**EXPLORING DIVERSE APPROACHES TO SOLVE**

**FIRST ORDER DIFFERENTIAL EQUATIONS**

**USING NUMERICAL METHODS**

**A SEMINAR 2 PRESENTATION**

**BY**

**JOSEPH EBENEZER DANIEL**

**(MATRIC NUMBER: 20183036)**

**DEPARTMENT OF MATHEMATICS**

**COLLEGE OF PHYSICAL SCIENCES**

**IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE IN MATHEMATICS,**

**FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA.**

**SUPERVISOR: PROF. M.O OMEIKE**

# 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.

................................................. .......................................

**PROF. M.O OMEIKE** **Date**

**(Supervisor)**

............................................. ....................................

**DR. E.O. ADELEKE** **Date**

**(Head of Department)**

# 1.0 INTRODUCTION

# 1.1 Introduction

My CONTENT GOES HERE

Differential equations play a crucial role in science and engineering as models for various problems involving systems undergoing change. These equations are widely applicable in fields such as economics, biology, business, health science, and social science. Mathematicians have developed numerous methods to solve differential equations, either analytically or numerically. When solving a differential equation numerically, we typically require an initial condition or boundary conditions. An equation with an initial condition is referred to as an initial value problem (IVP), while an equation with boundary conditions is known as a boundary value problem (BVP).

Differential equations serve as a powerful language for expressing fundamental laws of nature in disciplines like quantum physics, electronics, computational chemistry, and astronomy. Consequently, finding solutions to these equations holds great significance. Numerical solution methods are particularly valuable in applied problems where exact and analytic solutions are challenging or impossible to obtain. This can occur due to the nonlinearity of the equations or time-varying coefficients. As the complexity of the equations increases, such as those with higher-order coefficients, the task of solving them becomes more difficult. Certain equations also pose greater challenges due to multiple inputs under varying conditions.

## 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

References

1. Filipov, S. M., Gospodinov, I. D., & Farag´o, I. (2017). Shooting-projection method for two-point boundary value problems. Applied Mathematics Letters, 72, 10-15.
2. Denis, B. (2020). An overview of numerical and analytical methods for solving ordinary differential equations. arXiv preprint arXiv:2012.07558.
3. Farag´o, I. (2013). Note on the convergence of the implicit Euler method. In Numerical Analysis and Its Applications: 5th International Conference, NAA 2012, Lozenetz, Bulgaria, June 15-20, 2012, Revised Selected Papers 5 (pp. 1-11). Springer Berlin Heidelberg.
4. Hirsch, M. W., Smale, S., & Devaney, R. L. (2012). Differential equations, dynamical systems, and an introduction to chaos. Academic press.
5. Muhammad, R., Yahaya, Y. A., & Abdulkareem, A. S. (2020). An analysis of algebraic pattern of a first order and an extended second order Runge-Kutta Type Method. Science World Journal, 15(2), 16-18.
6. Ogunrinde, R. B., Fadugba, S. E., & Okunlola, J. T. (2012). On some numerical methods for solving initial value problems in ordinary differential equations. On Some Numerical Methods for Solving Initial Value Problems in Ordinary Differential Equations.
7. Perry, A. B., Jardine, D., & Shell-Gellasch, A. (2011). Connections between Newton, Leibniz, and calculus I. Mathematical time capsules, 133-137.
8. Pinchover, Y., & Rubinstein, J. (2005). An introduction to partial differential equa-tions (Vol. 10). Cambridge university press.
9. Thiele, R. (2005). The mathematics and science of Leonhard Euler (1707–1783). Mathematics and the Historia’s Craft: The Kenneth O. May Lectures, 81-140.