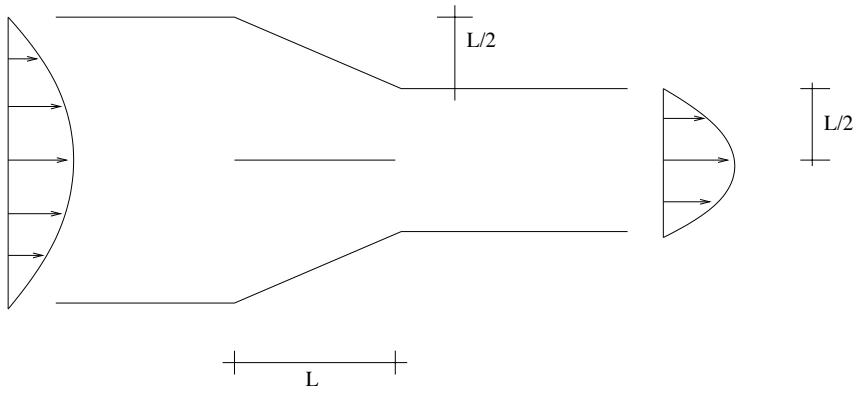
HW 8: Due April 27

1. Consider a thin flat plate in a long water channel with a reduction section. The mean velocity of the input flow is U_o (but of Hagen-Poiseuille character). Determine the drag coefficient for the plate

$$C_D = \frac{F_{\text{drag}}}{\frac{1}{2}\rho U_o^2 b L}\,, \tag{1}$$

where b is the plate width into the "page", L is the plate length, and ρ the fluid density. Compute the drag coefficient as a function of Reynolds number near $Re = \frac{U_o L}{\nu} = 10^5$.



Modeling issues that you will need to consider:

(a) How to get a good model of the input conditions?

(b) How to get a good model of the output conditions?

(c) How fine to make the mesh so that you adequately resolve the boundary layer?

(d) Should you do this transient or steady-state? What is the difference?

(e) How can you assure convergence of the non-linear iterations?

(f) Do you need to pick a thickness for the plate? does it matter? can you do the analysis with an infinitely thin plate?

Remember: You should turn your work in in the form of an analysis report.