**EXPLORING DIVERSE APPROACHES TO SOLVE**

**FIRST ORDER DIFFERENTIAL EQUATIONS**

**USING NUMERICAL METHODS**

**A SEMINAR 2 PRESENTATION**

**BY**

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# CERTIFICATION

This is to certify that this report was undertaken and submitted by **JOSEPH EBENEZER DANIEL** with matriculation number **20183036**, a student of the department ofMathematics, College of Physical Sciences, Federal University of Agriculture, Abeokuta, for SEMINAR 2.

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# 1.0 INTRODUCTION

## 1.1 Introduction

Differential equations serve as the foundation for modeling dynamic systems in numerous fields, ranging from physics and engineering to biology and economics. Their ubiquitous presence in the sciences and engineering disciplines underscores their paramount importance in understanding real-world phenomena. While analytical methods can provide elegant solutions to many differential equations, a significant portion of these equations remain intractable, necessitating the use of numerical techniques for their approximation.

This project embarks on a journey through the intriguing landscape of numerical methods for solving first-order differential equations. The motivation behind this exploration lies in the ever-increasing need for efficient, accurate, and adaptable tools to simulate and predict the behavior of dynamic systems. Numerical methods offer a versatile toolbox for tackling these challenges, enabling researchers and engineers to address a wide array of problems, from modeling chemical reactions to predicting the trajectories of celestial bodies.

Our investigation seeks to shed light on the diverse approaches available for solving first-order differential equations numerically. We will delve into the intricacies of these methods, their underlying principles, and their unique capabilities. By comprehensively examining both classical and modern techniques, we aim to equip readers with a nuanced understanding of when and how to employ these numerical tools effectively.

Throughout this exploration, we will assess the strengths and weaknesses of various numerical methods, considering factors such as accuracy, stability, and computational efficiency. By comparing their performance across a spectrum of differential equations with distinct characteristics, we aim to provide insights into the optimal choice of method for different scenarios.

This journey into the realm of numerical methods for first-order differential equations promises not only to expand our knowledge of these mathematical tools but also to empower researchers, scientists, and engineers with the skills and insights needed to tackle complex problems in their respective domains. Let us embark on this voyage of discovery, where the convergence of mathematics and computation illuminates new paths in our pursuit of understanding the dynamic world around us.

User

## 1.2 Preliminaries and Definitions of Terms

* Differential Equation
* Ordinary Differential Equation
* A Solution of Ordinary Differential Equation

## 1.3 Errors in Numerical Computation

An error is a derivative from accuracy or correctness. In numerical analysis, an error (*E*) is the difference between the true value (*T* ) and the approximation value (A) of a mathematical problem i.e. *T* –*A*, where T = True value and A = Approximation value.

### 1.3.1 Types of Errors

There are five major sources of errors in numerical computation:

* Rounding-off error: Also cumulative, arises from using only finite number of digits. It can be shown that the global truncation error forth Euler method is proportional to h2 and for the
* Initial error: Also uncertainty error,these are errors in the data collection e.g. when a data is obtained from a physical or chemical experiment
* Absolute error: Is the error between two values and define as *Eab* = |*x*–*u*| where *x* denotes the exact value and u denotes its approximation
* Relative Error: is the absolute error/ actual value. Percentage error = relative error \* 100
* Truncation: Also discretization or approximation error are much harder to analyze. The size of this error depends on a parameter( often called the step-size), whose appropriate value is a compromise between obtaining a small error and a fast computation

## 1.4 Literature Review

## 1.5 Problem Section

### 1.5.1 Statement of Problem

### 1.5.2 Motivation

### 1.5.3 Existing Approaches

## 1.6 Objectives

# 2.0 DISCUSSION

# 3.0 CONCLUSION AND RECOMMENDATION

## 3.1 Conclusion

## 3.2 Recommendation

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