國立清華大學 104 學年度碩士班考試入學試題

系所班組別：核子工程與科學研究所 甲組(工程組)

考試科目（代碼）：流體力學(2704)

1. 解釋名詞 30%

- Largrangian Method 與 Eulerian Method
- Streamline, Pathline, Streakline
- (a)What is the Bernoulli equation?
  (b) 應用 Bernoulli equation 的假設為何?
  (c)以 pressure 的觀點解釋 Bernoulli equation 內每一項
  (d)以 head 的觀點解釋 Bernoulli equation 內每一項
- Fully developed and developing
- Major loss and Minor loss
- Boundary layer thickness and momentum thickness

2. (20 %)

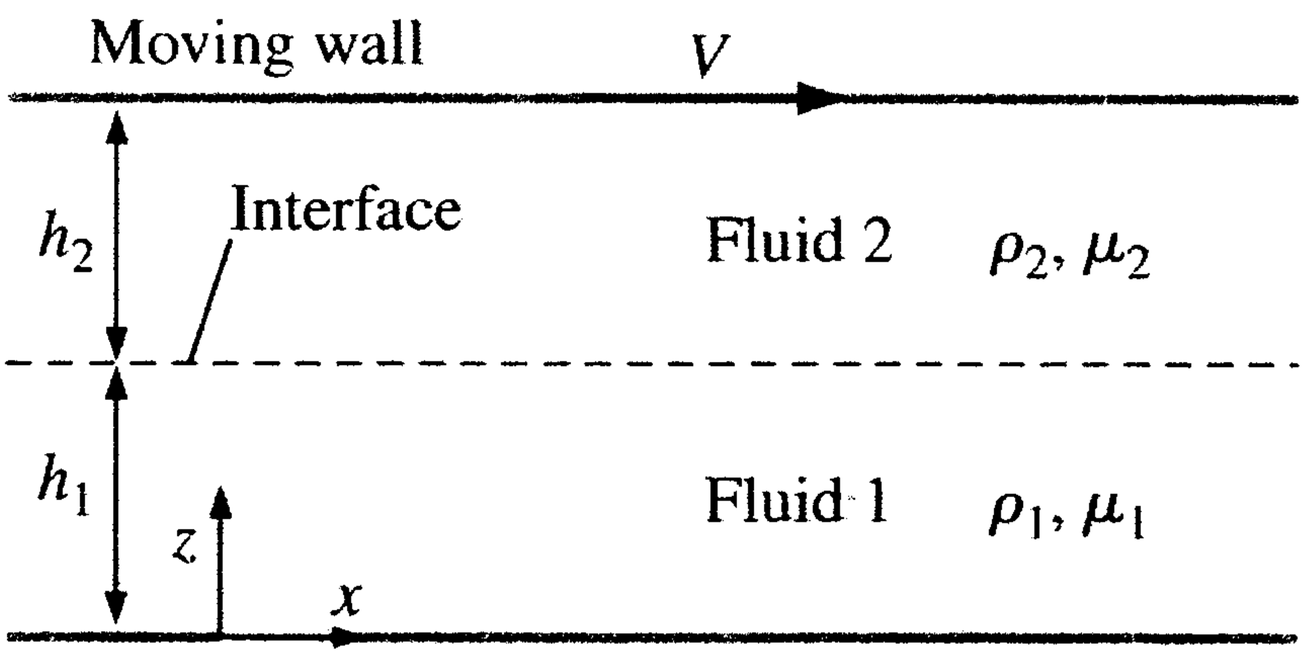
試畫出 Moody chart(儘量詳細)，並解釋圖上每一個參數以及 Moody chart 的用途

3. (25 %)

Consider a modified form of Couette flow in which there are two immiscible fluids sandwiched between two infinitely long and wide, parallel flat plates, as shown below. The flow is steady, incompressible, parallel and laminar. The top plate moves at velocity V to the right, and the bottom plate is stationary. Gravity acts in the -z direction. There is no forced pressure gradient pushing the fluids through the channel. You may ignore surface tension effects and assume that the interface is horizontal. The pressure at the bottom of the flow (z=0) is equal to P_o.

(a) List all the appropriate boundary conditions on both velocity and pressure.

(b) Solve for the velocity field. [hint: Generate expressions for u_1 and u_2 as functions of z]



Providing 2-D N-S equations

$$\rho\left(\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+w\frac{\partial u}{\partial z}\right)=-\frac{\partial p}{\partial x}+\rho g_x+\mu\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial z^2}\right)$$

$$\rho\left(\frac{\partial w}{\partial t}+u\frac{\partial w}{\partial x}+w\frac{\partial w}{\partial z}\right)=-\frac{\partial p}{\partial z}+\rho g_z+\mu\left(\frac{\partial^2 w}{\partial x^2}+\frac{\partial^2 w}{\partial z^2}\right)$$

國立清華大學 104 學年度碩士班考試入學試題

系所班組別：核子工程與科學研究所 甲組(工程組)

考試科目（代碼）：流體力學(2704)

4. (25%)

Experiments are being designed to measure the horizontal force F on a nozzle, as shown in the following figure. $F = fn(V_1, \Delta P, \rho, \mu, A_1, A_2, L)$ $\Delta P = P_1 - P_2$. Determine the functional relationship between the horizontal force F and the independent variables using dimensional analysis.