আন্তর্জাতিক ইসলামী বিশ্ববিদ্যালয় চট্টগ্রাম
الجامعة الإسلامية العالمية شيتاغونغ
International Islamic University Chittagong

Department of Computer Science & Engineering
Program: B. Sc in CSE

Project Title: Numerical Solution of Non-linear Equations

Team Name : Team Gamma
Team leader : C193049 Jabed Iqbal Joy
Deputy leader : C193075 Muhammad Rahatul Islam
Member :
C193052 Fahim Chowdhury Jisun
C193057 Shuvo Das
C193053 Sakawat Hossain Chowdhury

Course Code: CSE-4746

Course Title: Numarical Method

Name of the course Teacher:

Prof. Mohammed Shamsul Alam
Professor
Department of CSE, IIUC

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Introduction: Nonlinear equations are those which contain one or more terms that involve power or product of the unknown variable(s). Nonlinear equations with mixed terms, such as combinations of polynomial and trigonometric functions, are common in many scientific and engineering problems. These equations do not have closed-form solutions and often require numerical methods for finding approximate solutions. In this project, we propose to implement numerical methods to solve nonlinear equations with mixed terms, including the Newton-Raphson method, the Bisection method, the Secant method, and the fixed point method.

Objective:

These are the project's primary objectives:

- Understand the concept of nonlinear equations and numerical methods used for solving them.
- To use a variety of numerical techniques, such as the Secant, Bisection, and Newton-Raphson methods, to solve nonlinear equations.
- To evaluate the convergence, accuracy, stability, and effectiveness of different numerical techniques for dealing with mixed-term nonlinear equations.
- To compare the effectiveness of various numerical approaches and create a C++ program-based numerical solver that can handle nonlinear equations with mixed terms.
- To test the numerical solution using a variety of nonlinear problem scenarios**.**

METHODOLOGY:

We will start by studying and understanding the concept of nonlinear equations and different numerical methods used for solving them. Next, we will implement the Bisection method, Newton-Raphson method, Secant method, and Fixed-Point iteration method in C++ . We will then use a nonlinear equation such as **f(x) = sin(x) + x^3 - 2x = 0**. To compare the effectiveness and efficiency of these methods. Finally, we will test our program on multiple nonlinear equations of varying complexity to determine its accuracy and versatility.

POSSIBLE ADDITIONAL FEATURE:

This project can also contain elements like sensitivity analysis, visualization of results, extension to higher dimensions, performance comparison of various numerical methods, and development of a user-friendly numerical solver interface. The project's comprehensiveness, usefulness, and applicability may be improved by these features, which will also offer useful tools and insights for solving nonlinear equations with mixed components in a variety of scientific and engineering applications.

OUTCOME:

The outcome of this project includes a comprehensive understanding of nonlinear equations with mixed terms, implementation of multiple numerical methods for solving these equations, validation and testing of the developed numerical solver, a report summarizing the findings, and conclusions with recommendations for future research. This project will contribute to the advancement of numerical methods for solving nonlinear equations with mixed terms, providing a valuable tool for finding approximate solutions in scientific and engineering applications.

CONCLUSION:

The proposed project addresses an important problem in many fields that require solving nonlinear equations with mixed terms. The suggested numerical approach is anticipated to offer a trustworthy and effective solution to this issue. With practical applications in many different sectors, this project will help to develop numerical techniques for solving nonlinear equations.