = negative

Hence root lies between (1.3125,1.375)
y4 = (1.3125+1.375)/2 = 1.34375
g(y4) = g(1.34375) = positive

Hence root lies between (1.3125,1.34375)
y5 = (1.3125+1.34375)/2 = 1.328125
g(y5) = g(1.328125) = positive

Hence root lies between (1.3125,1.328125)
y6 = (1.3125+1.328125)/2 = 1.320313
g(y6) = g(1.320313) = negative

Hence root lies between (1.320313,1.328125)
y7 = (1.320313+1.328125)/2 = 1.324219
g(y7) = g(1.324219) = negative

Hence root lies between (1.324219,1.328125)
y8 = (1.324219+1.328125)/2 = 1.326172
g(y8) = g(1.326172) = positive

Hence root lies between (1.324219,1.326172)
y9 = (1.324219+1.326172)/2 = 1.325195
g(y9) = g(1.325195) = positive

Hence root lies between (1.324219,1.325195)
y10 = (1.324219+1.325195)/2 = 1.324707
g(y10) = g(1.324707) = negative

Hence root lies between (1.324707,1.325195)
y11 = (1.324707+1.325195)/2 = 1.324951
g(y11) = g(1.324951) = positive

Hence root lies between (1.324707,1.324951)
y12 = (1.324707+1.324951)/2 = 1.324829
g(y12) = g(1.324829) = positive

Hence root lies between (1.324707,1.324829)
y13 = (1.324707+1.324829)/2 = 1.324768
g(y13) = g(1.324768) = positive

Hence root lies between (1.324707,1.324768)

OK stop it …. I know you are getting tired… but there is no shortcut.

Now if you observe two limits (1.324707, 1.324768) of above range, they are almost same, which is our root of given equation.

Answer: y=1.324707

Table:

ITERATION NUMBER	ROOT LIES BETWEEN	VALUE OF Y
1	(1,1.5)	1.324707
2	(1.25,1.5)	
3	(1.25,1.375)	
4	(1.3125,1.375)	
5	(1.3125,1.34375)	
6	(1.3125,1.328125)	
7	(1.320313,1.328125)	
8	(1.324219,1.328125)	
9	(1.324219,1.326172)	
10	(1.324219,1.325195)	
11	(1.324707,1.325195)	
12	(1.324707,1.324951)	
13	(1.324707,1.324829)	
14	(1.324707,1.324768)	

III. CONCLUSION

Bisection technique is the safest and it always converges. The bisection method is the simplest of all other technique and is guaranteed to converge for a continuous function. It is always possible to find the number of steps required for a given accuracy and the new methods can also be developed from bisection method and bisection method plays a very crucial role.

ACKNOWLEDGEMENT

We would like to express our special thanks of gratefulness to Dr. D.S Banker. Head Department of Electrical Engineering for their able guidance and support for completing the paper.

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