Homework #6

Reading Assignment: Chapter 7.1-6

Problems: 7.5 (Note: \( v \) is the \( y \)-component of velocity and \( \nu \), the Greek letter nu, is the kinematic viscosity in the second equation on the right), 7.9, 7.14, 7.27, 7.41, 7.63

Answers: 

7.5 \( Re = \frac{V_0 L}{\nu} \)

7.9 \( F \propto \mu V D \)

7.14 \( \frac{V}{\sqrt{g D}} = f \left( \frac{\sigma}{\rho g D^2} \right) \)

7.27 \( \Pi = \frac{\mu}{\rho d^{3/2} g^{1/2}} \)

7.41 match \( Re \), 5.39 \( \times 10^5 \) Pa, 1.33 kN

7.63 250 m/s, check Mach number for compressible effects

Objectives:

1. Be able to non-dimensionalize the differential forms of the conservation of mass and the momentum equation to form dimensionless groups.
2. Be able to use the Buckingham Pi theorem to form dimensionless groups.
3. Be able to define the following dimensionless groups: Reynolds number, Froude number, Euler number and Mach number.
4. Understand the requirements for similarity between experiments. Be able to define geometric, kinematic, and dynamic similarity.
5. Be able to use results presented in dimensionless form.
6. Understand how dimensionless groups allow us to simplify analysis, classify flows, and generalize results.