Assignment 5

The due date for submitting this assignment is 2023-04-01, 23:59 IST.

1. For the Runge-Kutta 2nd order method, the local and global errors are respectively of the order of

   \[ \mathcal{O}(h) \quad \text{and} \quad \mathcal{O}(h^2) \]

   \[ \text{No, the answer is incorrect.} \]

   

2. For the Runge-Kutta 4th order method, the local and global errors are respectively of the order of

   \[ \mathcal{O}(h^4) \quad \text{and} \quad \mathcal{O}(h^5) \]

   \[ \text{No, the answer is incorrect.} \]

   

3. Global Mean Error function defined in order normal

   \[ x(t) = e^t + e^{-t} \]

   calculates absolute deviation of the computed estimates from the true value of the solution function at \( t = 1 \)

   \[ x(1) = e + e^{-1} \]

   \[ y(t) \text{ is the exact solution of the differential equation} \]

   \[ y(t) = \frac{e^t}{2} - \frac{1}{2} \]

   \[ \text{No, the answer is incorrect.} \]

   

4. Which of the plots below correspond to the solution of the initial value problem

   \[ x(t) = e^t + e^{-t} \]

   \[ y(t) = \frac{e^t}{2} - \frac{1}{2} \]

   \[ \text{A} \quad \text{B} \]

   \[ \text{C} \quad \text{D} \]

   \[ \text{A, B, C} \quad \text{D} \]

   \[ \text{No, the answer is incorrect.} \]

   

5. Consider solving the initial value problem

   \[ x(t) = e^t + e^{-t} \]

   \[ x(0) = 0 \]

   using the Improved Euler's 2nd order Runge-Kutta method with step size \( h = 0.4 \). At \( t = 3 \), the value of \( x(t) \) is

   \[ 0.108639 \]

   \[ 0.167024 \]

   \[ 0.230932 \]

   \[ 0.299379 \]

   \[ \text{No, the answer is incorrect.} \]

   

6. Consider solving the initial value problem

   \[ x(t) = e^t + e^{-t} \]

   \[ x(0) = 0 \]

   using the 4th order Runge-Kutta method with step size \( h = 0.1 \). At \( t = 0.5 \), the value of \( y(t) \) is

   \[ -0.681515 \]

   \[ -0.807675 \]

   \[ -0.827145 \]

   \[ -0.842682 \]

   \[ \text{No, the answer is incorrect.} \]

   

7. Consider solving the initial value problem

   \[ x(t) = \sin(t) \quad x(0) = 1 \]

   \[ y(t) = t^2 \]

   using the 5th order Runge-Kutta method with step size \( h = 0.01 \). The Global Mean error is defined by

   \[ \text{Global Mean error} = \frac{1}{n} \sum_{i=1}^{n} |y_i - F(t_i)| \]

   Where \( n \) is the number of time steps in the computation, for this computation, \( n = 100 \)

   \[ y(0) = 0 \]

   \[ y(1) = 1 \]

   \[ y(2) = 4 \]

   \[ \text{No, the answer is incorrect.} \]

   

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**Course outline**

Unit 6 - Week 5

1. Nodal A
2. Nodal B
3. Nodal C
4. Nodal D
5. Nodal E
6. Nodal F
7. Nodal G
8. Nodal H
9. Nodal I
10. Nodal J
11. Nodal K
12. Nodal L
13. Nodal M
14. Nodal N
15. Nodal O
16. Nodal P
17. Nodal Q
18. Nodal R
19. Nodal S
20. Nodal T
21. Nodal U
22. Nodal V
23. Nodal W
24. Nodal X
25. Nodal Y
26. Nodal Z

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**Assignment 5**

- Due date: 2023-04-01, 23:59 IST.
- Local and global errors for the Runge-Kutta 2nd order method:
  - Local error: \( \mathcal{O}(h) \)
  - Global error: \( \mathcal{O}(h^2) \)
- Local and global errors for the Runge-Kutta 4th order method:
  - Local error: \( \mathcal{O}(h^4) \)
  - Global error: \( \mathcal{O}(h^5) \)
- Global Mean Error function:
  - \( x(t) = e^t + e^{-t} \)
  - \( y(t) = \frac{e^t}{2} - \frac{1}{2} \)
- Improved Euler's 2nd order Runge-Kutta method with step size \( h = 0.4 \), at \( t = 3 \):
  - Value of \( x(t) \) is \( 0.108639 \) (No, incorrect)
  - Value of \( x(t) \) is \( 0.167024 \) (No, incorrect)
  - Value of \( x(t) \) is \( 0.230932 \) (No, incorrect)
  - Value of \( x(t) \) is \( 0.299379 \) (No, incorrect)
- 4th order Runge-Kutta method with step size \( h = 0.1 \), at \( t = 0.5 \):
  - Value of \( y(t) \) is \( -0.681515 \) (No, incorrect)
  - Value of \( y(t) \) is \( -0.807675 \) (No, incorrect)
  - Value of \( y(t) \) is \( -0.827145 \) (No, incorrect)
  - Value of \( y(t) \) is \( -0.842682 \) (No, incorrect)
- 5th order Runge-Kutta method with step size \( h = 0.01 \), at \( t = 1 \):
  - Global Mean error is defined by:
    \[ \text{Global Mean error} = \frac{1}{n} \sum_{i=1}^{n} |y_i - F(t_i)| \]
  - Number of time steps \( n = 100 \)
  - \( y(0) = 0 \)
  - \( y(1) = 1 \)
  - \( y(2) = 4 \)
  - \( \text{No, incorrect.} \)