Διατμητική αστοχία:

Διάτμηση → αστοχία

Μονοαξονική συμπίεση/παραμόρφωση → όχι αστοχία.

κριτήρια αστοχίας?? ⇝ τι ελέγχουν;;

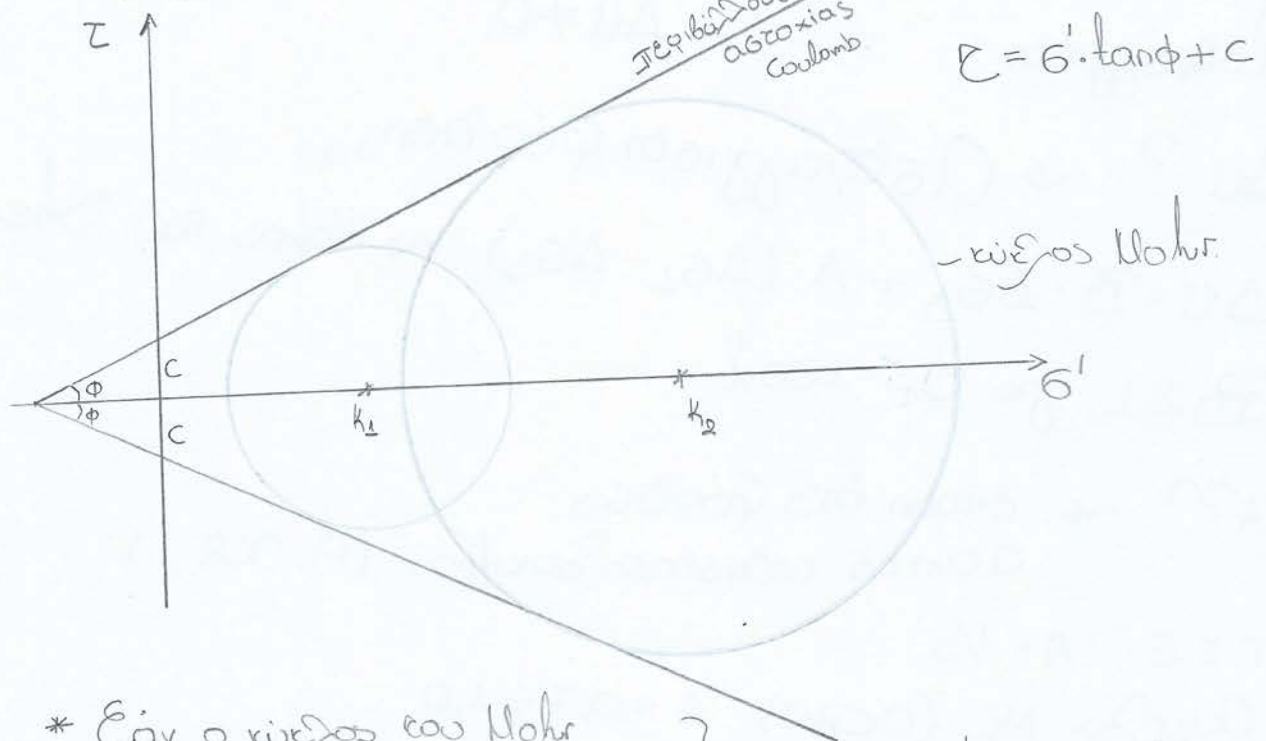
$$\underset{\sim}{\sigma} = \underset{\sim}{C}^{ep} : \underset{\sim}{\varepsilon}$$

$\underset{\sim}{C}^{ep}$: ελαστοπλαστικό μητρώο δυσκαμψίας

* Κριτήριο Mohr - Coulomb.

