淡江大學 101 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：2 月 26 日(星期日) 第 2 節　　本試題共　5 大題，　1 頁

1. The speed of sound a of a gas varies with pressure p and density ρ. Show by dimensional analysis or Buckingham theory that for this sound speed a, the proper form must be a= (constant) $(p/\rho)^{1/2}$. (20%)

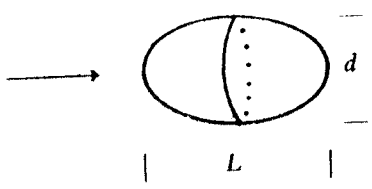
2. The frequently used Navier-Stokes equation is as follow: $\rho\frac{\partial \bar{V}}{\partial t}+\rho\bar{V}\bullet\nabla\bar{V}=-\nabla P+\mu\nabla^2\bar{V}$

   Now explain the physical meanings of this entire equation and each term. Also for 1-D, steady, and inviscid flow, derive the Bernoulli's equation from the above Navier-Stokes equation. (20%)

3. Consider the 2-D velocity field given by $u=-y/(x^3+x^2y^2+y^3)$, $v=x/(x^3+x^2y^2+y^3)$, now calculate the equation of the streamlines that passing through the points (0, 7) and (3, 4). Also give a name for this flow. (20%)

4. The following table showing the drag coefficient C_D for a 3-D ellipsoid (橢圓體) at different conditions. Explain why these C_D values will decrease as L/d increase and the flow change into turbulent behavior. Do we need to use the Bernoulli's equation in this drag explanation? Why? (20%)

Ellipsoid:



L/d	Laminar	Turbulent
0.75	0.5	0.2
1	0.47	0.2
2	0.27	0.13
4	0.25	0.1
8	0.2	0.08

5. A jet of water exhausts to the atmosphere through a pipe as showing in the following figure. If the velocity at point B is 10 m/s, what is the pressure at point A? Also calculate the mass flow rate of water through the pipe. (Hint: neglect all losses; water density is 1000 kg/m^3). (20%)