International Islamic University Chittagong

Project Proposal
On
NUMERICAL METHODS LAB

Submitted to —

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Title: Non-Linear Equation Solution Project using Numerical Methods.

Introduction:

Non-linear equations are mathematical equations that do not have a linear relationship between the variables. Solving non-linear equations analytically can be challenging, and often requires the use of numerical methods. **In this project, we aim to solve the non-linear equation $(x^2 - 1) \sin(x) = 2x \cos(x)$ using four different numerical methods: Newton Bisection method, Newton-Raphson method, False Position method, and Secant method**.

Description:

The non-linear equation $(x^2 - 1) \sin(x) = 2x \cos(x)$ is a transcendental equation that involves both trigonometric and polynomial terms. It does not have a closed-form solution, which makes it an ideal candidate for numerical methods. The goal of this project is to implement and compare the performance of four different numerical methods in finding the solutions of this equation.

Methodology:

1. Newton Bisection Method: This method involves dividing the interval where the solution lies into smaller intervals and then applying the bisection method to each interval until the desired accuracy is achieved.

2. Newton-Raphson Method: This method is an iterative technique that involves using the derivative of the function to approximate the solution. It starts with an initial guess and iteratively refines the guess until the solution is found.

3. False Position Method: This method is also an iterative technique that involves creating a secant line between two initial guesses and finding the point where the secant line intersects the x-axis. This point is then used as the new guess for the next iteration.

4. Secant Method: This method is similar to the false position method, but instead of using a secant line between two guesses, it uses the slope of the function at the previous point to approximate the next point.

Aims and Goals:

The aims and goals of this project are:

1. To implement and compare the performance of four different numerical methods for solving the given non-linear equation.
2. To analyze the convergence rate and accuracy of each method.
3. To study the computational efficiency and robustness of each method.
4. To provide recommendations on the most suitable method for solving this particular non-linear equation.

Conclusion:

In conclusion, this project aims to solve the non-linear equation$(x^2 - 1) \sin(x) = 2x \cos(x)$ using four different numerical methods: Newton Bisection method, Newton-Raphson method, False Position method, and Secant method. Through the implementation and comparison of these methods, we expect to gain insights into their performance, convergence rate, accuracy, computational efficiency, and robustness. The findings of this project can be useful in selecting an appropriate numerical method for solving similar non-linear equations in various real-world applications.

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