Pre-Lab for Tank Draining Experiment (Lab 6)

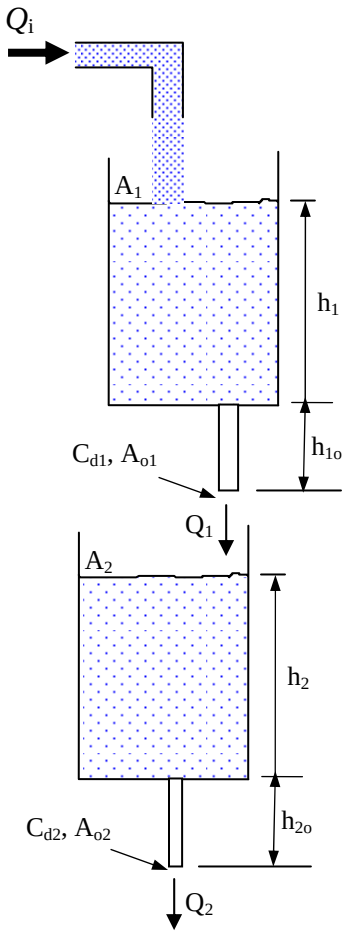
The goals of Lab 6 are:

- To measure the initial-condition response of a single draining tank.
- To compare this experimental response to a model simulation and to use this comparison to obtain best estimates for the values of the discharge coefficients, C_{d1} and C_{d2}, for the two tanks.
- To use the best-estimate single-tank models to predict the behavior of the two-tank system, and to compare this prediction to the experimental initial-condition response of the two-tank system.

The purpose of this pre-lab exercise is for you to create a Simulink Model of a two-tank draining system so that your lab team can more effectively use the lab time. No homework was assigned on Monday to give you more time to work on this pre-lab.

For this pre-lab you are to do the following:

a) Determine a set of nonlinear differential equations, describing the heights of the fluids in the two tanks (h_1 and h_2). The input to the system is Q_i. (These two equations cannot be reduced to a single differential equation.) Note the definitions of h_1 and h_2 are from the bottom of the tank. The flow through the orifice will depend on the height of fluid above the orifice exit (*e.g.*, h_1+h_{10} for the top tank).



b) Create a simulation diagram from the equations you derived in part (a) and implement it in Simulink. Use the simulation to plot the heights of both tanks on the same graph given the following parameters and initial conditions. Let $Q_i = 0$. Assume the area of each tank is 30 in^2, the diameter of upper tank's orifice is 0.375 inch, the diameter of the lower tank's orifice is 0.250 inch, the distance from the bottom of the tank to each orifice exit is 1 in and the discharge coefficients are 0.7. The upper tank is initially filled with 8 inches of water and the lower tank is filled with 6 inches of water. **Note: You will need to add a switch or switches to your simulation so that when the height of fluid (as measured from the bottom) falls below zero, the outflow is set to zero.**