κύκλος του Mohr : Mohr ⇝ Γερμανός Π.Μ. (1835-1918)

Περιβάλλουσα Coulomb: Coulomb ⇝ Γάλλος Φ. (1736-1806)

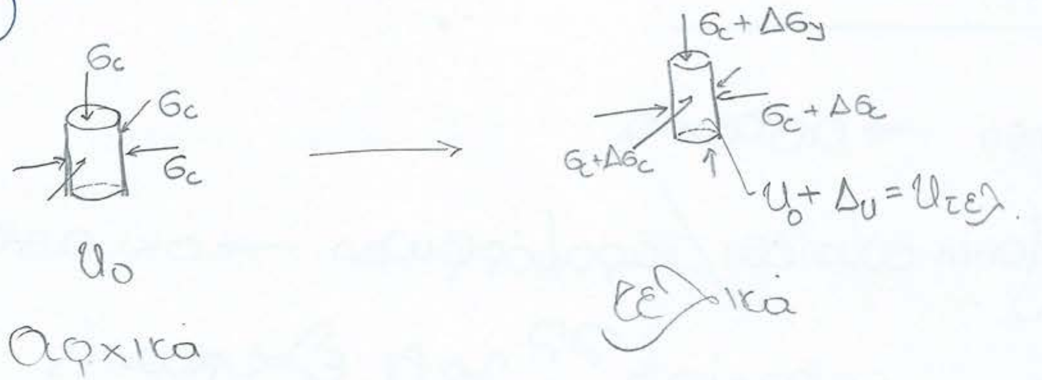


* Εάν ο κύκλος του Mohr εφάπτεται στην περιβάλλουσα Coulomb } ⇝ το υλικό σημείο αστοχεί

* Εάν ο κύκλος του Mohr εσωτερικεύεται της περιβάλλουσας Coulomb } → το υλικό σημείο ΔΕΝ αστοχεί ⇒ συμπεριφέρεται ελαστικά

* Εάν ο κύκλος του Mohr τέμνει την περιβάλλουσα Coulomb } ⇒ Αδύνατον!

Τριαξονική συμπίεση:



σ_c: πίεση κυψέλης.

Συνθετέστερη Περίπτωση: $\Delta\sigma_c = 0$

$u_0 \overset{?}{=} 0$ (θα πρέπει να ελέγχεται).

Στραγγισμένη φόρτιση: $\Delta u = 0$.

Αστράγγιστη " : $\Delta u \neq 0$.

Δu ? → αστράγγιστη φόρτιση;;;

$\Delta u = B \cdot \Delta\sigma_3 + A \cdot (\Delta\sigma_1 - \Delta\sigma_3)$ → Νόμος του Skempton

$B \approx 1$ για $S_r = 100\%$.

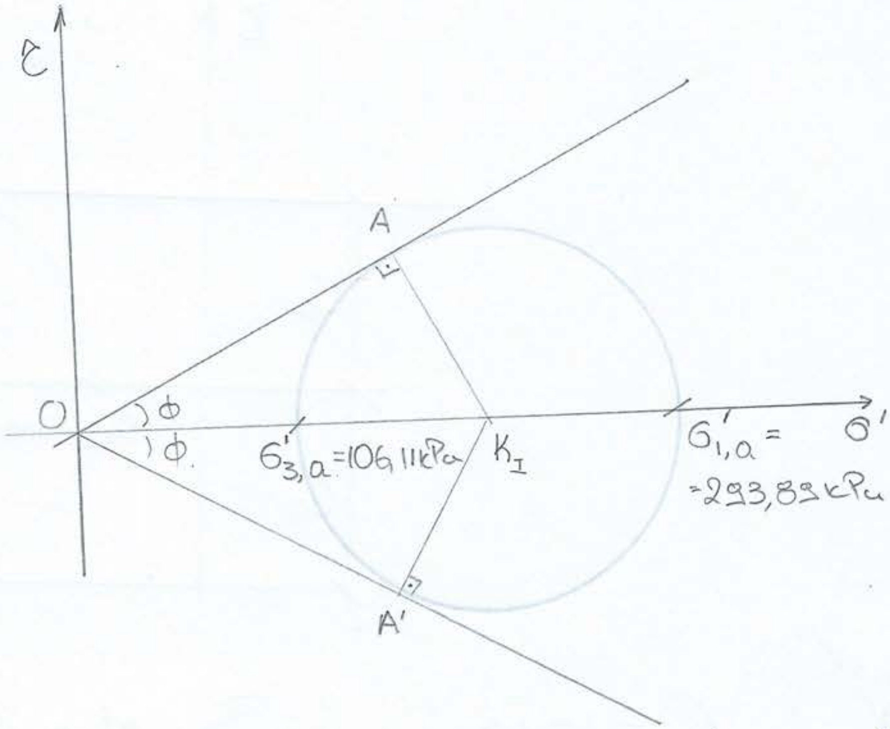
A?? → ένταση της φόρτισης
αρχική κατάσταση δοκιμίου (D_r, OCR, ...)

