

Comparisons of Various Numerical Methods on Differential Equation

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Abstract: *This paper helps to find a comparison of analytical and Numerical methods of a simple first order Differential equation of the form $dy/dx = f(x,y)$, with an initial solution $y(x_0) = y_0$. Here we can see three Numerical methods Euler, Modified Euler, Runka-Kutta have been calculated using the MATLAB and the results will be compared with analytical methods. We will also compare different errors between Numerical methods and will come in to conclusion regarding which method is more efficient.*

Keywords – Numerical Methods, Euler, Modified Euler, Runka-Kutta, Differential Equation, comparison.

I.INTRODUCTION

A differential Equation may contain one or more terms which contains derivatives of one variable with respect to another variable(dependent variable y with respect to independent variable x). eg.,

$$\frac{dy}{dx} = 10x$$

Normally differential equations are divided into broad categories then in to small categories – when function associated depends only on one variable then its derivatives are ordinary derivatives and the differential equation is known as Ordinary differential Equation. If function depends on severable variables, then it is known as partial differential equation. Here we will be solving simple differential equation with three different numerical methods. Here Euler methods , Modified Euler methods and Runga –Kutta methods will be compared with each other. Then both methods of Anlytical and numerical methods will be compared.

II.EXISTING SYSTEM

The Existing system deals the solving of differential equation with Euler and IFDE and has compared the errors of both has been done using MATLAB software. This equation lacks the broad view of comparing many methods. This method has disadvantages of only limited techniques have been compared.

III.PROPOSED SYSTEM

In the Proposed system, calculation of Differential equation using three numerical methods Euler methods, Modified Euler method and Runka-Kutta muthod has been done and will be compared with each other to find which method is better. To find which method is better, we will be comparing the analytical method with these numerical methods and the errors will be calculated. All these comparisons will be done using MATLAB. MATLAB coding helps fro early comparisons of methods

IV.METHODOLOGY AND EXPERIMENT ANALYSIS:

This program deals with solving different Numerical methods

- (a) Euler Method
- (b) Modified-Euler Method
- (c) Runka-Kutta Method

Then, this will be compared with Analytical solution of $(1+0.25*x.^2).^2$.

From this comparison we will get to know how much deviation have been there with the actual solution. The more the deviation, the more is the error.

