

Unit 11 - Week 9: MAC Algorithm

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

Week 8: Vorticity-Stream Function Formulation

Week 9: MAC Algorithm

Lec 1: Solution of Navier-Stokes Equation using FDM

Lec 2: Solution of Navier-Stokes Equation using FDM (Continued)

Quiz : Assignment 9

Feedback form for week 9

Week 10: Finite Volume Method - I

Week 11: Finite volume method - II

Week 12: SIMPLE Algorithm

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Assignment 9

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

Due on 2020-04-01, 23:59 IST.

1) What discretization scheme is used in MAC algorithm? 1 point

- Forward Time Backward Space
 Forward Time Forward Space
 Backward Time Forward Space
 Forward Time Central Space

No, the answer is incorrect.
Score: 0

Accepted Answers:
Forward Time Central Space

2) The pressure correction formula at main grid point P in MAC algorithm is 1 point

$$p'_P = -\frac{\tilde{u}_P - \tilde{u}_W + \tilde{v}_P - \tilde{v}_S}{\frac{2\Delta t}{\rho} \left[\frac{1}{\Delta x^2} + \frac{1}{\Delta y^2} \right]}$$

$$p'_P = -\frac{\tilde{u}_P - \tilde{u}_W + \tilde{v}_P - \tilde{v}_S}{\frac{\Delta t}{\rho} \left[\frac{1}{\Delta x^2} + \frac{1}{\Delta y^2} \right]}$$

$$p'_P = -\frac{\tilde{u}_E - \tilde{u}_W + \tilde{v}_N - \tilde{v}_S}{\frac{\Delta t}{\rho} \left[\frac{1}{\Delta x^2} + \frac{1}{\Delta y^2} \right]}$$

$$p'_P = -\frac{\tilde{u}_E - \tilde{u}_W + \tilde{v}_N - \tilde{v}_S}{\frac{2\Delta t}{\rho} \left[\frac{1}{\Delta x^2} + \frac{1}{\Delta y^2} \right]}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$p'_P = -\frac{\tilde{u}_P - \tilde{u}_W + \tilde{v}_P - \tilde{v}_S}{\frac{2\Delta t}{\rho} \left[\frac{1}{\Delta x^2} + \frac{1}{\Delta y^2} \right]}$$

3) In order to accelerate p'_P calculation in MAC method, which of the following is correct? 1 point

- Under-relaxation factor is used
 Over-relaxation factor is used
 Any relaxation factor cannot be used
 None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Over-relaxation factor is used

4) The pressure gradient term in x-momentum equations is discretized at main grid point P in MAC algorithm as 1 point

$$-\frac{\partial p}{\partial x} = -\frac{1}{\Delta x} (p_E - p_W)$$

$$-\frac{\partial p}{\partial x} = -\frac{1}{2\Delta x} (p_E - p_W)$$

$$-\frac{\partial p}{\partial x} = -\frac{1}{\Delta x} (p_E - p_P)$$

$$-\frac{\partial p}{\partial x} = -\frac{1}{2\Delta x} (p_E - p_P)$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$-\frac{\partial p}{\partial x} = -\frac{1}{\Delta x} (p_E - p_P)$$

5) The u-velocity is updated at grid point P in MAC algorithm as 1 point

$$u_P^{n+1} = \tilde{u}_P - \frac{\Delta t}{2\rho\Delta x} (p'_E - p'_P)$$

$$u_P^{n+1} = \tilde{u}_P - \frac{\Delta t}{\rho\Delta x} (p'_E - p'_P)$$

$$u_P^{n+1} = \tilde{u}_P - \frac{\Delta t}{2\rho\Delta x} (p'_E - p'_W)$$

$$u_P^{n+1} = \tilde{u}_P - \frac{\Delta t}{\rho\Delta x} (p'_E - p'_W)$$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $u_P^{n+1} = \tilde{u}_P - \frac{\Delta t}{\rho\Delta x} (p'_E - p'_P)$

6) The collocated grid is used to discretize the unsteady Navier-Stokes equations in MAC algorithm. 1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

7) Three-dimensional unsteady Navier-Stokes equations can be solved using MAC algorithm. 1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True

8) The (u, v, p) system is known as the "primitive variable" system. 1 point

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True