Γ.Ι.Ε: $A = 1/3$.

άργιλοι NC (OCR=1): $A = 0,7 \div 1,0$

" OC : $A = -0,3 \div 0,2$.

Άσκηση 4:



$$\sigma_c = \sigma'_c = 200\,kPa$$

$$u_0 = \sigma_c - \sigma'_c = 0$$

$$c = 0$$

$$\varphi = 28^\circ$$

$$A_a = 0,5$$

α) $S_u = ?$

$C_u = ?$

$$\sigma_{1,0} = \sigma_c$$

$$\sigma_{1,a} = \sigma'_{1,a} + u_a \Rightarrow \sigma'_{1,a} = \sigma_{1,a} - 0,5\cdot\Delta\sigma_1 = 0,5\cdot(\sigma_{1,a} + \sigma_{1,0})$$

$$\sigma_{3,0} = \sigma_c$$

$$\sigma_{3,a} = \sigma'_{3,a} + u_a \Rightarrow \sigma'_{3,a} = \sigma_{3,a} - 0,5\cdot\Delta\sigma_1 = \sigma_{3,a} - 0,5\cdot(\sigma_{1,a} - \sigma_{1,0})$$

$$\Delta u = \Delta\sigma_3\cdot B + A\cdot(\Delta\sigma_1 - \Delta\sigma_3) = A\cdot\Delta\sigma_1$$

$$u_a = u_0 + \Delta u = A\cdot\Delta\sigma_1 = 0,5\cdot\Delta\sigma_1$$

$$\sigma'_{1,a} = 0,5\cdot\sigma_{1,a} + 0,5\cdot\sigma_c = \sigma_{1,a} - 0,5\cdot\Delta\sigma_1$$

$$\sigma'_{3,a} = \sigma_{3,a} - 0,5\cdot\Delta\sigma_1$$

$$(OK_I) = \frac{\sigma'_{1,a} + \sigma'_{3,a}}{2} = \frac{\sigma_{1,a} - 0,5\cdot\Delta\sigma_1 + \sigma_{3,a} - 0,5\cdot\Delta\sigma_1}{2} = \frac{\sigma_{1,a} + \sigma_{3,a}}{2} - 0,5\cdot\Delta\sigma_1$$

$$(AK_I) = \frac{\sigma'_{1,a} - \sigma'_{3,a}}{2} = \frac{\sigma_{1,a} - \sigma_{3,a}}{2} = \frac{\Delta\sigma_1}{2}$$

$$(OK_I) = \sigma_c + \frac{\Delta\sigma_1}{2} - 0,5\cdot\Delta\sigma_1 = \sigma_c = 200\,kPa$$

$$\sin\phi = \frac{(AK_I)}{(OK_I)} = \frac{\frac{\Delta\sigma_1}{2}}{200} \Rightarrow \Delta\sigma_1 = 187,79\,kPa$$

