

Assignment 7

1. Implement the following algorithms to numerically solve a differential equation $d(x_1, x_2)/dt = (x_2, -x_1)$ starting with $x_1(0) = 0.5$ and $x_2(0) = 0$ for t lying in the range $(0, 4)$ after division of this interval into n equal parts.
 - a. Euler's Method
 - b. Heun's Method (RKH of order 2)
 - c. Runge-Kutta of order 4
2. Plot the x_1 obtained in each solution against the "analytic" solution using sine and cosine.
3. Write a program to check whether a given set of parameters satisfies the algebraic equations for a Runge-Kutta-Heun method of order 4.
4. Find at least two alternative solutions to these equations.
5. Write a program to use a Runge-Kutta-Heun method of order 4 to solve a vector differential equation with a given step size.
6. (Starred) Modify your program to use an adaptive method to determine the correct step size.