Name (2 points): Dawson

March 30, 2016
ChBE 3200
Quiz 6

Q1 (3 points): Two identical rectangular flat plates are placed in an air stream as shown below. An incompressible Newtonian fluid flows parallel to the plate surfaces with bulk (free-stream) velocity of v_∞ as shown in the diagram.

Is the total drag force of the fluid on the plate the same for both plates? Why or why not?

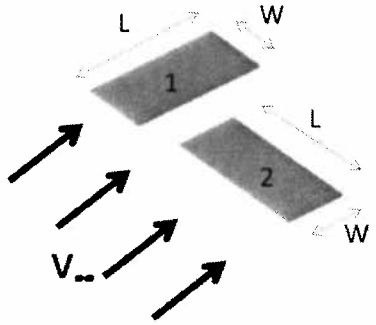
$$F = A\, C_F\, \frac{\rho V_\infty^2}{2}$$

$A_1 = A_2 \quad \rho_1 = \rho_2 \quad V_{\infty 1} = V_{\infty 2}$

$C_{F_1} \neq C_{F_2}$

$C_F = f(Re_L)\,;\ L_1 \neq L_2$

No



Q2 (5 points): Ignoring head loss from the piping system, determine the maximum height (h) of the pump above the water surface that can be used without cavitation.

$\frac{dW_f}{dt} = \frac{dW_s}{dt} = \frac{dQ}{dt}$ in constant

$$\frac{P_1}{\rho} + e_1 = \frac{P_2}{\rho} + e_2$$

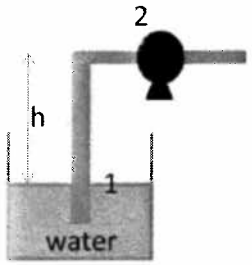
$$\frac{P_1}{\rho} + \frac{V_1^2}{2} + gy_1 + u_1 = \frac{P_2}{\rho} + \frac{V_2^2}{2} + gy_2 + u_2$$

$u_2 - u_1 = 0 \qquad V_1 \ll V_2 \qquad P_1 = P_{atm}$

$P_2 = P_i$

$$y_2 - y_1 = \frac{P_{atm} - P_i}{\rho g} - \frac{V_i^2}{2g}$$

$$y_2 - y_1 = \frac{P_{atm} - P_V}{\rho g}$$



Assume

① $NPSH + \frac{P_V}{\rho g} = \frac{V_i^2}{2g} + \frac{P_i}{\rho g}$ ✱

② V_i small $P_i \sim P_V$ when $NPSH \to 0$

same conclusion