Article Stress-strain behavior of sand at high strain rates (Mehdi Omidvar et al,2012)

M. Omidvar et al. / International Journal of Impact Engineering 49 (2012) 192–213

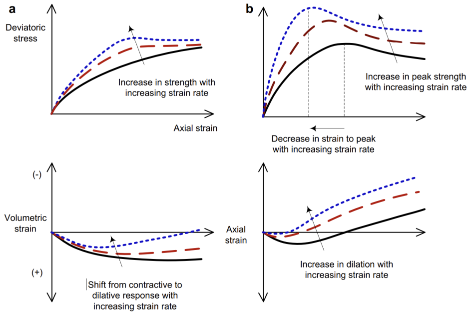

Fig. 19. Effect of increase in strain rate on stress-strain response and volumetric strains in (a) loose sand, (b) dense sand (interpreted based on data from Table 3).

"Under HSR loading, there is not enough time for strain energy accumulation, which prohibits crushing and promotes rolling-rearrangement resulting in a higher resistance to shear"

Trouver le régime de l'état critique

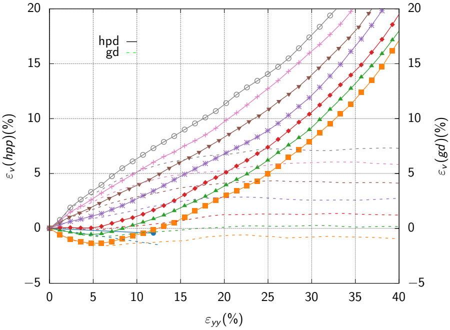

Figure 1 – Déformation Volumique

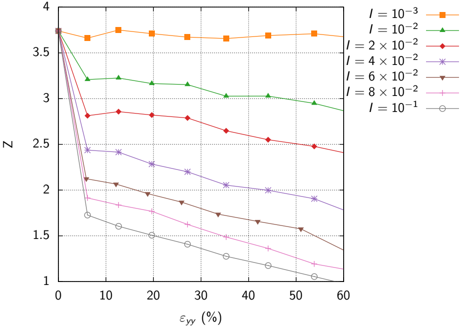

Figure 2 – Nombre de Coordination

hpp : $\varepsilon_{yy} = \dfrac{\Delta h_{yy}}{h_{yy}^0}; \varepsilon_v = \varepsilon_{xx} + \varepsilon_{yy} + \varepsilon_{zz}$

gd : $\varepsilon_{yy} = \ln\left(\dfrac{h_{yy}}{h_{yy}^0}\right); \varepsilon_v = \dfrac{\Delta V}{V_0};$

$$Z = \frac{2N_{contact}}{N_{particule}} \; ; \; I = \frac{v}{H_0}\sqrt{\frac{m}{P\overline{a}}}$$

