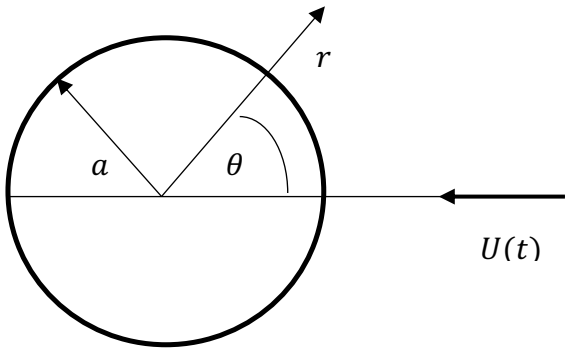
ME 55600/I0200: Potential Flow
HW #8

1. Inviscid irrotational fluid flows over a fixed sphere of radius a. The fluid velocity far from the sphere is uniform but changes with time as $U(t)$.



   (a) Determine the solution for the velocity potential.
   (b) Use the result from (a) and Bernoulli's equation to derive the pressure distribution on the surface of the sphere.
   (c) Determine the drag force on the sphere.

2. A spherical gas bubble is immersed in a quiescent incompressible inviscid fluid of density ρ. The bubble is made to expand isothermally such that the gas inside obeys the ideal gas equation of state $pV = RT$, where V is the bubble volume, P is the pressure, R is the gas constant, and T the absolute temperature.

   Derive the ordinary differential equation that governs the radius of the expanding bubble $a(t)$, if the pressure far from the bubble is constant p_∞ and the surface tension effects are negligible. Note that the radial surface velocity of the bubble is given by $\frac{da}{dt}$.