

Unit 5 - Week 3: Finite Difference Method

Course outline

How does an NPTEL online course work?

Week 0: Prerequisite

Week 1: Introduction to Computational Fluid Dynamics

Week 2: Classification of PDEs

Week 3: Finite Difference Method

Lec 1: Finite difference by Taylor series expansion

Lec 2: Finite difference by general approximation and polynomials

Lec 3: Finite difference in non-uniform grid

Lec 4: Types of error and accuracy of FD solutions

Quiz : Assignment 3

Solution: Assignment 3

Feedback form for week 3

Week 4: Elliptic Equations

Week 5: Parabolic Equations

Week 6: Hyperbolic Equations

Week 7: Stability Analysis

Week 8: Vorticity-Stream Function Formulation

Week 9: MAC Algorithm

Week 10: Finite Volume Method - I

Week 11: Finite volume method - II

Week 12: SIMPLE Algorithm

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Assignment 3

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-02-19, 23:59 IST.

1) On increasing the number of grid points in the computational domain, the truncation error

1 point

- increases
 decreases
 does not change
 none of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
decreases

2) According to the Lax equivalence theorem, for a numerical scheme to be convergent, it should be

1 point

- consistent
 stable
 consistent and stable
 inconsistent and unstable

No, the answer is incorrect.
Score: 0

Accepted Answers:
consistent and stable

3) First order forward difference formula on a uniform grid is exact for which type of equation?

1 point

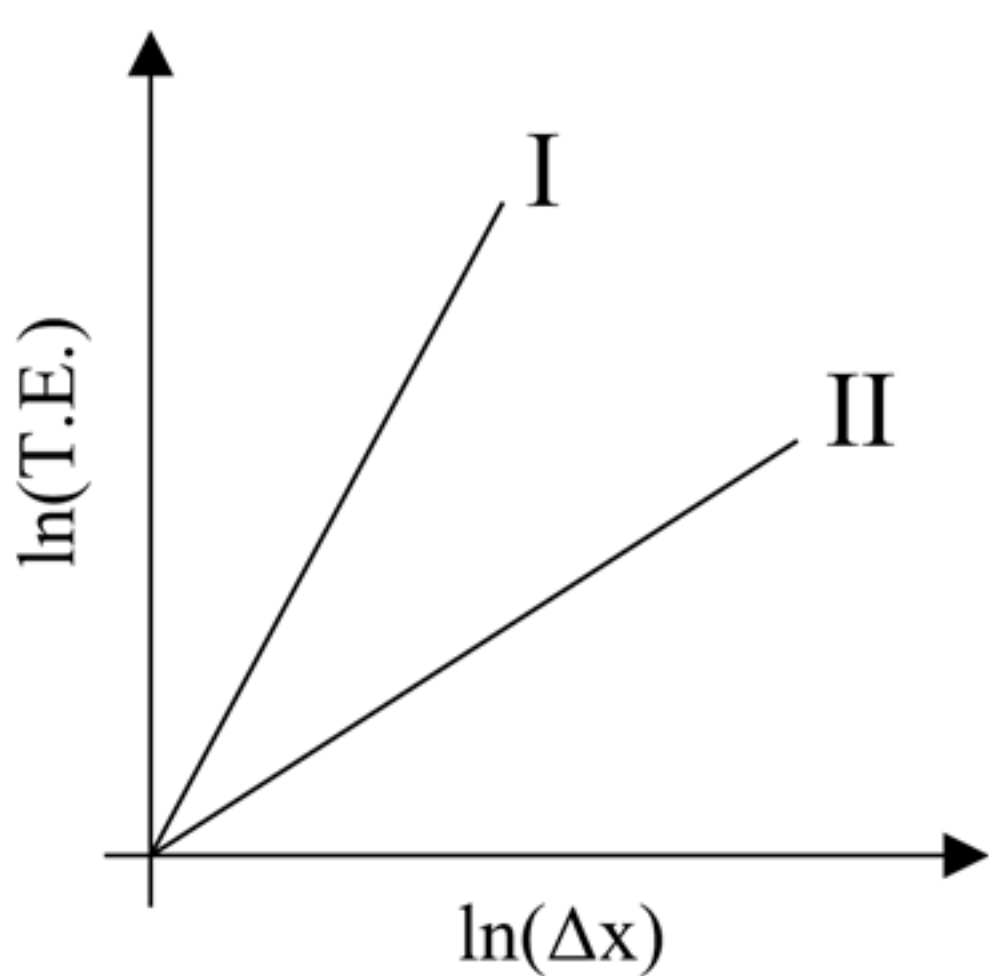
- linear
 quadratic
 cubic
 non-linear

No, the answer is incorrect.
Score: 0

Accepted Answers:
linear

4) In the logarithmic graph of truncation error vs. grid size (Δx), I and II respectively represents

1 point



- Forward difference and Central difference
 Central difference and Forward difference
 Backward difference and Central difference
 none of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Central difference and Forward difference

5) Which type of grids are best for flow over a horizontal flat plate ?

1 point

- uniform grids
 non-uniform grids with decreasing grid size in the x-direction
 non-uniform grids with increasing grid size in the y-direction
 non-uniform grids with increasing grid size in both x & y-direction

No, the answer is incorrect.
Score: 0

Accepted Answers:
non-uniform grids with increasing grid size in the y-direction

6) On operating the forward difference operator (δ^+) on f_i , we will get

1 point

- $\delta^+ f_i = f_i - f_{i-1}$

 $\delta^+ f_i = f_{i-1} - f_i$

 $\delta^+ f_i = f_i - f_{i+1}$

 $\delta^+ f_i = f_{i+1} - f_i$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $\delta^+ f_i = f_{i+1} - f_i$

7) To obtain a third order accurate scheme in $\frac{df}{dx}\bigg|_i = \frac{1}{\Delta x}(\alpha f_{i-2} + \beta f_{i-1} + \gamma f_i + \delta f_{i+1})$, we have

1 point

- $\alpha = 1/4, \beta = -1, \gamma = 2/4, \delta = 3/4$
 $\alpha = 1/5, \beta = -1, \gamma = 4/5, \delta = 3/5$
 $\alpha = 1/6, \beta = -1, \gamma = 3/6, \delta = 2/6$
 $\alpha = 1/7, \beta = -1, \gamma = 4/7, \delta = 5/7$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $\alpha = 1/6, \beta = -1, \gamma = 3/6, \delta = 2/6$

8) In this numerical derivative $\frac{d^3 f_i}{dx^3} = \frac{1}{\Delta x^3}(-5f_i + 18f_{i+1} - Cf_{i+2} + 14f_{i+3} - 3f_{i+4})$ the value of C is _____

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 24

1 point

9) The order of the leading truncation error in $\frac{du}{dx}\bigg|_i = \frac{-3u_i + 4u_{i+1} - u_{i+2}}{2\Delta x}$ is _____.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 2

1 point

10) Consider the function $f(x) = e^x$. Using a mesh increment of $\Delta x = 0.1$, $f'(x)$ computed at $x = 1$ with the forward difference formula, when compared with the exact value, gives an percentage error of _____ % (upto two decimal places).

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 4.5,5.7

1 point