Trouver le régime de l'état critique

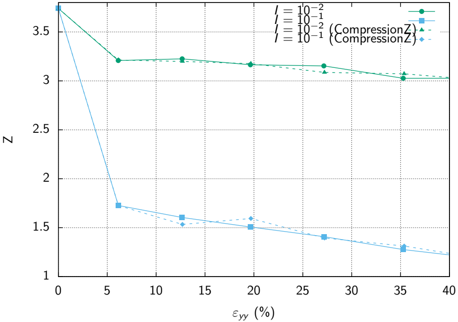

Figure 3 – Nombre de Coordination

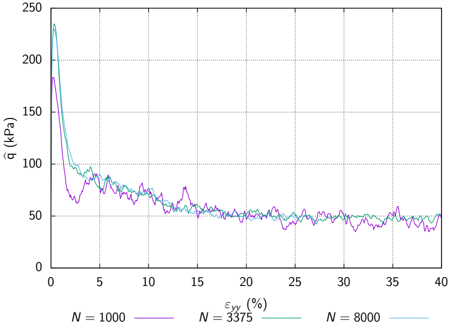

Figure 4 – Nombre de Particules

échantillon aléatoire par compression dans l'axe Z

État Rankine

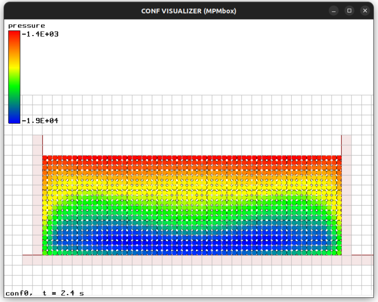

Figure 5 – Pression en bas

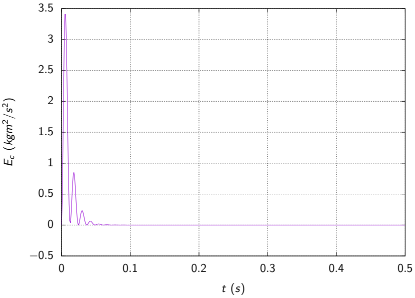

Figure 6 – Énergie cinétique

État Rankine

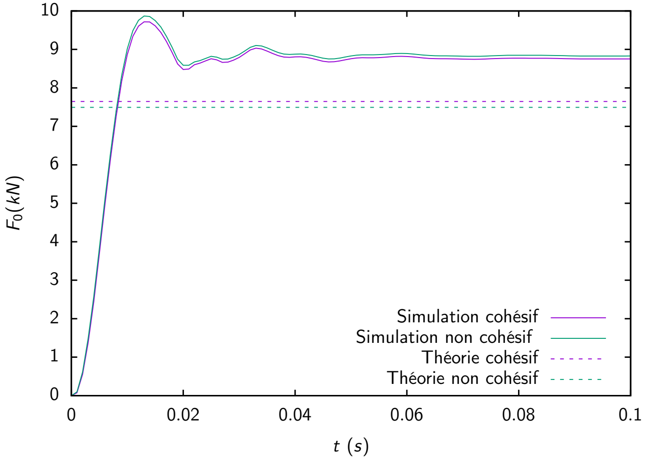

Figure 7 – Non cohésif

Paramètres principaux

Symbole	Paramètre	Valeur
L	Longueur	3 m
H	Hauteur	1 m
ρ	Densité	2700 $\mathrm{kg/m^3}$
E	Module de Young	1×10^9 Pa
ν	Coefficient de Poisson	0.2
φ	Angle de frottement	$25°$
ψ	Angle de dilatance	$\approx 0°$
v	Vélocité de déplacement	0.005 m/s
c	Cohésion	0 & 100 Pa

Table 1 – Paramètres du modèle Mohr-Coulomb

État Rankine - Théorie

Coefficient K : la relation entre la contrainte verticale et horizontal :

- Poussée active : $K_a = \dfrac{1 - \sin(\varphi)}{1 + \sin(\varphi)} = 0.406$
- Poussée passive : $K_p = 1/K_a = 2.464$
- État au repos : $K_0 = 1 - \sin(\varphi) = 0.577$

La somme de pression F(kN) appliqué sur le mur :

Sans cohésif :

$$F_a = \frac{1}{2}\gamma H^2 K_a = 5.376861$$

$$F_a = \frac{1}{2}\gamma H^2 K_p = 32.619458$$

$$F_0 = \frac{1}{2}\gamma H^2 K_0 = 7.647$$

Cohésif :

$$F_a = \frac{1}{2}\gamma H^2 K_a - 2cH\sqrt{K_a} = 5.249425$$

$$F_p = \frac{1}{2}\gamma H^2 K_p + 2cH\sqrt{K_p} = 32.93334$$

$$F_0 = \frac{1}{2}\gamma H^2 K_p + 2cH\sqrt{K_0} = 7.495$$

État Rankine - Pression Active

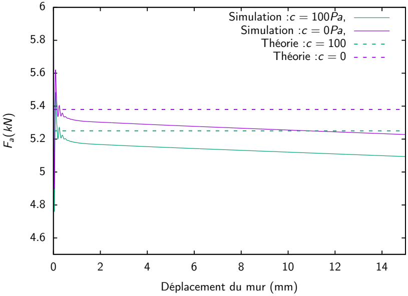

Figure 8 – Pression active $v = 0.005 = const$

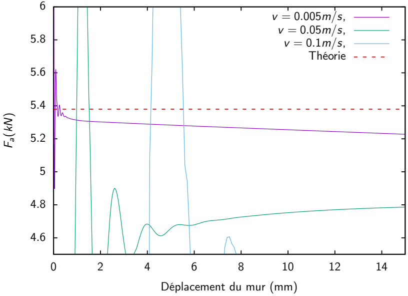

Figure 9 – Pression active $c = 0 = const$

État Rankine - Pression Passive

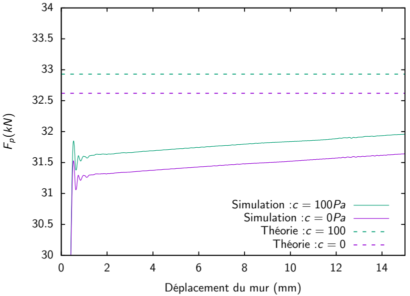

Figure 10 – Pression passive
$v = 0.005 = const$

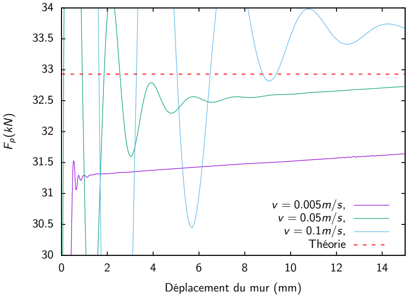

Figure 11 – Pression passive
$c = 0 = const$