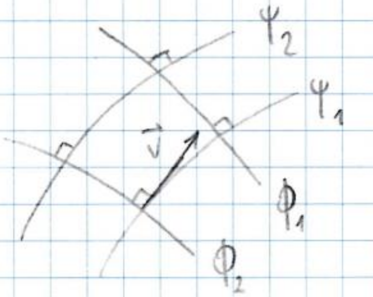
$1\, bar = 10^5\, Pa$ — Formule: — 2. Kolokvij - Hidromehanika — (1)

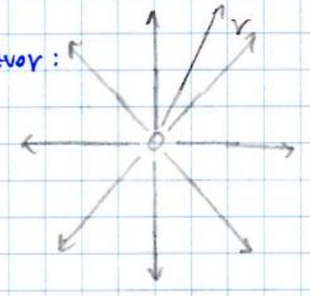
Tokovne mreže: Ψ - tokovnice, ϕ - ekvipotencialne črte

$\Psi \perp \phi$

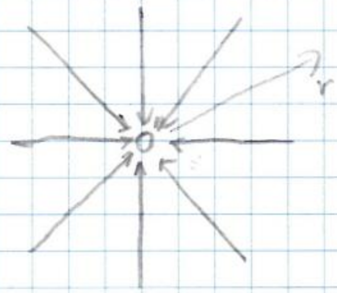
$\vec{v} = grad\, \phi \Rightarrow \vec{v} \perp \phi$ in tangencialni na Ψ



Izvor:

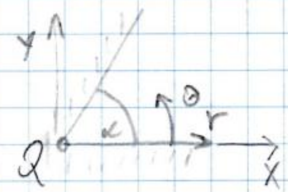


Ponor:



$v_r \neq 0$ in $v_r > 0$ — $v_r \neq 0$ in $v_r < 0$

Jakost izvora oz. ponora:



$$Q = \frac{v \cdot \pi \cdot r \cdot b \cdot \alpha}{180°}$$ (b – globina ravninskega toka), $$v = \frac{Q \cdot 180°}{\pi \cdot r \cdot b \cdot \alpha}$$

Splošno: $v = \frac{Q}{S_n}$

Enačbi tokovnic in ekvipotencialnih črt:

$$u = \frac{\partial \phi}{\partial x} = \frac{\partial \Psi}{\partial y}, \quad v = \frac{\partial \phi}{\partial y} = -\frac{\partial \Psi}{\partial x}$$

$$v_r = \frac{1}{r}\frac{\partial \Psi}{\partial \theta} = \frac{\partial \phi}{\partial r}, \quad v_\theta = -\frac{\partial \Psi}{\partial r} = \frac{1}{r}\frac{\partial \phi}{\partial \theta}$$

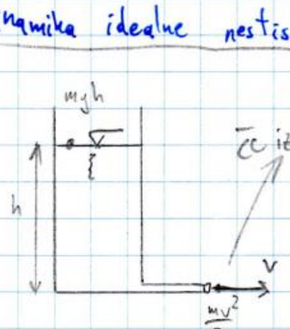
$$d\Psi = \frac{\partial \Psi}{\partial r} dr + \frac{\partial \Psi}{\partial \theta} d\theta, \quad d\phi = \frac{\partial \phi}{\partial r} dr + \frac{\partial \phi}{\partial \theta} d\theta$$

Paralelni tok z izvorom/ponorom:

× zastojna točka: $|v_r| = |u|$

Dinamika idealne nestisljive tekočine:

