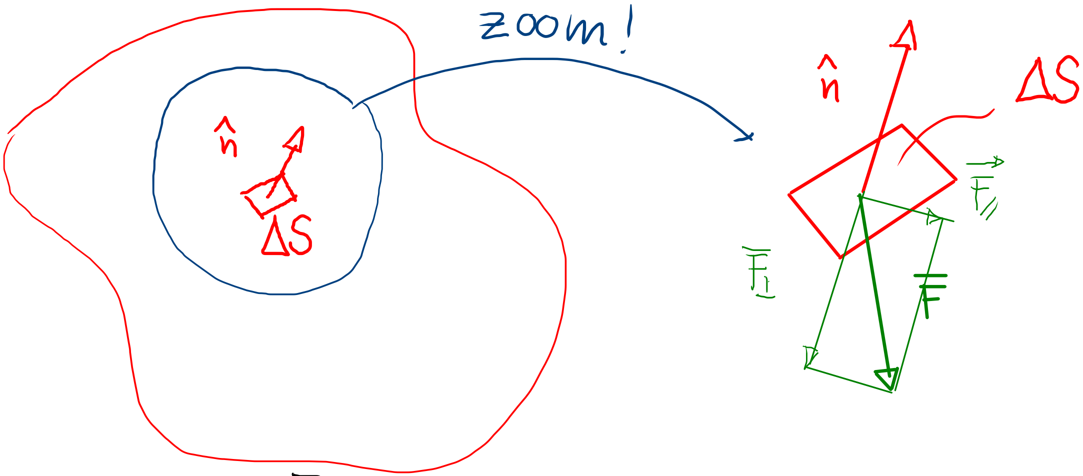
I FLUIDI

	VOL. PROPRIO	FORMA PROPRIA
Solidi	✓	✓
liquidi	✓	✗
gas	✗	✗

$\Rightarrow$ i liquidi sono incomprimibili

PRESSIONE



$$p = \frac{|\vec{F}_\perp|}{\Delta S} \qquad [p] = \frac{N}{m^2} = Pa \quad (\text{Pascal})$$

$$\text{cgs}: \quad \frac{dyne}{cm^2} = \frac{10^{-5}\,N}{10^{-4}\,m^2} = 10^{-1}\,Pa = \text{baria}$$

$$1 \text{ bar} = 10^6 \text{ barie}$$

$$1 \text{ mbar} = 10^3 \text{ barie}$$

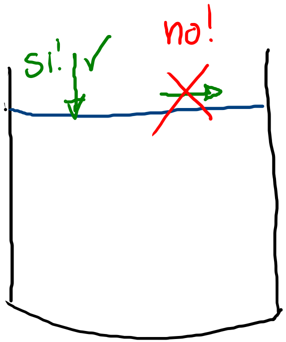
$$1\ \text{atm} = 101\,300\ \text{Pa} \cong 10^5\ \text{Pa}$$

