

Unit 9 - Week 7: Stability Analysis

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

Week 4: Elliptic Equations

Week 5: Parabolic Equations

Week 6: Hyperbolic Equations

Week 7: Stability Analysis

● Lec 1: von Neumann stability analysis of different schemes for Parabolic equations

● Lec 2: von Neumann stability analysis of different schemes for Parabolic equations

○ Lec 3: von Neumann stability analysis of different schemes for Hyperbolic equations

● Lec 4: Modified equation, Artificial viscosity, Numerical diffusion

○ Quiz : Assignment 7

○ Feedback form for week 7

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 7

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

Due on 2020-03-18, 23:59 IST.

1) The von Neumann stability analysis is applicable for

1 point

- Nonlinear PDEs with periodic boundary conditions
 Nonlinear PDEs with non-periodic boundary conditions
 Linear PDEs with periodic boundary conditions
 Linear PDEs with non-periodic boundary conditions

No, the answer is incorrect.

Score: 0

Accepted Answers:

Linear PDEs with periodic boundary conditions

2) The range of γ for getting a converged solution using consistent Forward Time Central Space discretization for a problem governed by a one dimensional unsteady parabolic equation is

0 points

- $\gamma < 0$
 $0 < \gamma < 0.5$
 $0 < \gamma < 1$
 $\gamma > 1$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$0 < \gamma < 1$

3) Comment on the stability of the implicit Forward Time Central Space scheme applied to linear convective equation

1 point

- Always unstable
 Unconditionally stable
 Conditionally stable
 Cannot be determined

No, the answer is incorrect.

Score: 0

Accepted Answers:

Unconditionally stable

4) Even order derivatives in the leading truncation error results in

1 point

- Dissipation error
 Dispersion error
 Both Dispersion and Dissipation error
 None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Dissipation error

5) Numerical dissipation causes

1 point

- smearing of sharp gradients
 oscillations
 undershoots and overshoots
 inaccuracy

No, the answer is incorrect.

Score: 0

Accepted Answers:

smearing of sharp gradients

6) Which is correct regarding the upwind scheme?

1 point

- Only numerical dispersion error arises
 Only numerical diffusion error arises
 Both numerical dispersion and numerical diffusion error arise
 Neither numerical dispersion nor numerical diffusion error arise

No, the answer is incorrect.

Score: 0

Accepted Answers:

Both numerical dispersion and numerical diffusion error arise

7) Stability is the property of a

1 point

- Partial differential equation
 Discretized equation
 Modified partial differential equation
 None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Discretized equation

8) The von Neumann stability analysis can be used to predict the stability criteria of nonlinear partial differential equations.

1 point

- True
 False

No, the answer is incorrect.

Score: 0

Accepted Answers:

False