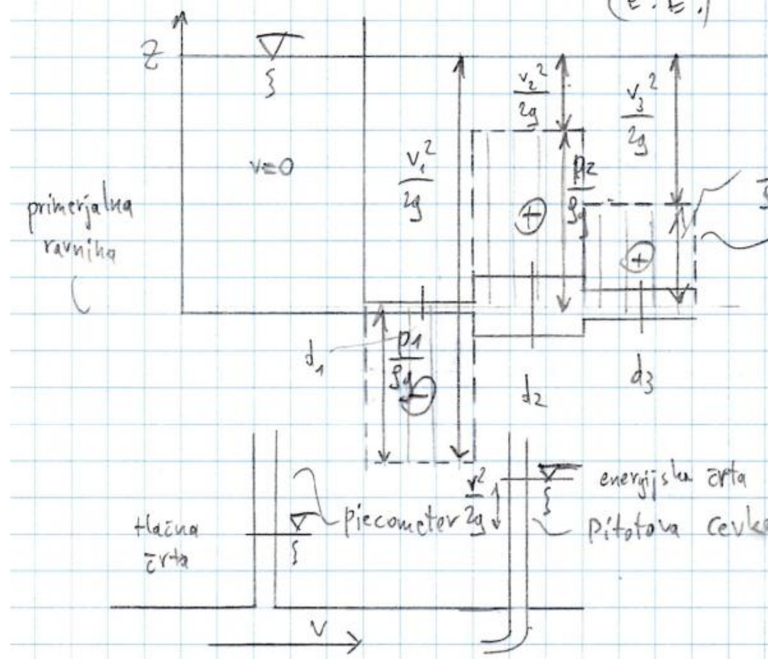
Govorimo o tem koliko energije nosi N težka voda.



Pretvorba energij: $m \cdot g \cdot h = \frac{m \cdot v^2}{2} \Rightarrow v = \sqrt{2gh}$

Bernoullijeva enačba: $\frac{\rho v^2}{2} + \rho g z + p = const. \quad / \cdot \frac{1}{\rho g}$

Energijska enačba (E.E.): $\frac{v^2}{2g} + z + \frac{p}{\rho g} = const. \quad [m] = [\frac{Nm}{N}]$



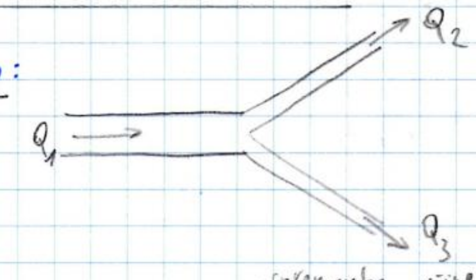
$d_1 < d_3 < d_2$

Kavitacija: $\frac{p}{\rho g} = -10$ m VS (vodnega stolpca) – minimalno toliko je lahko

Pretok (K.E.): $Q = v \cdot S = \frac{v \cdot d^2 \pi}{4}$

$Q_1 = Q_2 = Q_3$

Razcep:



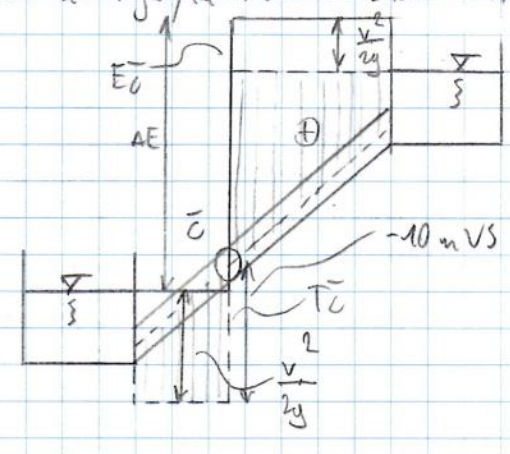
Pretok: $Q_1 = Q_2 + Q_3$

$v_1 d_1^2 = v_2 d_2^2 + v_3 d_3^2$

Črpalke: $\left.\begin{matrix} P_č \\ N_č \end{matrix}\right\} = \frac{Q_č \cdot \Delta E \cdot \rho \cdot g}{\eta_č}$

(ΔE – sprememba višine EČ; $\eta_č$ – izkoristek; $Q_č$ – pretok skozi črpalko)

Max, do tega da imamo v sistemu -10 m VS!



Formule : 2. kolokvij - Hidromehanika ②

Tok podtalnice :

Podobno kot tokovne mreže.

