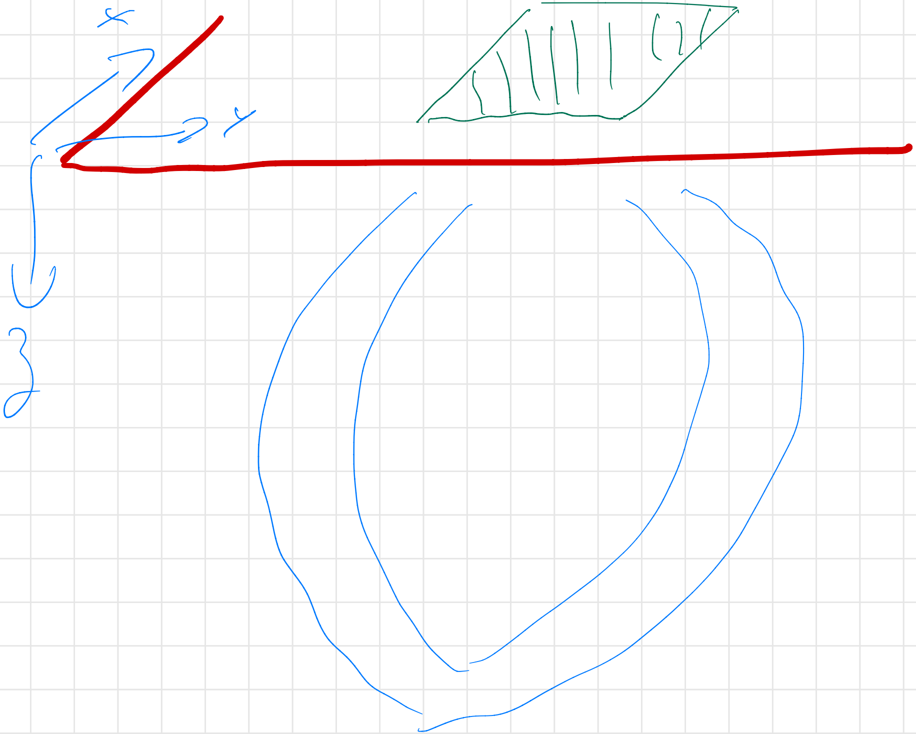
WEEK #5

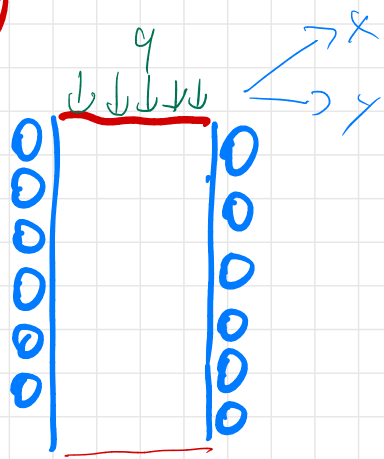


Elasticité $\boxed{3D}$

avec BOUSSINESQ

+ Superposition.

Simplification 1D



$\varepsilon_{xx} = \varepsilon_{yy} = 0$

Pas de Def. latérale

conditions oedométrique

E.D
$\Rightarrow \quad \partial_3 \sigma_{33} = 0$

$\Rightarrow \quad \sigma_{33} = q$

la loi de comportement élastique

$$\sigma_{33} = 2G\,\varepsilon_{33} + (K - 2/3\,G)\,[\varepsilon_{33} + \underbrace{\varepsilon_{xx} + \varepsilon_{yy}}_{0}]$$

$$\boxed{\sigma_{33} = (K + 4/3\,G)\,\varepsilon_{33}}$$

Note
pour les sols
cas drainé on
remplace σ_{33} par σ'_{33}

On A $\sigma_{33} = q = \left(K + \frac{4}{3} G\right) \varepsilon_{33}$

b) $$\varepsilon_{33} = \frac{q}{K + \frac{4}{3} G}$$

$$K = \frac{E}{3(1-2\nu)} \qquad G = \frac{E}{2(1+\nu)}$$

$$K + \frac{4}{3} G = \frac{E(1-\nu)}{(1+\nu)(1-2\nu)}$$

$$\left[\ \varepsilon_{33} = \frac{(1+\nu)(1-2\nu)}{E(1-\nu)}\, q\ \right]$$

si $\nu = 0.5$
(argiles non drainées)
alors $\varepsilon_{33} = 0$

CONSERVATION de la masse d'eau

$$\underbrace{\frac{\partial m_f}{\partial t}}_{\frac{\partial n}{\partial t} + n\beta_w \frac{\partial u}{\partial t}} + \underbrace{q_{i,i}}_{\sum_i \frac{\partial q_i}{\partial x_i}} = 0$$

Loi de DARCY

$$q_i = -k\underbrace{\left(\frac{u}{\gamma_w} + z\right)}_{h}{}_{,i}$$

$$\frac{\partial n}{\partial t} + n\beta_w \frac{\partial u}{\partial t} - k\left(\frac{u}{\gamma_w} + z\right)_{,ii} = 0 \quad X$$

$$-\Delta n = \varepsilon_v = \varepsilon_{zz} = \frac{\sigma'_{zz}}{K + 4/3\, G}$$

(conditions oedométriques)

en 1D selon z

$$\frac{\partial n}{\partial t} + n\beta_w \frac{\partial u}{\partial t} - k\frac{\partial^2}{\partial z^2}\underbrace{\left(\frac{u}{\gamma_w}+z\right)}_{h} = 0$$

on calcule

$$u = u - u^{st}$$

$$-\frac{\partial \varepsilon^v}{\partial t} + n\beta_w\frac{\partial u}{\partial t} - \frac{k}{\gamma_w}\frac{\partial^2 u}{\partial z^2} = 0$$

$$\varepsilon^v = m_v\left(\sigma_{zz} - u\right)$$

$$-m_v\frac{\partial \sigma_{zz}}{\partial t} + \underbrace{\left(m_v + n\beta_w\right)}\frac{\partial u}{\partial t} - \frac{k}{\gamma_w}\frac{\partial^2 u}{\partial z^2} = 0$$

$m_v + n\beta_w$