$$\Delta u = 93,89\,kPa$$

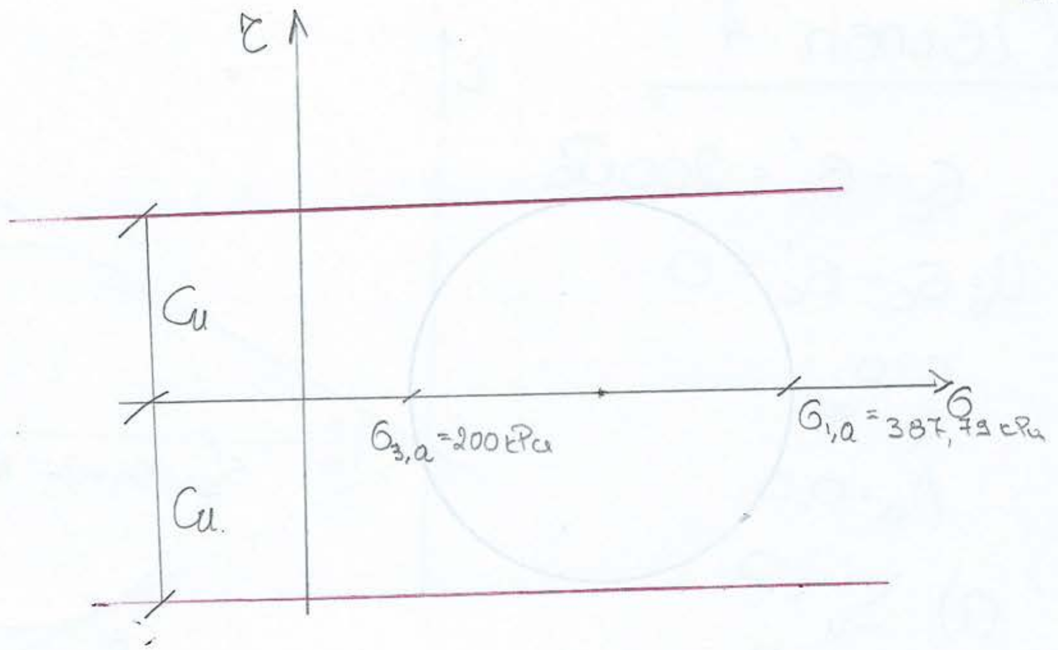
$$u_a = 93,89\,kPa$$

$$\sigma_{1,a} = \sigma_{1,0} + \Delta\sigma_1 = 387,79\,kPa$$

$$\sigma_{3,a} = 200\,kPa$$

$$\sigma'_{3,a} = \sigma_{3,a} - u_a = 106,11\,kPa$$

$$\sigma'_{1,a} = \sigma_{1,a} - u_a = 293,89\,kPa$$



Αρχικές τάσεις

c_u = αστράγγιστη διατμητική αντοχή = S_u.

$$c_u = \frac{\sigma_{1,a} - \sigma_{3,a}}{2} = \frac{387,79 - 200}{2} = 93,89 \text{ kPa}$$

Άσκηση 28.3

$\sigma_3' = \sigma_c' = 300kPa$

$\sigma_{3_I}' = 150kPa$ $\qquad$ $\sigma_{3_{II}}' = 100kPa$

$c = 20kPa.$

$\varphi = 22^\circ$

I: - Αποφόρτιση από $\sigma_3' = 300kPa \xrightarrow{\sigma\varepsilon} \sigma_{3_I}' = 150kPa$

$$OCR = \frac{300}{150} = 2 \Longrightarrow A_{f,I} = 0,36.$$

II: Αποφόρτιση από $\sigma_3' = 300\ kPa \xrightarrow{\sigma\varepsilon} \sigma_{3,II}' = 100kPa.$

$$OCR = \frac{300}{100} = 3 \Longrightarrow A_{f,II} = 0,14.$$

$\Delta u_{f,I} = B \cdot \Delta\sigma_3 + A_{f,I}(\Delta\sigma_1 - \Delta\sigma_3) = 0,36 \cdot \Delta\sigma_1$

$\Delta u_{f,II} = 0,14 \cdot \Delta\sigma_1$

$u_{f,I} = \cancel{u_{0,I}}^{\,0} + \Delta u_{f,I} = 0,36 \cdot \Delta\sigma_1$

$u_{f,II} = \cancel{u_{0,II}}^{\,0} + \Delta u_{f,II} = 0,14\Delta\sigma_1$

$K_a = \tan^2\left(45^\circ - \frac{\varphi}{2}\right) = 0,455$

$\sigma_{3,a}' = \sigma_{1,a}' \cdot K_a - 2c\sqrt{K_a}$

I: $(\sigma_{c_I} - u_{f,I}) = (\sigma_{c_I} + \Delta\sigma_{1,I} - u_{f,I}) \cdot K_a - 2c\sqrt{K_a}$

$(150 - 0,36\Delta\sigma_{1,I}) = (150 + 0,64 \cdot \Delta\sigma_{1,I}) \cdot K_a - 2 \cdot 20 \cdot \sqrt{K_a}$

$\Delta\sigma_{1,I} = 166,98\ kPa$

$\sigma_{1,a} = \sigma_{c_I} + \Delta\sigma_{1,I} = 150 + 166,98 = 316,98\,kPa$ // $u_{f,I} = 0,36 \cdot \Delta\sigma_{1,I} = 60,11\,kPa$

