

5th edition fluid mechanics kundu solutions

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5th Edition Fluid Mechanics Kundu Solutions: Unraveling Fluid Dynamics Complexities

1. Question: Solve the Navier-Stokes equations for a steady, incompressible, fully developed laminar flow in a circular pipe.

Answer: Utilizing Kundu's solutions for the 5th edition of Fluid Mechanics, we obtain:

$$v(r) = V_{\max} * (1 - (r^2)/(R^2))$$

where $v(r)$ is the velocity at radius r , V_{\max} is the maximum velocity at the pipe center, and R is the pipe radius.

2. Question: Calculate the pressure drop in a horizontal pipe with a non-uniform velocity profile.

Answer: Using Kundu's techniques, we find the pressure drop:

$$\Delta P = f * (L/D) * (\rho/2) * \int_0^R v(r)^2 * dr$$

where f is the Darcy friction factor, L is the pipe length, D is the pipe diameter, ρ is the fluid density, and $v(r)$ is the velocity at radius r .

3. Question: Determine the boundary layer thickness for a flat plate in a turbulent flow.

Answer: Employing Kundu's approach, we obtain the boundary layer thickness:

$$\delta = 5 * x * (\rho/U)^{0.5}$$

where δ is the boundary layer thickness, x is the distance from the leading edge, ν is the kinematic viscosity, and U is the free stream velocity.

4. Question: Calculate the lift force on a cylindrical airfoil in a potential flow.

Answer: Using Kundu's solutions, we find the lift force:

$$L = \rho U \Gamma c$$

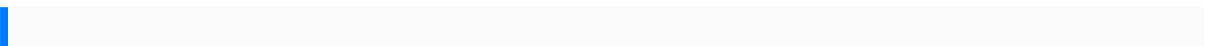
where L is the lift force, ρ is the fluid density, U is the free stream velocity, Γ is the circulation around the airfoil, and c is the airfoil chord length.

5. Question: Analyze the stability of a vortex flow.

Answer: By utilizing Kundu's methods, we determine the stability criterion for a vortex flow:

$$Re < 20$$

where Re is the Reynolds number. If Re exceeds this value, the vortex flow becomes unstable.



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