$$= 760\ \text{Torr} = 760\ \text{mmHg}$$

$$1\ \text{hPa} = 10^2\ \text{Pa} = 1\ \text{mbar}$$

FLUIDOSTATICA

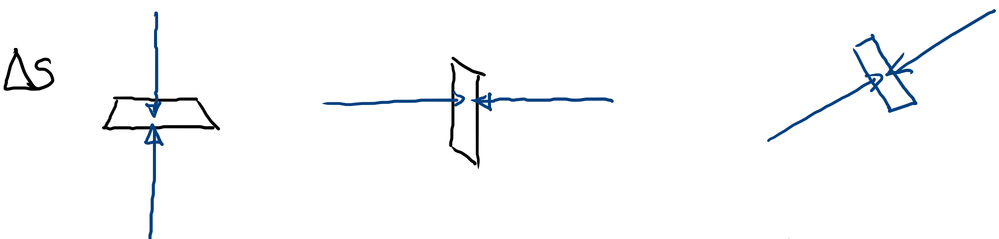
liquido fermo, in equilibrio



non ci sono $F_{\parallel}$ alla superficie

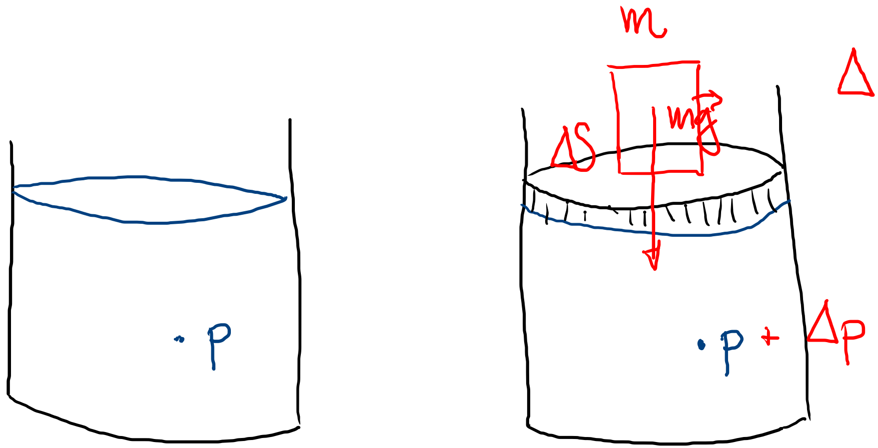
ci possono essere $F_{\perp}$

principio di isotropia della pressione



$\Rightarrow$ pressione in un punto

PRINCIPIO DI PASCAL

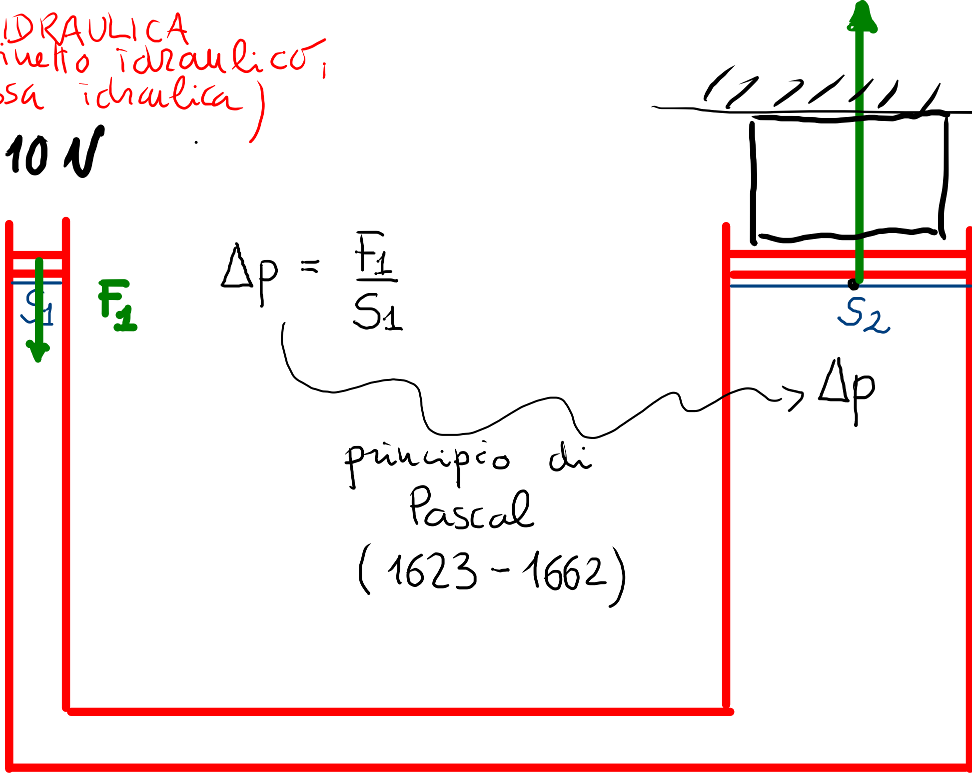


$\Delta p = \dfrac{mg}{\Delta S}$

sulla superficie

"Un Δp sulla superficie libera di un liquido si trasmette inalterato in ogni punto del liquido"

LEVA IDRAULICA
(martinetto idraulico, pressa idraulica)



