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NPTEL

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Courses » Introduction to boundary layers

Announcements **Course** Ask a Question Progress

Due on 2016-02-10, 22:30 IST

(1)

The flow through a converging nozzle shown in Fig. 1 has the following velocity profile:

at the entrance: $\vec{V} = \vec{V}_0\hat{i} + \vec{V}_0\hat{j}$

at the exit: $\vec{V} = 3\,\vec{V}_0\hat{i} - \vec{V}_0\hat{j}$

i. Compute the acceleration $\dfrac{D\vec{V}}{Dt}$ as a general function of x, y and t.

ii. If $\vec{V}_0 = 10m/s$, $\dfrac{L}{2} = D = 1m$, compute the accelerations at the entrance and exit.

Answer the following:

a) Did you follow an Eulerian/Lagrangian description of the flow field to make your computations? Explain.

b) Is the flow steady or unsteady?

c) Given that the acceleration due to gravity, $g = 9.8m/s^2$, will dynamic forces develop? Explain. (10)

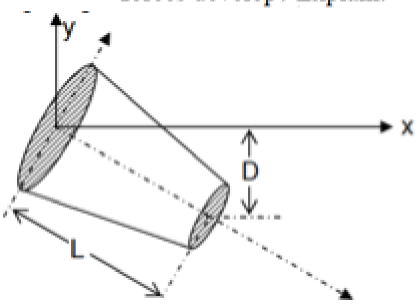

Fig. 1

(2)

The velocity field in a diffuser is given as $\vec{V} = \vec{V}_0 e^{-2x/L}\hat{i} + \vec{V}_0 \dfrac{y^2}{2L}\hat{j}$ and the density field is given as $\rho = \rho_0 e^{-2x/L}$. Find the rate of change of density at $x = L$.

Answer the following:

a) Did you follow an Eulerian/Lagrangian description of the flow field to make your computations? Explain.

b) Is the flow incompressible ? Explain. (10)

(3) Answer the questions below:

1. Define ‘control volume’ (2)
2. Define ‘system’ (2)
3. Time derivative associated with a ‘system’ is always the same as that associated with a ‘control volume’. True/False? (3)
4. What is the relationship between the Reynolds Transport Theorem and the material derivative? (3)

Your Submission:

Due Date Exceeded.
As per our records you have not submitted this assignment.