Homework 1 Due: 04/13/2015

Applied Transport Phenomena - CHME420

Exercise 1. Bird, Stewart, and Lightfoot page 814 (Appendix A), exercises 1 and 2.

Exercise 2. Estimate the viscosity of methyl chloride CH_3Cl at 560 °C and 132 atm using the corresponding states correlation (Fig 1.3-1 BSL).

Exercise 3. Sketch the flow pattern and write the components of the *combined momentum flux* tensor for each of the following velocities:

(a) $v_x = y, v_y = 0, v_z = 0$

(b) $v_x = y, v_y = x, v_z = 0$

(c) $v_x = -y, v_y = x, v_z = 0$

(d) $v_x = -\frac{1}{2}x, v_y = -\frac{1}{2}y, v_z = z$

Exercise 4. Consider the flow between parallel plates in relative motion as shown in Figure 1. Assume that the width of the plates is W and that the length is L. You may assume that there is a constant pressure drop in the x-direction of the form $\frac{P_0 - P_L}{L}$. Using the reference frame in Figure 1 do the following:

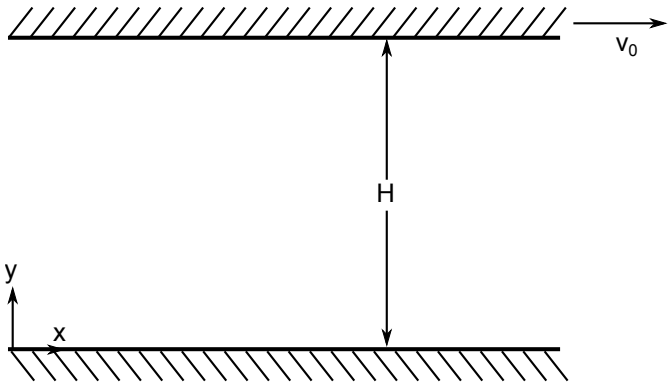

Figure 1: Combined drag and pressure driven flow between two plates.

(a) Derive the velocity profile between the plates.

(b) Obtain an expression for the volumetric flow rate, Q.

(c) Assuming that the volumetric flow rate is given, find the magnitude of the gap separation (H) that maximizes the pressure drop and obtain the maximum pressure drop.

Exercise 5. BSL 2B.11