$$\Delta p = \frac{F_1}{S_1}$$

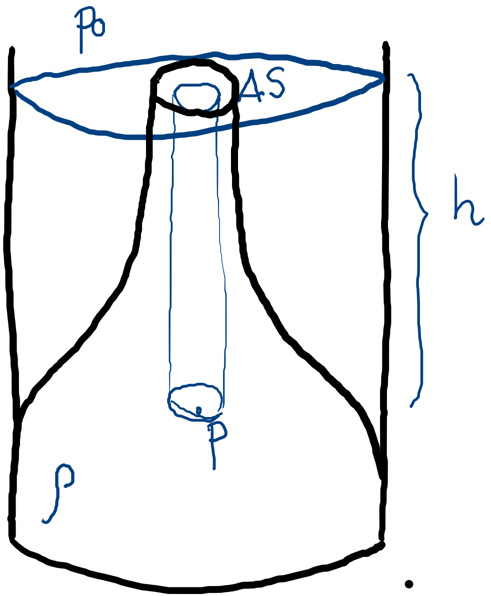
$S_2 \gg S_1$

$$F_2 = \Delta p \cdot S_2 = \frac{F_1}{S_1} \cdot S_2$$

$$F_2 = F_1 \frac{S_2}{S_1}$$

$\gg 1$

PRINCIPIO DI STEVINO (1548 - 1620)



$$p = p_0 + \frac{\text{peso colonna liquido}}{\Delta S}$$

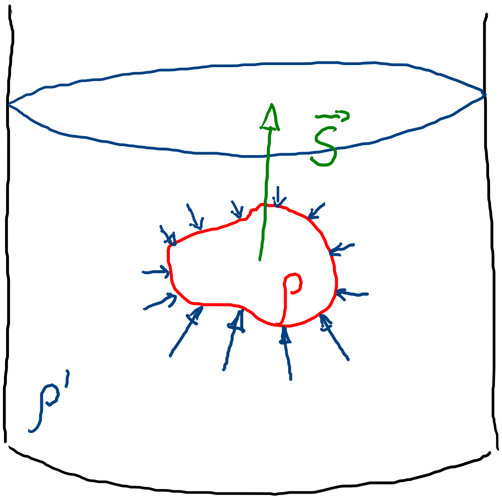
$$= p_0 + \frac{\rho V g}{\Delta S}$$

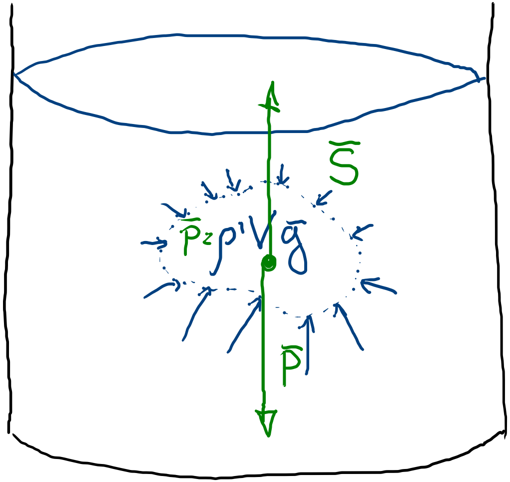
$$= p_0 + \frac{\rho \cancel{\Delta S} \cdot h \cdot g}{\cancel{\Delta S}}$$