Hitrost: $v_r = \oplus / \ominus \frac{Q \cdot 180^\circ}{\pi \cdot r \cdot h \cdot \alpha}$ oz. $v_r = +/- \frac{Q}{S}$

(+) izvor, polnenje; (−) ponor, črpanje

$v_r = \frac{\partial \phi}{\partial r} = \frac{\partial \psi}{\partial \theta} \frac{1}{r}$

npr:

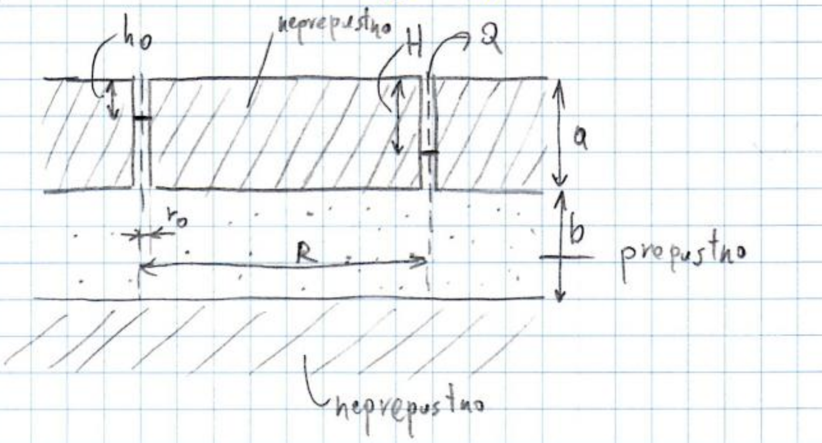
$v_\theta = 0 = \frac{\partial \phi}{r \cdot \partial \theta} = - \frac{\partial \psi}{\partial r}$

$d\phi = \frac{\partial \phi}{\partial r} dr + \frac{\partial \phi}{\partial \theta} d\theta$

$d\psi = \frac{\partial \psi}{\partial r} dr + \frac{\partial \psi}{\partial \theta} d\theta$

Sledi : $\ln\left(\frac{R}{r_0}\right) = \frac{k \cdot \pi \cdot b \cdot \alpha}{180^\circ \cdot Q} (H - h_0)$

k – koeficient prepustnosti (m/s oz. mm/s)



Darcy: $v = -k \cdot \text{grad}\, \Pi$

$v = -k \cdot \frac{\Delta h}{\Delta r}$

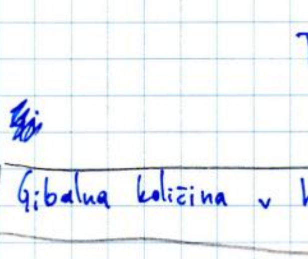
$v_r = -k \cdot \frac{dh}{dr}$

$v_r = -k \cdot \frac{dh}{dr} = +/- \frac{Q \cdot 180^\circ}{\pi \cdot r \cdot h \cdot \alpha}$

Čas onesnaženja: $v_r = \frac{Q \cdot 180^\circ}{\pi \cdot r \cdot b \cdot \alpha} = \frac{dr}{dt} \Rightarrow \frac{Q \cdot 180^\circ}{\pi \cdot b \cdot \alpha} \cdot \int_0^T dt = \int_{r_0}^{R} r\,dr$

$T = \frac{\pi \cdot b \cdot \alpha}{Q \cdot 180^\circ} \cdot \left(\frac{R^2}{2} - \frac{r_0^2}{2}\right)$

Gibalna količina v hidromehaniki :



$\Sigma F_x = F_{xr} + P_{1x} - P_{2x} = \rho Q (v_{2x} - v_{1x})$

F_{xr} – reakcijska sila, tista ki zadržuje na mestu

$F_{xr} = \rho Q (v_{2x} - v_{1x}) + P_{2x} - P_{1x}$, $Q_{rel} = S \cdot (v_1 - v_2)$ – če se stvar od curka odmika oz. primika

$P_{1x} = p_1 \cdot S_1 = p_1 \cdot \frac{d_1^2 \pi}{4}$

$P_{2x} = p_2 \cdot S_2 = p_2 \cdot \frac{d_2^2 \pi}{4}$