

淡江大學 102 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

考試日期：3月10日(星期日) 第3節

本試題共 9 大題， 1 頁

簡答題

1. 寫出兩個主要應用於流體力學的物理定律。(6分)
2. 何謂“steady” flow?何謂“uniform flow”? (6分)
3. 分別繪出一維流場、二維流場及均勻流場示意圖。(9分)
4. 分別繪出層流及紊流黏滯流體，流經二維圓柱體的流線示意圖，並標示分離點(point of separation)及迴流區(wake region)。此種流場所產生的阻力稱為什麼阻力?上述兩種流場的阻力何者較大?為什麼?(15分)
5. 繪出皮托管(pitot-static tube)的示意圖，並說明量測空速的原理?寫出不可壓縮流中，獲得速度的公式。(9分)
6. 何謂“Buckingham Pi Theorem”?其主要的目的為何?(10分)
7. 繪出流體流入一管子(pipe)的流場示意圖，說明靠近管壁的速度為何降低，管中央的速度為何增加。在管流的“entrance region”及“fully developed region”分別為幾維流場?(12分)

計算題

8. The drag of an airfoil at zero angle of attack is function of density, viscosity, velocity, and a length parameter. A 1/5 scale model of an airfoil was tested in a wind tunnel at a Reynolds number of 5.5×10^6 , based on chord length. Test conditions in the wind tunnel air stream were 15°C and 5 atm absolute pressure. The prototype airfoil has a chord length of 1 m, and is to be flown in air at standard conditions. Determine the speed at which the wind tunnel model was tested, and the corresponding prototype speed. (20分)

Notes: For air: $R = 287 \text{ N}\cdot\text{m}/\text{kg}\cdot\text{K}$, $\mu = 1.74 \times 10^{-5} \text{ N}\cdot\text{sec}/\text{m}^2$ at 15°C

9. Consider a flow with velocity component $u=0$, $v=-y^3-4z$, $w=3y^2z$. (13分)
 - (a) Is this a one-, two-, or three-dimensional flow?
 - (b) Demonstrate whether this is an incompressible or compressible flow.
 - (c) If possible, derive a stream function for this flow.