1052 機械系博士班資格考試題目

考試科目	方式	
流體力學	**Closed Book, 可使用計算機**	**Part I**

1.1 Define the Newtonian fluid and their viscosity , which related to rate of shear strain. (5%)

1.2 What is surface tension defined ? (5%)

1.3 Based on what assumptions? the Bernoulli equation are approximately valid. And define the static, stagnation, hydrostatic, dynamic and total pressure in Bernoulli equation. (10 %).

2. Consider the inviscid, incompressible, steady flow along the horizontal streamline A-B in front of the sphere of radius a, as shown in Fig. 4 from a more advanced theory of flow past a sphere, the fluid velocity along this streamline is

$V = V_O\left(1+\frac{a^3}{x^3}\right)$ as shown in Fig. 2 . Please determine the pressure variation along the streamline from point A far in front of the sphere (x_A =- ∞ and V_A= V_o) to point B on the sphere (x_B =-a and V_B =0) (15%)

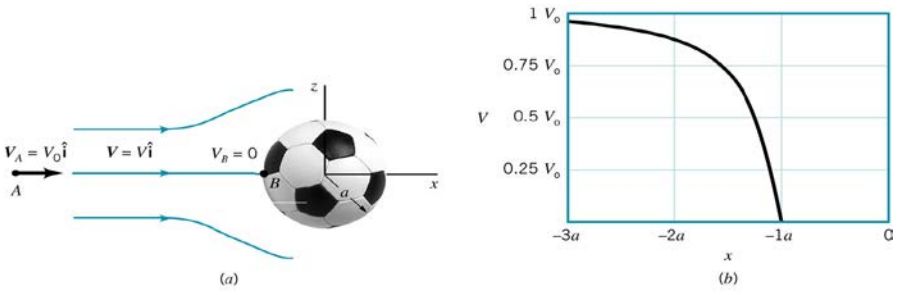

Fig. 2

3. 在流體運動流場中如下圖 Fig.3, 一般有兩種方式來描述流體運動方式一為 Eulerian method, 一為 Lagrangian method. (1). 請分別描述這兩種方式之差異. (2). 而大部分的流體力學理論分析中較常使用那一種方式. (3). 兩種方法與 system, control volume 定義有何關係。(15%)

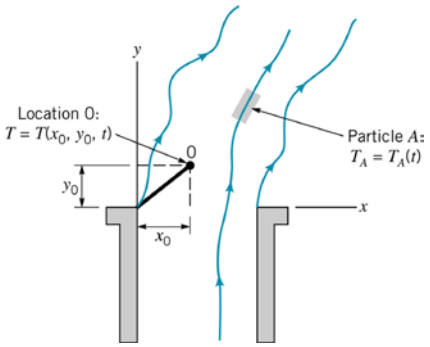

Fig. 3

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考試科目	方式	
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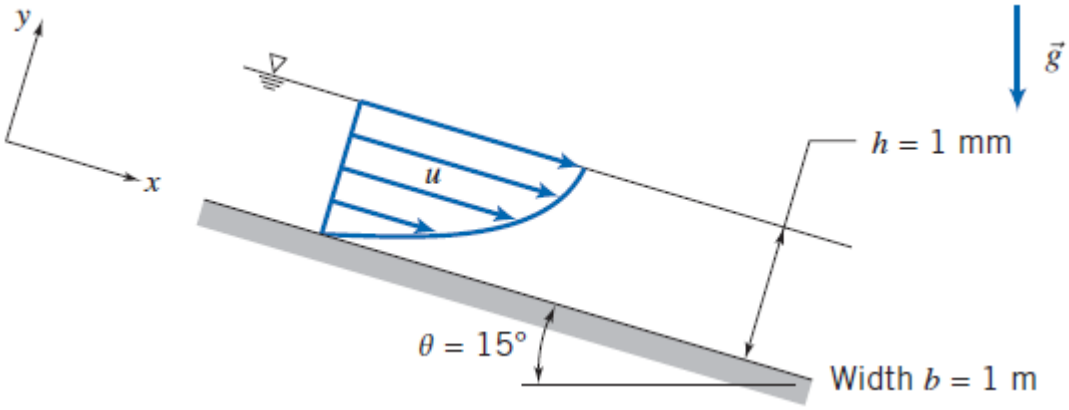
Fluids: Problem I (25 points)

A liquid flows down an inclined plane surface in a steady, fully developed laminar film of thickness h. (a) Simplify the continuity and Navier–Stokes equations to model this flow field. Obtain expressions for (b) the liquid velocity profile, (c) the shear stress distribution, (d) the volume flow rate, and (e) the average velocity.

Schematic:



Fluids: Problem II (25 points)

Fluids of viscosities μ_1 = 0.1 Ns/m^2 and μ_2 = 0.15 Ns/m^2 are contained between two plates (each plate is 1 m^2 in area). The thickness are h_1 = 0.5 mm and h_2 = 0.3 mm, respectively. Find the force F to make the upper plate move at a speed of 1 m/s. What is the fluid velocity at the interface between two fluids?

Schematic: