

AE480/AE721 Boundary Layer Theory

Test-2

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20

Duration: 30 min

Maximum marks: 20

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Questions:

1. What is material derivative? How is it different from a normal total derivative?

material derivative is calculated on the basis of objects.

While total derivative is calculated based on totality.

It is represented by $\left[\frac{D}{Dt} \right]$

Can't read

2. Write Reynolds transport theorem.

3. What is objectivity? Give example.

4. Difference between vorticity and vortex.

Vorticity is the strength of the vortex. While Vortex is phenomena caused by rotating fluid.

5. What is streakline?

Streakline is the line made by injecting a dye in the flow. The line made by the dye is called streakline. It is mainly used in Experimental Setups. ~~It is the medium location where~~

Define

6. Velocity gradient matrix, $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 2 \\ 1 & 2 & 3 \end{pmatrix}$. Write a deformation part of A.

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$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$$

7. Write a rotational part of A

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$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$$

8. Write a dilation part of A.

0

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$$

9. Write a deviatoric part of A.

0

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$$

10. Can you draw streamlines over an square fluid element for a case with $\nabla \cdot \mathbf{V} = 0, \nabla \times \mathbf{V} \neq 0$

