

Assignment#7

Solⁿ. of Ordinary Differential Equations

Initial Value Problems

1. Using **Euler's method**, find $y(0.2)$ from the equation: $y' = x + y$, $y(0) = 0$, take $h = 0.1$
2. **Derive Euler's formula** for solving initial value problem.
3. Solve $y' = y/(x^2 + y^2)$, $y(0) = 1$ using **RK-2 method** in the range 0, 0.5, 1.
4. Solve $y' = \sin x + \cos y$ subject to initial condition $y(0) = 2$ in the range 0(0.5)2 using the RK second order method.
5. Using the RK-2, obtain a solution of the equation $y' = xy + y^2$ with the initial condition $y(0) = 1$ for the range $0 \leq x \leq 0.6$ with increments of 0.2.
6. Solve $y' = 4e^{0.8x} - 0.5y$; subject to initial condition $y(0) = 2$, for $y(0.5)$ and $y(0.1)$ using Runge-Kutta 2nd order method.
7. Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ using RK-4 method, for $y(0.4)$. Given: $y(0) = 1$, $h = 0.2$
8. Write an **algorithm**, **pseudo-code** and a **program** in any high level language (C/C++/FORTRAN) to solve a first-order initial value problem using classical RK-4 method.
9. Solve the differential equation, $dy/dx = (1 + x^2)y$ within $x \leq 0(0.2)0.4$ and $y(0) = 1$ using RK 4th order method.
10. Solve $y' = xy + y^2$, $y(0) = 1$ for $y(0.1)$ & $y(0.2)$ using RK method of fourth order.
11. Solve the following simultaneous differential equations using RK 2nd order method at $x = 0.1$ & 0.2 ; $\frac{dy}{dx} = xz + 1$; $\frac{dz}{dx} = -xy$; with initial conditions $y(0) = 0$, $z(0) = 1$.
12. Solve by RK-2 method for $x = 0(0.1)0.2$

$$\frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0; y(0) = 1, y'(0) = 0$$

13. Using the RK-2 method, obtain a solution of the equation $y'' = y + xy'$ with the initial condition $y(0) = 1$, $y'(0) = 0$ to find $y(0.2)$ and $y'(0.2)$ [Take $h = 0.1$]
14. Solve the ordinary differential equation, $y'' = x(y')^2 - y^2$ for $x = 0.6$ with the initial condition $y(0) = y'(0) = 0$ by using RK-2 method. [Take $h = 0.3$]
15. Solve the following differential equation within $0 \leq x \leq 0.4$ using RK-2 method,

$$\frac{d^2y}{dx^2} + 2 \frac{dy}{dx} - 3y = 6x; y(0) = y'(0) = 1, h = 0.2.$$

16. Solve:

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 4y = 3x; y(0) = 0, y'(0) = 1, h = 0.5 \text{ within } 0 \leq x \leq 1.0 \text{ using RK 4}^{\text{th}} \text{ order method.}$$

17. Solve the following initial value problem for $y(1.2)$ using the RK-4th order method:

$$y'' - 3y' + y = \sin x; y(1) = 1.2, y'(1) = 0.5$$