TOTIMERSØVING NR 4 TEP 4105 FLUIDMEKANIKK

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Utført av: (alle i gruppa)

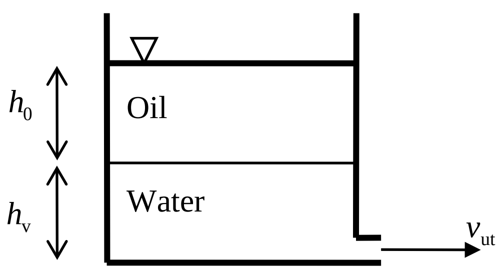
Oppgave 1

What assumptions must be made in order to use

$$\frac{p_1}{\rho}+\frac{v_1^2}{2}+gz_1=\frac{p_2}{\rho}+\frac{v_2^2}{2}+gz_2 \qquad (1)$$

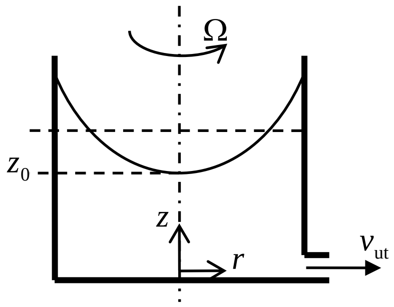
$$\int_1^2 \frac{\partial v}{\partial t}\mathrm{d}s+\int_1^2 \frac{\mathrm{d}p}{\rho}+\frac{1}{2}\left(v_2^2-v_1^2\right)+g\left(z_2-z_1\right)=0 \qquad (2)$$

$$\frac{p_1}{\rho g}+\alpha_1\frac{v_1^2}{2g}+z_1=\frac{p_2}{\rho g}+\alpha_2\frac{v_2^2}{2g}+z_2+h_\mathrm{f} \qquad (3)$$



Oppgave 2

Use the Bernoulli equation (1) to determine the velocity at the outlet, v_ut.



Oppgave 3

The pressure in a rotating basin is given by

$$p(r,z)=p_0+\rho g(z_0-z)+\frac{1}{2}\rho\Omega^2 r^2 \qquad (4)$$

What is v_ut in this case?

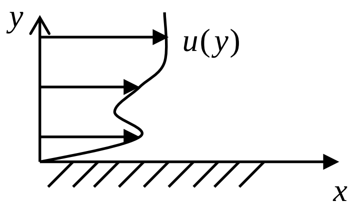
Oppgave 4

The surface of the rotating basin in oppgave 3 is given as

$$z = z_0 + \frac{\Omega^2 r^2}{2g} \qquad (5).$$

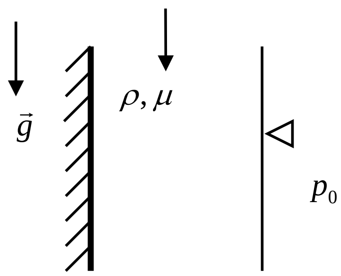
(Obtained by requiring $p(r,z) = p_0$ in equation (4).) Use Bernoullis equation from $(r = 0, z = z_0)$ to an arbitrary point on the surface. Why does the z we obtain from this approach differ from (5)? What is wrong?

Oppgave 5



Given a stationary and incompressible flow parallel to a wall at $y = 0$. The velocity $\vec{v} = (u,0)$ is dependent only on *y*. Show that the acceleration of a fluid particle is zero.

Oppgave 6



A liquid film with thickness *h* flows parallel to a vertical wall. Friction between the fluid and the surrounding air is negligible. Sketch the resulting velocity profile.

Use force-conservation to determine the viscous shear τ_w on the wall.

Oppgave 7

A high speed gas moves along the surface resulting in a constant shear τ_0 on the surface.

Sketch some possible velocity profiles. What is τ_w in this case?