$$\boxed{p = p_0 + \rho g h}$$

PRINCIPIO DI ARCHIMEDE

$$S = \rho' V g$$

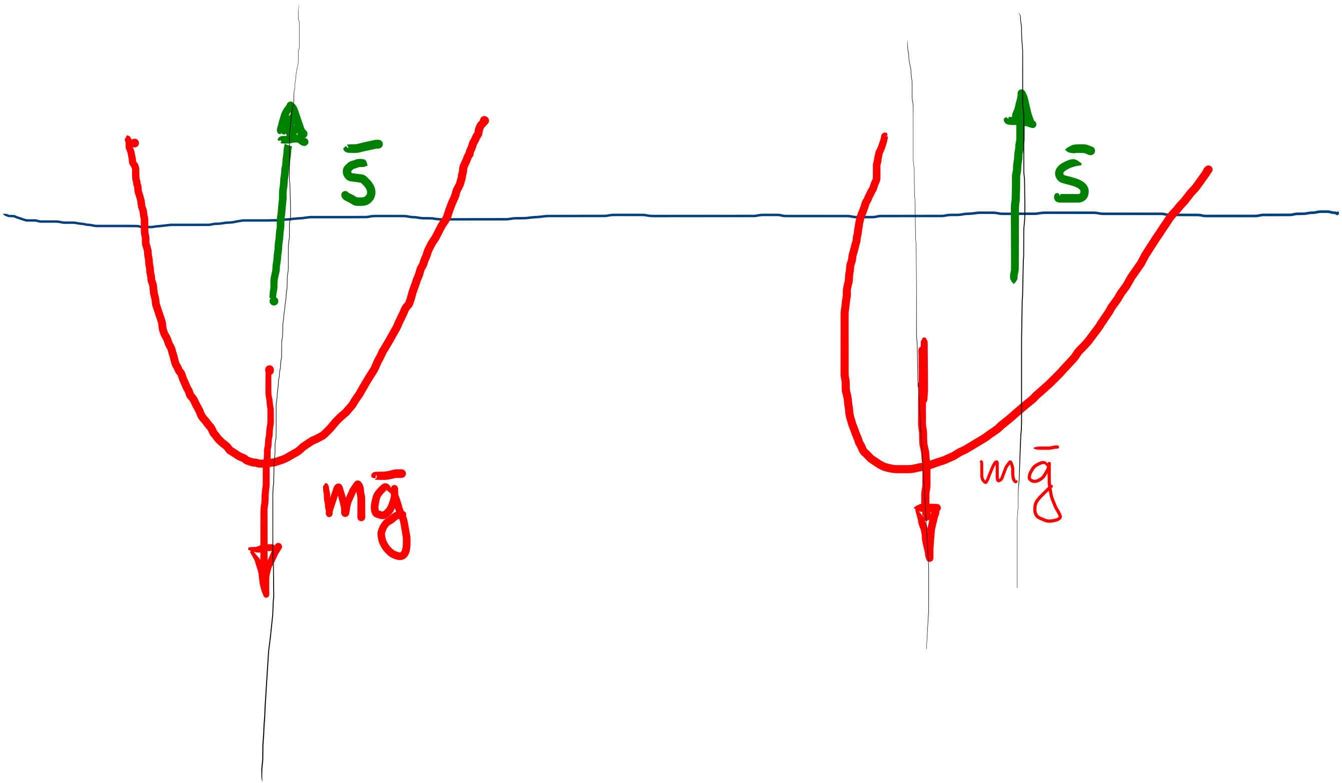




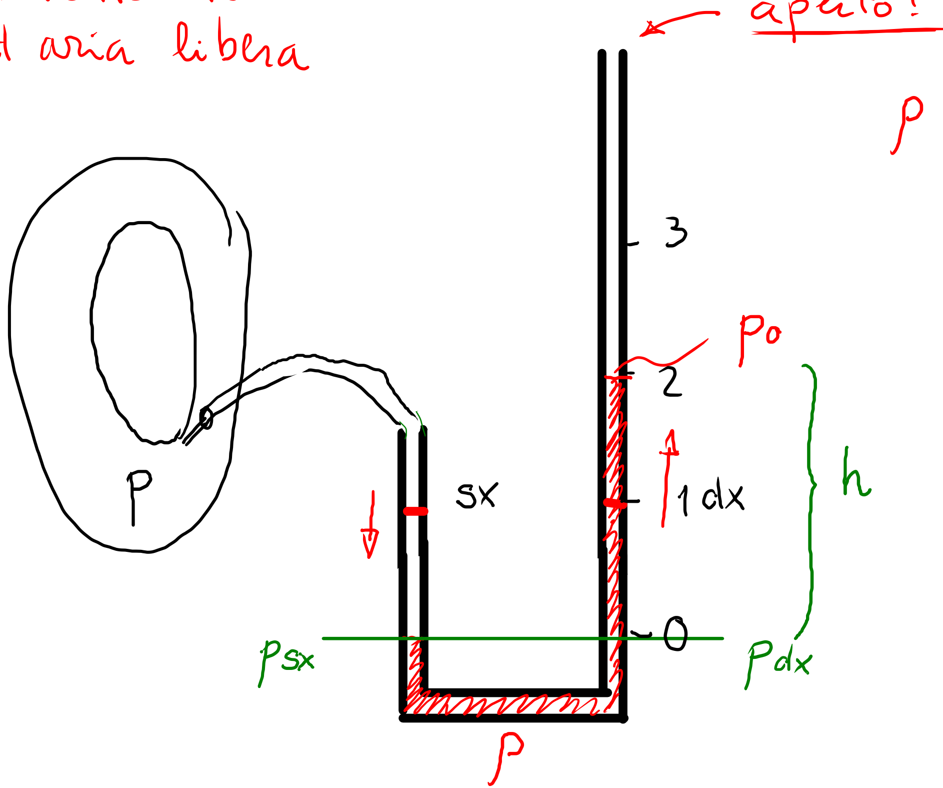
$$\bar{S} = -\rho' V \bar{g}$$

$\Rightarrow$ $\bar{S}$ è applicato al centro del fluido spostato!

