

所別：太空科學研究所碩士班 一般生 科目：流體力學

1. Given the steady two-dimensional velocity distribution
$$V_x = Kx, V_y = -Ky, V_z = 0$$
where K is a positive constant, compute and plot the streamlines of the flow, including directions. (10%)
2. Write down the governing equations for ideal, compressible and adiabatic fluid and give the physical meaning of the terms in each equation. (10%)
3. Write down the Bernoulli's equation and describe how the relation is obtained and the assumptions used. (10%)
4. Derive the phase speed of sound wave from the ideal fluid equations and explain the propagation mechanism of the sound wave. (15%)
5. Explain how a shock wave is formed as an object moves horizontally in the air with velocity V faster than the sound speed. What is the angle between the shock front and the horizontal axis? (10%)
6. Obtain the pressure profile for the Earth's atmosphere in hydrostatic equilibrium with isothermal temperature. (10%)
7. What is the incompressible fluid? Write down the momentum equation for incompressible viscous fluid. What is the Reynolds number? (15%)
8. Considering the incompressible viscous fluid confined between two horizontal infinite plates. If the top plate moves with a velocity U relative to the bottom plate and assuming steady state, solve the pressure and velocity profiles of the fluid. (15%)
9. Explain the meaning of $d\vec{v}/dt$, where \vec{v} is the fluid velocity. (5%)