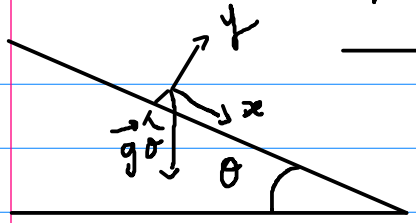
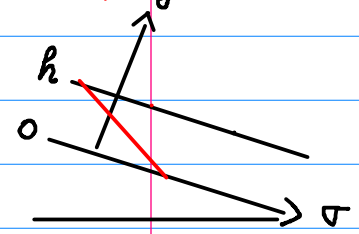
Mesure du seuil d'écoulement d'un Fluide complexe



$$\vec{\nabla}.\underline{\underline{\sigma}} + \rho\vec{g} = \vec{0}$$
$$\nabla.\underline{\underline{\sigma}}.\vec{e_i} = \sum \frac{\partial \sigma_{ij}}{\partial x_j}$$

1) - Symétrie de translation selon x ⇒ les ≠ paramètres sont indépendants de x
- $h \ll L$ (longueur du plan incliné) ⇒ infini selon x

symétrie de translation en x

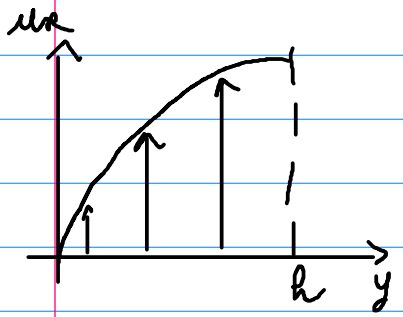


2) $\cancel{\frac{\partial \sigma_{xx}}{\partial x}} + \frac{\partial \sigma_{xy}}{\partial y} + \rho g \sin\theta = 0$

3) $\sigma_{xy} = -\rho g y + K$ ⊗ $\sigma_{xy}(h) = 0$
$= \rho g (h-y)\sin\theta$

4) fluide newtonien $\sigma'_{xy} = \eta \frac{\partial u_x}{\partial y}$ $\sigma'_{xy} = \sigma_{xy}$

$$\frac{\partial u_x}{\partial y} = \frac{\rho g \sin\theta}{\eta}(h-y)$$



$$u_x = \frac{\rho g \sin\theta}{\eta}\left(hy - \frac{y^2}{2}\right) + K$$

$y=0 \Rightarrow u_x = 0 \Rightarrow K = 0$

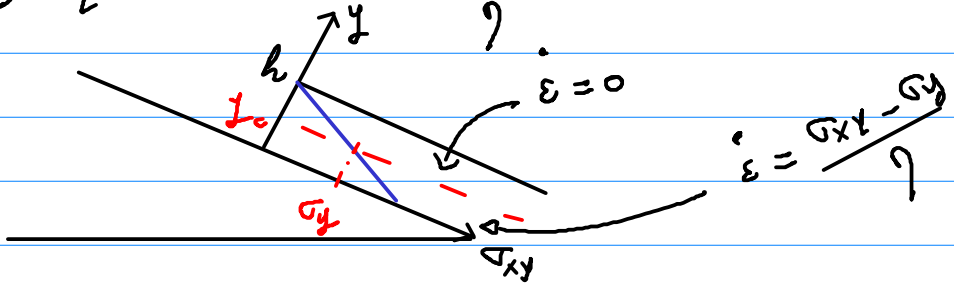
en $y = h$

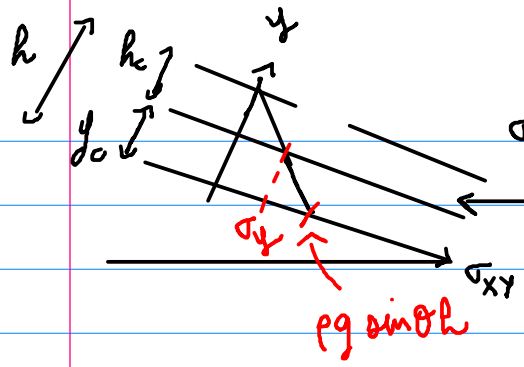
$$u_x = \frac{\rho g \sin\theta}{2\eta} h^2$$

5) Fluide à seuil

$\sigma_{xy} < \sigma_y$ $\quad \dot{\varepsilon} = 0$

$\sigma_{xy} > \sigma_y$ $\quad \dot{\varepsilon} = \frac{\sigma_{xy} - \sigma_y}{\eta}$





$\dot{\varepsilon} = 0$

$\sigma_{xy}(y_c)$ sur $h - y_c$

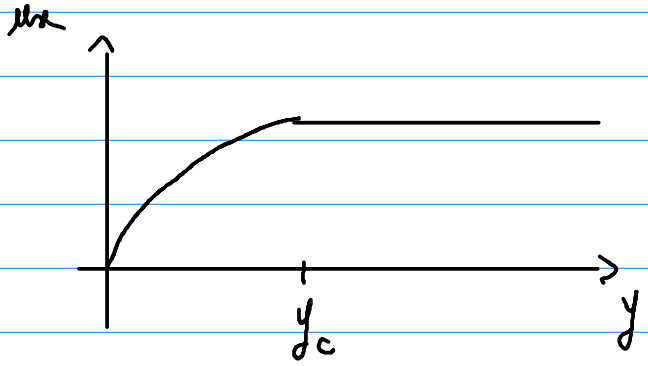
6) en $y = y_c$ $\quad \boxed{\rho g \sin\theta \, h_c = \sigma_y}$

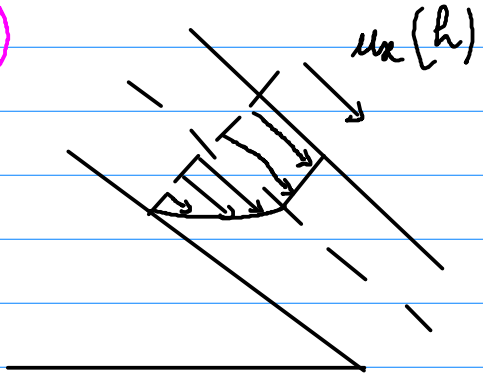
7) pour $y < y_c$ $\quad \eta \frac{\partial u_x}{\partial y} = \rho g \sin\theta (h - h_c - y)$

$u_x = 0$ en $y = 0$

$$u_x = \frac{\rho g}{\eta} \sin\theta \left((h - h_c) y - \frac{y^2}{2} \right) + \cancel{K}$$

pour $y \geq y_c$ $\quad u_x = \frac{\rho g \sin\theta}{2\eta} (h - h_c)^2$





8) $u_x(h) \Rightarrow h_c \Rightarrow \sigma_y$

On peut mesurer $u_x(h)$ à l'aide de traceurs.

+ d'une modélisation directe