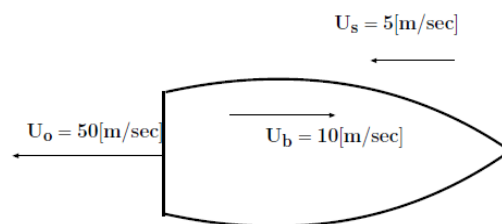


Momentum Equation

- Q1) A boat travels at speed of 10m/sec upstream in a river that flows at a speed of 5 m/s. The inboard engine uses a pump to suck in water at the front $A_{in} = 0.2 \text{ m}^2$ and eject it through the back of the boat with exist area of $A_{out} = 0.05 \text{ m}^2$. The water absolute velocity leaving the back is 50m/sec, what are the relative velocities entering and leaving the boat and the pumping rate?



- Q2) Liquid A enters a mixing device depicted in at 0.1 [kg/s]. In same time liquid B enter the mixing device with a different specific density at 0.05 [kg/s]. The density of liquid A is $1000 \text{ [kg/m}^3\text{]}$ and liquid B is $800 \text{ [kg/m}^3\text{]}$. The results of the mixing are a homogeneous mixture. Assume incompressible process. Find the average leaving velocity and density of the mixture leaving through the 20 [cm] diameter pipe.
- Q3) A 90° elbow is used to direct water flow at a rate of 40 kg/s in a horizontal pipe upward. The diameter of the entire elbow is 10 cm. The elbow discharges water into the atmosphere, and thus the pressure at the exit is the local atmospheric pressure. The elevation difference between the centers of the exit and the inlet of the elbow is 50 cm. The weight of the elbow and the water in it is considered to be negligible. Determine (a) the gage pressure at the center of the inlet of the elbow and (b) the anchoring force needed to hold the elbow in place. Take the momentum-flux correction factor to be 1.03. (x-z in horizontal plane)

