

Problem 123A

For the purposes of estimating the drag force on a spherical body (radius, R) in a uniform stream (velocity, U , and density, ρ) it is assumed that the pressure distribution over the upstream side (facing the oncoming stream) is the same as in potential flow whereas the pressure on the downstream side is constant simulating the conditions in a wake. Moreover the pressures match at the “equator”, $\theta = \pi/2$ (where θ is the angle measured from the front stagnation point). Find the drag, D , on the sphere as a function of ρ , R and U . Evaluate the “drag coefficient” defined as $C_D = Drag/(0.5\rho U^2 \pi R^2)$.