(parentesi di ingegneria navale)



MANOMETRO ad aria libera

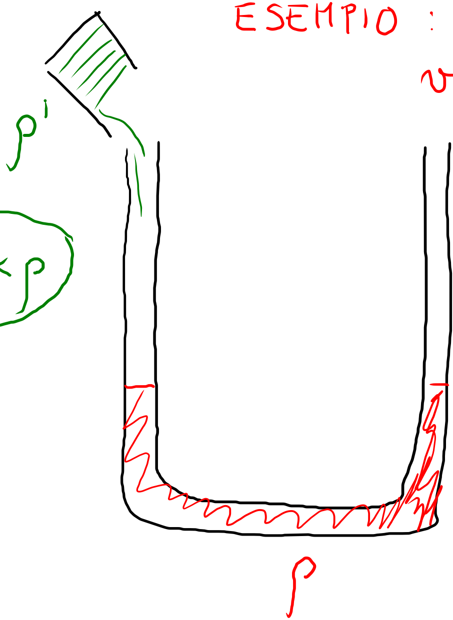


$\rho = 13{,}5 \ g \ cm^{-3}$

$$p = p_0 + \rho g h$$

$$(p - p_0) = \rho g h$$

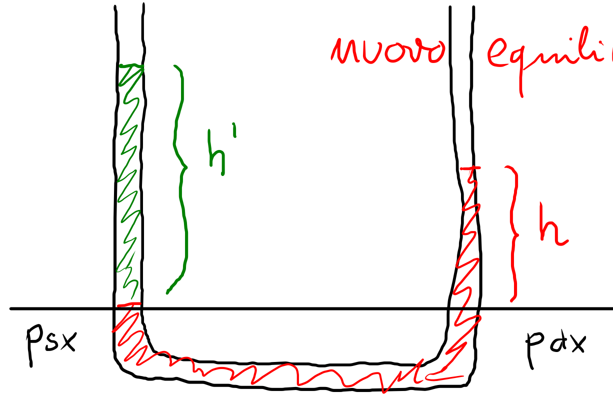
ESEMPIO: aggiunta di liquido verde su liquido rosso



