Auditorieøving 6, Fluidmekanikk

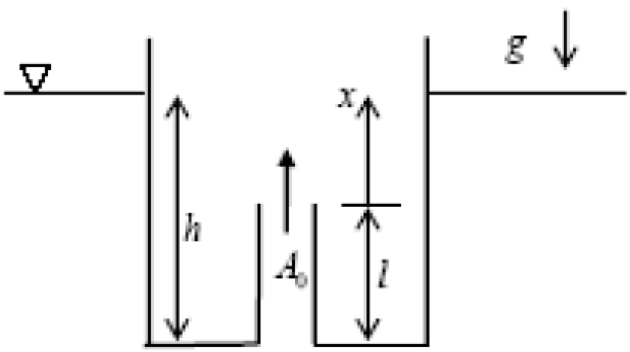
Utført av:

Oppgave 1:

A container is open at one end and has a hole in the bottom, fitted to an inward facing tube of length *l* and circular cross section with area A_0. The container, which is originally empty, is lowered into the water to a depth *h*> *l* as shown in the figure, and kept in this position.

Assume that the flow arising from hole and in the tube is friction free and steady. Consider the situation only before the liquid level inside the container reaches the tube top.

Determine the velocity *v* through the tube and find the pressure in the tube as a function of height *z* above the container bottom.



Oppgave 2:

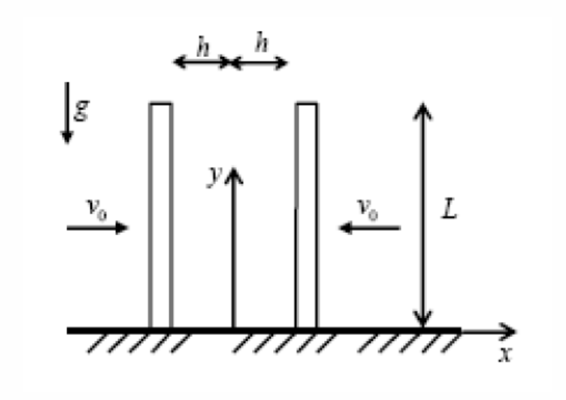
Two vertical plates with height *L* are at an arbitrary time a separated by a distance *2h.* The plates move towards each other with constant velocity v_0 on a smooth horizontal table. The space between the plates is filled with an incompressible fluid, which in addition is assumed to be inviscid. Because of the plates movement, the distance *h* decreases with time and fluid is expelled from the gap.

This results in a non-stationary flow, which is assumed to be two-dimensional.

Find the force must be used to push the plates together as you assume that

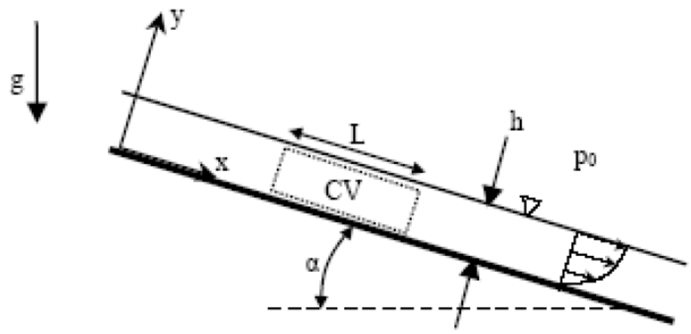
$$u_x = u(x) = -\frac{v_0 x}{h}$$

Note that *h=h(t)!*



Oppgave 3:

A liquid film of density ρ and viscosity μ flows in a laminar and stationary flow along a straight plate that has a slope α with the horizontal plane as the figure shows.



The liquid film has a constant thickness *h*, and the friction force with the atmosphere can be neglected.

We are given the following solutions for the flow

$$p(y) = p_0 + \rho g(h - y)\cos(\alpha)$$

$$u(y) = \frac{\rho g \sin(\alpha)}{\mu}(yh - \frac{1}{2}y^2)$$

a) Verify that the solution fulfills the boundary conditions of the problem.

b) Consider the control volume CV shown in the figure. Find all the forces acting on the fluid in the control volume (both *x*- and *y*-direction).

Oppgave 4:

Derive the kinematic boundary condition for waves in a geometrical way with aid of the figure shown below. A fluid element placed in *A* at the time *t* will move to point *B* during the time *dt.* The distance travelled is in this case ***V****dt,* where ***V***=*[u,w].*

Hint: Add the line elements *AD* and *DE.*