Problem No : 02

Problem Name : Root Finding of Non-Linear Equations Using the False Position Method.

Problem Definition : The purpose of this lab is to find the root of a non-linear equation using the Regula Falsi method (also known as the False Position method).The method uses two initial guesses that bracket the root and iteratively refines these guesses to converge on the root within a specified tolerable error.

Algorithm :

1. Start

2. Define function $f(x)$

3. Choose initial guesses $x0$ and $x1$ such that $f(x0) f(x1) < 0$

4. Choose pre-specified tolerable error e.

5. Calculate new approximated root as :
   $x2 = x0 - ((x0 - x1) * f(x0)) / (f(x0) - f(x1))$

6. Calculate $f(x0) f(x2)$
   a. If $f(x0) f(x2) < 0$ than $x0 = x0$ and $x1 = x2$
   b. If $f(x0) f(x2) > 0$ than $x0 = x2$ and $x1 = x1$
   c. If $f(x0) f(x2) = 0$ than goto (8)
   d.

7. If $|f(x2)| > e$ then goto (5) otherwise goto (8)

8. Display x2 as root.

9. Stop.

Code :

```
RegulaFalsi_1028.m  ×    +
/MATLAB Drive/RegulaFalsi_1028.m
1      clc
2      syms x;
3      y = input('Enter non-linear equations:');
4      a = input('Enter your first guess: ');
5      b = input('Enter your second guess:');
6      e = input('Tolerable error: ');
7
8      fa = eval(subs(y,x,a));
9      fb = eval(subs(y,x,b));
10
11     if fa*fb > 0
12         disp('Given values do not bracket the root.');
13     end
14     while(fa*fb>0)
15         a=a+1;
16         b=b+1;
17         fa = eval(subs(y,x,a));
18         fb = eval(subs(y,x,b));
19     end
20         c= a-(a-b)*fa/(fa-fb);
21         fc = eval(subs(y,x,c));
22         fprintf('\n\na\t\t\tb\t\t\tc\t\t\tf(c)\n\n');
23         while abs(fc)>e
24             fprintf('%f\t%f\t%f\t%f\n',a,b,c,fc);
25             if fa*fc<0
26                 b =c;
27             else
28                 a =c;
29             end
30              c= (a+b)/2;
31              fc= eval(subs(y,x,c));
32         end
33         fprintf('\nRoot is: %f\n', c);
34
```

Input & Output :

```
RegulaFalsi_1028.m
Command Window
Enter non-linear equations:
x^3+x+1
Enter your first guess:
-1
Enter your second guess:
1
Tolerable error:
0.001


a                    b                    c                    f(c)

-1.000000      1.000000       -0.500000      0.375000
-1.000000      -0.500000      -0.750000      -0.171875
-0.750000      -0.500000      -0.625000      0.130859
-0.750000      -0.625000      -0.687500      -0.012451
-0.687500      -0.625000      -0.656250      0.061127
-0.687500      -0.656250      -0.671875      0.024830
-0.687500      -0.671875      -0.679688      0.006314
-0.687500      -0.679688      -0.683594      -0.003037
-0.683594      -0.679688      -0.681641      0.001646

Root is: -0.682617
>>
```

Discussion : The False Position Method (Regula Falsi) is a numerical technique used to find roots of non- linear equations. This method requires non-linear equation, two initial guesses that bracket the root, and a tolerable error. We can find the root in a short time through programming. It is a fast method than bisection method. It iteratively refines the guesses based on the sign of the function values, narrowing the interval until the root is found within the specified error tolerance. This approach ensures that the interval always brackets the root, providing an efficient and reliable means to approximate the root of the equation.