$\rho' < \rho$

eq. iniziale

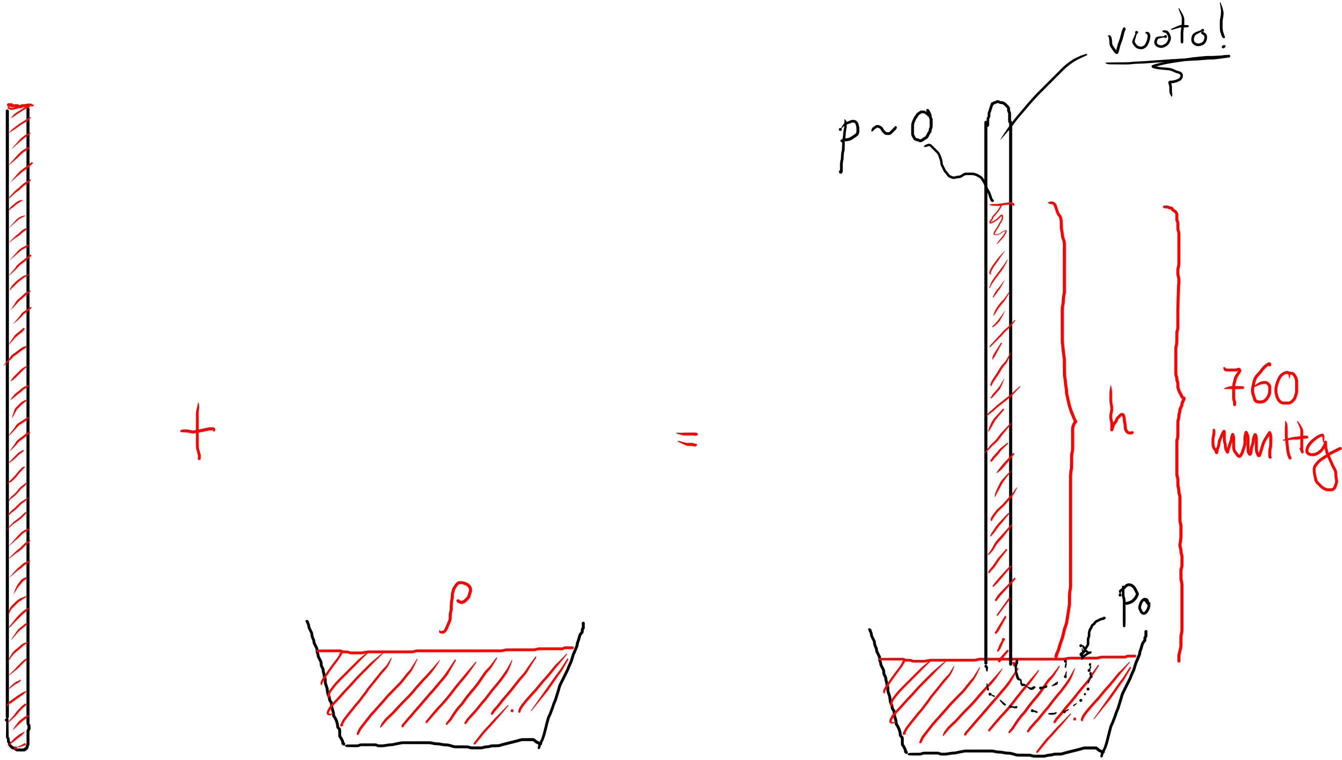
nuovo equilibrio



$$\left.\begin{aligned} p_{sx} &= p_0 + \rho' g h' \\ p_{dx} &= p_0 + \rho g h \end{aligned}\right\} \quad \rho' \cancel{g} h' = \rho \cancel{g} h$$

$$h' = h \underbrace{\frac{\rho}{\rho'}}_{>1}$$

ESPERIENZA DI TORRICELLI (1608 - 1647)

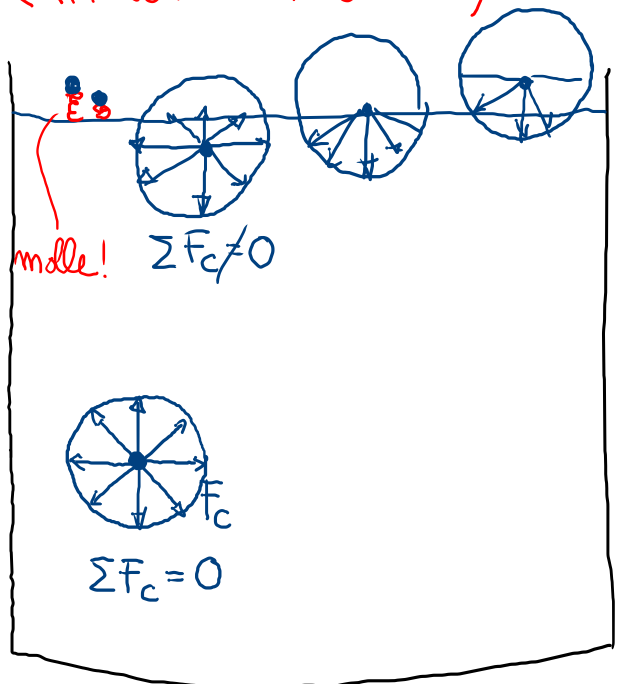


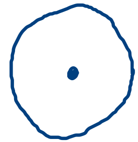
$$0 + \rho g h = p_0$$

$$1 \text{ atm} = 760 \text{ mmHg} = 760 \text{ Torr}$$

NOTA: le slide che seguono costituiscono un approfondimento e non sono materia d'esame

TENSIONE SUPERFICIALE (APPROFONDIMENTO)