(a) Comparison of Analytical and Numerical solution

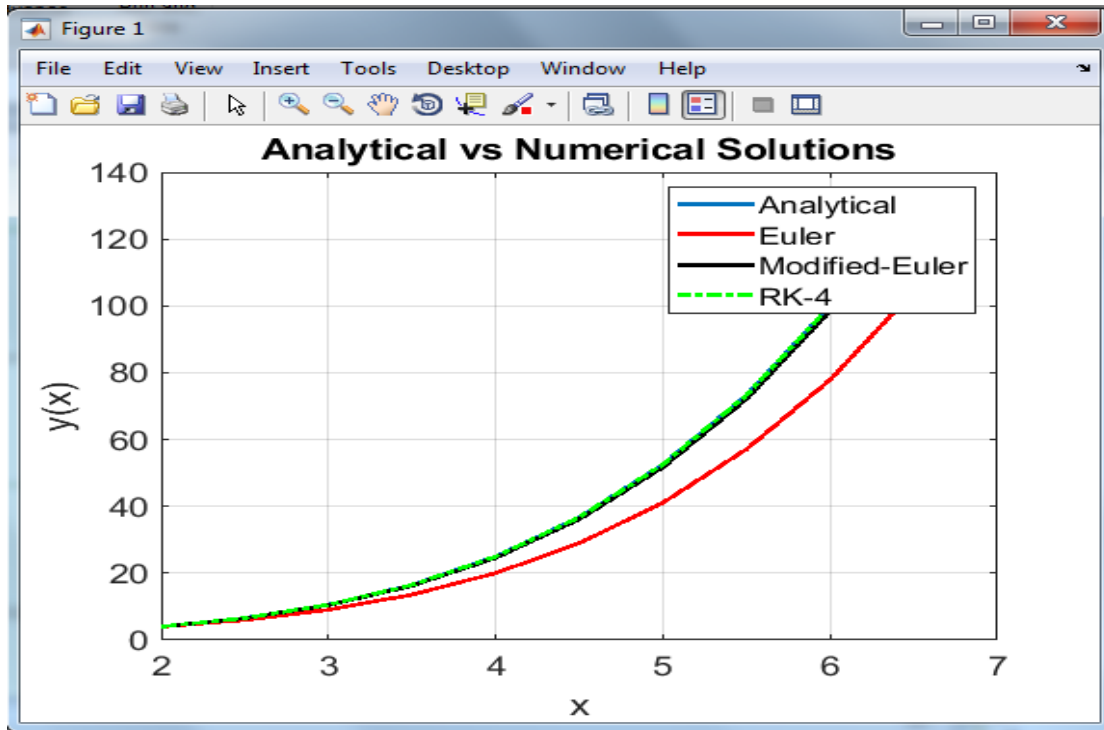


Fig.1. Analytical Vs Numerical Solution

(b) Error comparison of various Numerical Solutions

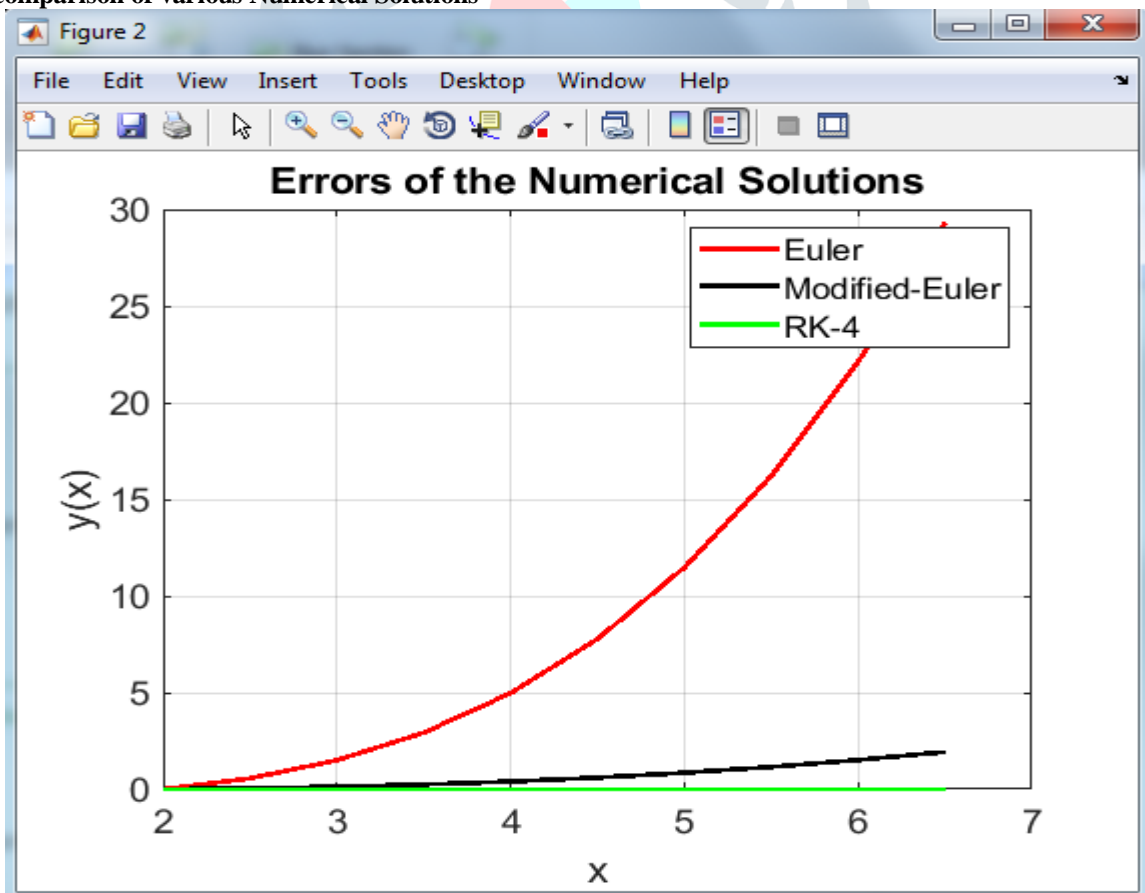


Fig.2. Error Calculation

V.CONCLUSION

Hence the Best method for solving the given differential equation is Runka-kutta by comparing it with the techniques of Euler and Modifier Euler method errors. Errors of Runka-Kutta are negligible when compared it with the analytical methods. Hence compared various Numerical methods using MATLAB.

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