淡江大學九十學年度碩士班招生考試試題

系別：航空太空工程學系　　科目：流 體 力 學

准帶項目請打「○」否則打「×」	
計算機	字典
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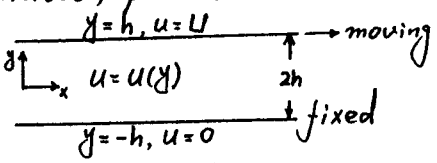
本試題共 1 頁

1. Explain the physical meanings of the following in detail. (20%)
   (a) Vorticity
   (b) Turbulence
   (c) Streamline
   (d) Potential Vortex
   (e) Bernoulli Equation

2. Continuity equation has the form $\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{V}) = 0$, where ρ is fluid density and $\vec{V}$ is fluid velocity. Please list all the assumptions and simplifications, and derive the form $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$ (20%)

3. Two infinite plates are 2h apart, and the upper plate moves at speed U relative to the lower. The pressure P is assumed constant. The boundary conditions are independent of X or Z, so $u = u(y)$ only. For this Couette flow between parallel plates, please derive the velocity distribution $u(y)$. (20%) (U is constant)

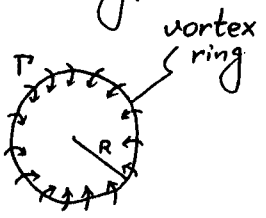


4. In a 2-D, incompressible flow the velocity components are given by

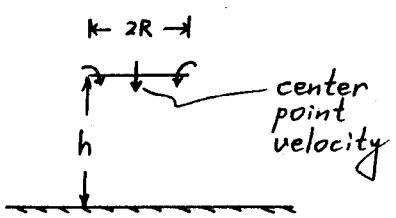
$$u = x - 4y$$
$$v = -y - 4x$$

Is this flow physically possible? If the answer is yes, obtain the expression for the streamfunction. (20%)

5. Find out the expression for center point velocity of a vortex ring with radius R, constant circulation strength Γ, and this vortex ring is near a flat surface at distance h. [Hint: Biot-Savart law is $d\vec{V} = \frac{\Gamma}{4\pi} \frac{d\vec{l} \times \vec{r}}{|\vec{r}|^3}$ and use image vortex ring.] (20%)



top view



side view