<u>forze di coesione</u>

tendono a minimizzare la superficie del liquido

se la sup. aumenta ΔS
$\Rightarrow$ costa $\mathcal{L}$

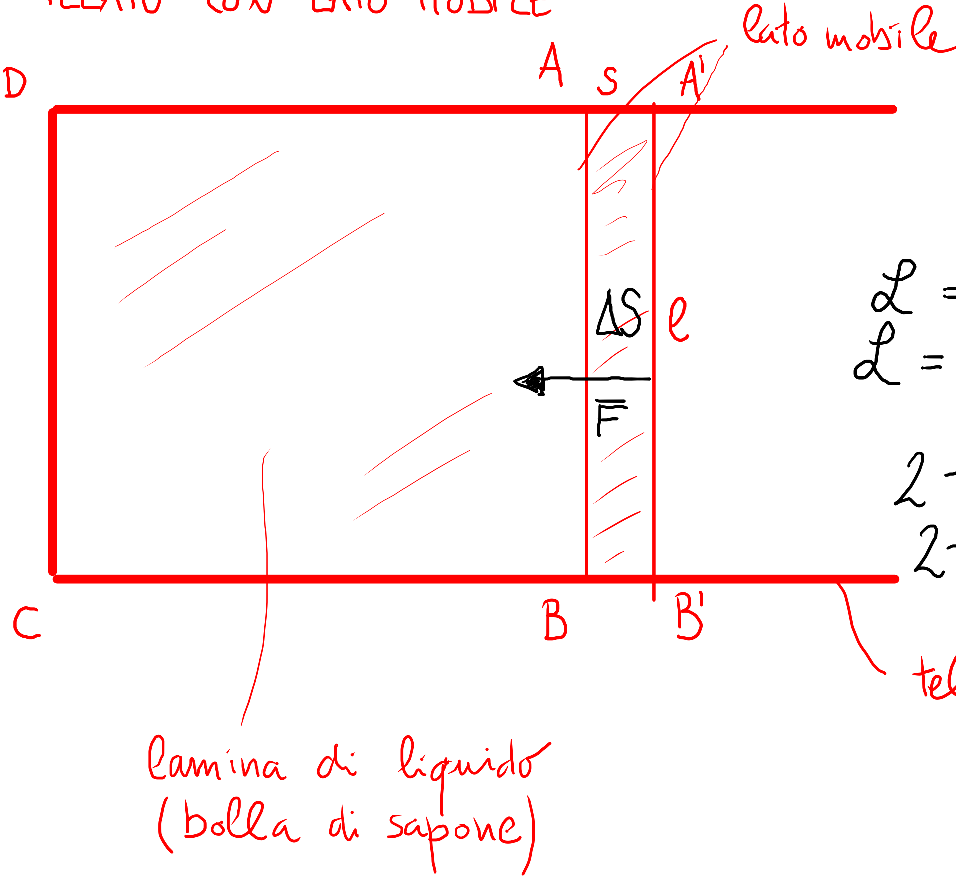
Definizione di tensione superficiale

$$\tau = \frac{\mathcal{L}}{\Delta S}$$

$$[\tau] = \frac{J}{m^2} = \frac{N \cdot \cancel{m}}{m^{\cancel{2}}} = \frac{N}{m}$$

energia per unità di superficie
forza per unità di lunghezza

TELAIO CON LATO MOBILE



$$\Delta S = s \cdot l$$

perché lamina ha 2 facce

$$\mathcal{L} = \tau \cdot \Delta S \cdot 2 \quad \text{def. } \tau$$

$$\mathcal{L} = F \cdot s \quad \text{def. } \mathcal{L}$$

$$2\tau \Delta S = F \cdot s$$

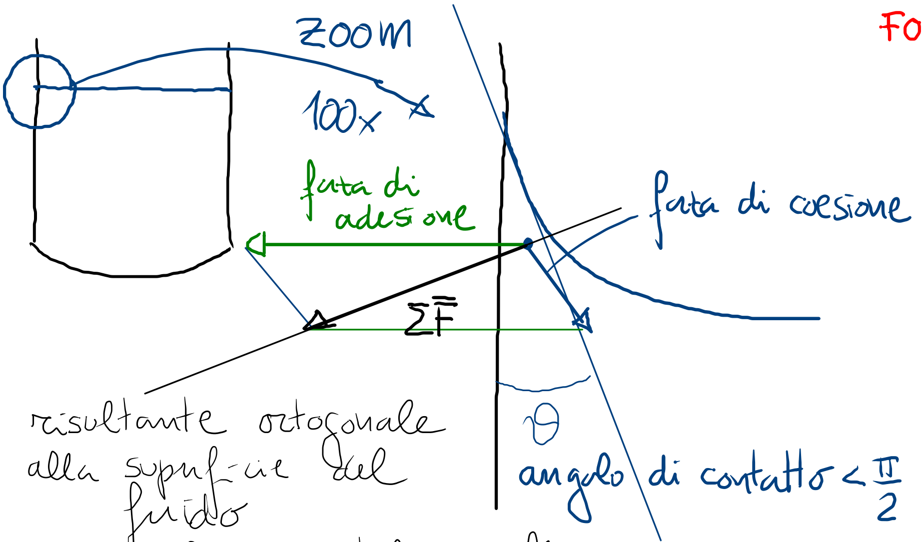
$$2\tau \cdot \cancel{s} \cdot l = F \cdot \cancel{s}$$