II: $(\sigma_{c,II} - u_{f,II}) = (\sigma_{c,II} + \Delta\sigma_{1,II} - u_{f,II}) \cdot K_a - 2c\sqrt{K_a}$

$(100 - 0,14\,\Delta\sigma_1)_{II} = (100 + 0,86\,\Delta\sigma_1)_{II} \cdot K_a - 2 \cdot 20 \cdot \sqrt{K_a} \Longrightarrow \Delta\sigma_{1,II} = 153,38\,kPa$

$$\sigma_{1,a_{II}} = \sigma_{c_{II}} + \Delta\sigma_{1,II} = 100 + 153,38 = 253,38\,kPa$$

$$u_{f,II} = 0,14 \cdot \Delta\sigma_1 = 0,14 \cdot 153,38 = 21,47\,kPa$$

Άσκηση 28.4.

$c = 0$

$\varphi = 30^\circ$

I. Ισότροπη βάση $\sigma_c = \sigma_c' = 100\,kPa$

A: $\sigma_c = 100\,kPa$

$\sigma_c' = 100\,kPa$

$u_0 = 0.\ (= \sigma_c - \sigma_c')$

$\sigma_1 = \sigma_3 = 100\,kPa$

$\sigma_1' = \sigma_3' = 100\,kPa$

B: $\sigma_c = 100\,kPa$

$\sigma_c' = 100\,kPa$

$u_0 = 0.$

$\sigma_1 = \sigma_3 = 100\,kPa$

$\sigma_1' = \sigma_3' = 100\,kPa$

II: Ισότροπη θλίψη → αστράγγιστη φόρτιση.

A: $\Delta\sigma_c = 100\,kPa$

$u_1 = \cancel{u_0}^{\,0} + \Delta\sigma_c = \Delta\sigma_c = 100\,kPa$

$\sigma_1 = \sigma_3 = 200\,kPa\ (= \sigma_c + \Delta\sigma_c)$

$\sigma_1' = \sigma_3' = \sigma_1 - u_1 = \sigma_3 - u_1 = 100\,kPa$

B: $\Delta\sigma_c = 200\,kPa$

$u_1 = \cancel{u_0}^{\,0} + \Delta\sigma_c = \Delta\sigma_c = 200\,kPa$

$\sigma_1 = \sigma_3 = 300\,kPa$

$\sigma_1' = \sigma_3' = \sigma_1 - u_1 = \sigma_3 - u_1 = 100\,kPa$

III: Τριαξονική καταπόνηση:

$$K_a = \tan^2\left(45^\circ - \frac{\varphi}{2}\right) = \frac{1}{3}$$

$$\sigma_{3,a}' = \sigma_{1,a}' \cdot K_a - 2c\sqrt{K_a}$$

A: $\Delta u_A = B \cdot \cancel{\Delta\sigma_3}^{\,0} + A \cdot (\Delta\sigma_1 - \cancel{\Delta\sigma_3}^{\,0}) = A \cdot \Delta\sigma_1$

$\Delta u_A = A \cdot \Delta\sigma_{v,A}$

$u_2 = u_1 + \Delta u_A = 100 + A \cdot \Delta\sigma_{v,a}.$

$(\sigma_{3,a} - u_2) = (\sigma_{1,a} - u_2) \cdot K_a - \cancel{2c\sqrt{K_a}}^{\,0}$

για $A=1$ $(200 - 100 - A \cdot \Delta\sigma_{v,a}) = (200 + \Delta\sigma_{v,a} - A \cdot \Delta\sigma_{v,a} - 100) \cdot K_a$

$\Longrightarrow \Delta\sigma_{v,A} = 100\,kPa$

B: $\Delta u_B = A \cdot \Delta\sigma_1 = A \cdot \Delta\sigma_{v,B}$

$u_2 = u_1 + \Delta u_B = 200 + A \cdot \Delta\sigma_{v,B}$

$(\sigma_{3,a} - u_2) = (\sigma_{1,a} - u_2) \cdot K_a - \cancel{2c\sqrt{K_a}}^{\,0}$

$(300 - 200 - A \cdot \Delta\sigma_{v,B}) = (300 + \Delta\sigma_{v,B} - 200 - A \cdot \Delta\sigma_{v,B}) \cdot K_a$

$\Delta\sigma_{v,B} = 100\,kPa$