簡答題

1. 何謂流體靜力學(fluid statics)?何謂流體動力學(fluid dynamics)?寫出探討流體力學常用的三定律。(10 分)

2. 流體力學中，介紹 "stream function" 與 "velocity potential" 主要目的為何? 寫出流場速度與 velocity potential 的關聯。如何由 stream function 獲得流場的流線? (10 分)

3. 何謂黏滯流(viscous flow)? 說明流體流經物體表面時，因黏滯性所造成的流場特性。(10 分)

4. 說明因次分析(dimensional analysis)在實驗流體力學的重要性。什麼是 "incomplete similitude"? (10 分)

5. 在管流(pipe flow) 中，什麼是 "entrance region"、"fully developed region"、"major loss" 與 "minor loss"? (15 分)

計算題

6. An airplane moves forward at a speed of 971 km/hr. The frontal intake area of the jet engine is 0.8 m^2 and the entering air density is 0.736 kg/m^3. A stationary observer determines that relative to the earth, the jet engine exhaust gases move away from the engine with a speed of 1050 km/hr. The engine exhaust area is 0.588 m^2 and the exhaust gas density is 0.515 kg/m^3. Estimate the mass flow rate of fuel into the engine in kg/hr. (Note: applying the integral continuity equation to solve the problem) (15 分)

7. For a flow in the xy plane, the y component of velocity is given by v=y^2-2x+2y. Determine a possible x component for steady, incompressible flow. Is it also valid for unsteady, incompressible flow? Why? (Note: applying the differential continuity equation to solve this problem) (15 分)

8. Air flows steadily and at low speed through a horizontal nozzle, discharging to the atmosphere (density is 1.23 kg/m^3). At the nozzle inlet, the area is 0.1 m^2. At the nozzle exit, the area is 0.02 m^2. The flow is essentially incompressible, and frictional effects are negligible. Determine the gage pressure required at the nozzle inlet to produce an outlet speed of 50 m/s. (Note: applying the Bernoulli equation to solve the problem) (15 分)