$$F = 2\tau l$$

$$\tau = \frac{F}{2l}$$

FORZE DI ADESIONE

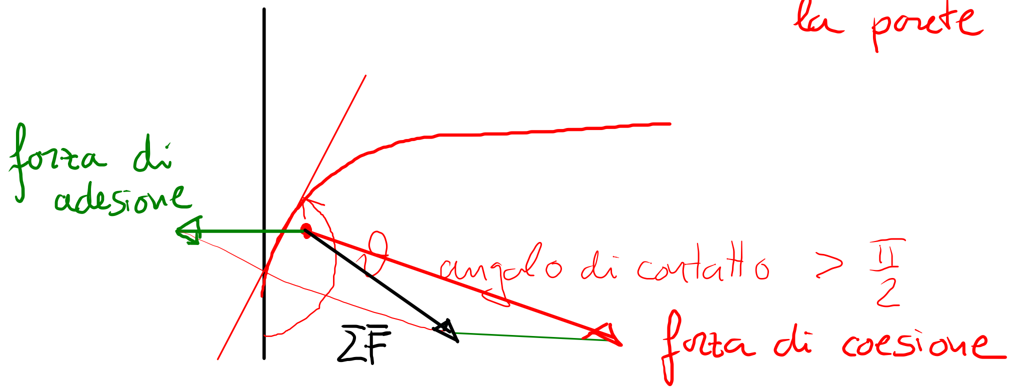
acqua "bagna" la parete



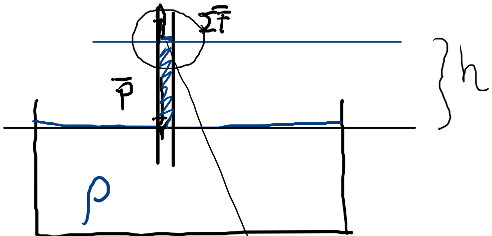
$\Rightarrow$ ipotesi fondamentale in fluidostatica

forze di adesione > forze di coesione

mercurio "non bagna" la parete



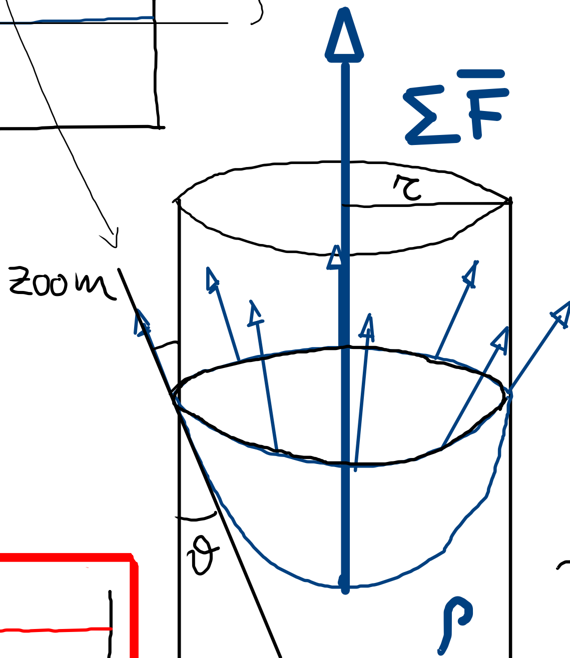
FENOMENI CAPILLARI



H_2O e per i fluidi che bagnano il vetro

$$\Sigma F = \tau \cdot 2\pi r \cdot \cos\vartheta$$

tens. sup. — lunghetta su cui agisce τ — comp. vert.



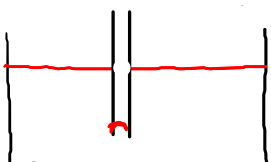
Legge di Jurin

$$P = mg = \rho V g = \rho \pi r^2 \cdot h \cdot g$$

$$\boxed{\Sigma F = P}$$

$$\tau \cdot 2\cancel{\pi r} \cdot \cos\vartheta = \rho \cancel{\pi r}^2 h \cdot g$$

$$\boxed{h = \frac{2\tau\cos\vartheta}{r\rho g}}$$



per Hg e per i fluidi che "non bagnano" la parete