CE 3305 Engineering Fluid Mechanics
Exercise Set 13
Summer 2018 – GERMANY

Purpose : Momentum balance
Assessment Criteria : Completion, plausible solutions, use **R** as a calculator.

Exercises

1. (Problem 6.7 pg 238) Figure 1 is a balloon rocket held in place by a force F. The nozzle is a 0.8 cm diameter tube, and an air jet exits the nozzle with a speed of 45 m/s and a density of 1.2 kg/m^3. Find the force F needed to hold the balloon stationary.

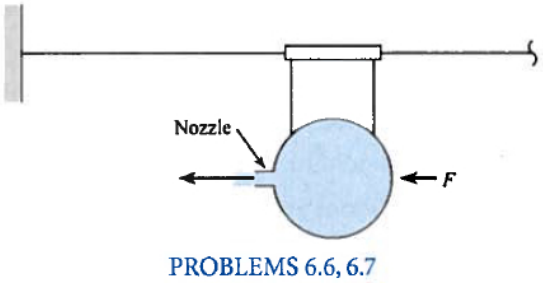


Figure 1: Balloon rocket

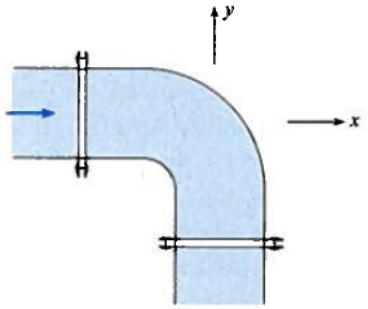
2. (Problem 6.16 pg 239) Figure 2 is a schematic of a boat held stationary by a cable attached to a pier. A firehose directs a jet of 5 ^oC water at a speed of $V = 50m/s$. The allowable load on the cable is 5 kN. Determine:

   (a) The mass flow rate of the water jet.

   (b) The diameter of the water jet.

Figure 2: Fire boat restrained by a cable

3. (Problem 6.63 pg 246) Figure 3 is a schematic of an elbow fitting in a pipe system. The gage pressure throughout the horizontal 90^o bend (the elbow lies in the horizontal plane – the figure is a plan view of the bend) is 300 kPa. If the pipe diameter is 1 m and the water (at 10 ^oC) flow rate is 10 m^3/s, what $x-$component of force must be applied to the bend to hold in in place against the water action.



PROBLEMS 6.62, 6.63

Figure 3: Elbow fitting on a pipe line.