

WTNV101 - Triaxial compression test not drained with the model of Laigle and hydraulic coupling

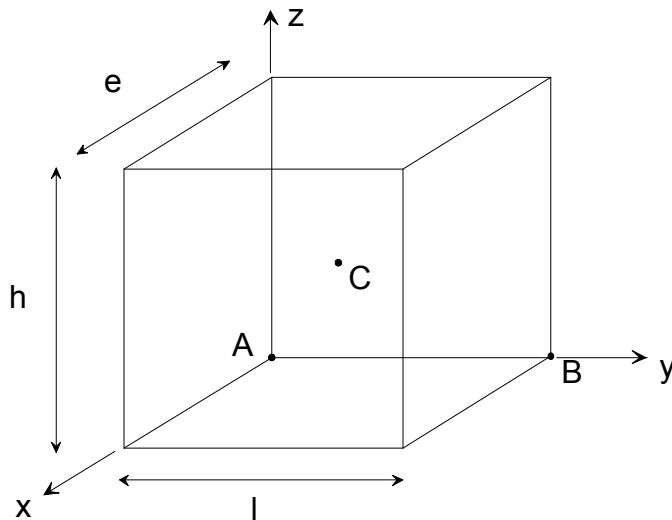
Summary

This test makes it possible to validate the model of Laigle with hydraulic coupling. It is about a triaxial compression test in not drained condition. The aspect not drained is modelled by a worthless voluminal deformation of the skeleton and the hydraulic coupling is taken into account, the sample is completely saturated, the incompressible skeleton and the fluid being supposed.

By reason of symmetry, one is interested only in the eighth of a sample subjected to a triaxial compression test. The level of containment is of 8MPa .

1 Problem of reference

1.1 Geometry



hauteur : $h = 1 \text{ m}$
largeur : $l = 1 \text{ m}$
épaisseur : $e = 1 \text{ m}$

Coordinates of the points (in meters):

	A	B	C	D
x	0.	0.	0.5	1.
y	0.	1.	0.5	1.
z	0.	0.	0.5	0.

1.2 Material property

$$E = 1500 \cdot 10^3 \text{ kPa}$$

$$\nu = 0,27$$

$$\gamma_{ult} = 0.132;$$

$$\gamma_e = 0.005;$$

$$m_{ult} = 2.0;$$

$$m_e = 7.0;$$

$$a_e = 0.65;$$

$$m_{pic} = 15.0;$$

$$a_{pic} = 0.5;$$

$$\eta = 0.45;$$

$$\xi = 0.25;$$

$$\gamma_{ejs} = 0.7;$$

$$\sigma_{p1} = 9.09 \cdot 10^6 \text{ Pa};$$

$$\sigma_{p2} = 23.05 \cdot 10^6 \text{ Pa};$$

1.3 Initial conditions, boundary conditions, and loading

1.3.1 Modeling coupled with hydraulics

Phase 1:

One brings the sample in a homogeneous state of effective stresses: $\sigma_{xx}^0 = \sigma_{yy}^0 = \sigma_{zz}^0$, by imposing the corresponding total pressure on the front, side right-hand side and higher faces and by imposing worthless water pressures everywhere. Displacements are blocked on the faces postpones ($u_x = 0$), side left ($u_y = 0$) and lower ($u_z = 0$).

Phase 2:

One maintains displacements blocked on the faces postpones ($u_x = 0$), side left ($u_y = 0$) and lower ($u_z = 0$). On all the faces, hydraulic flows are worthless.

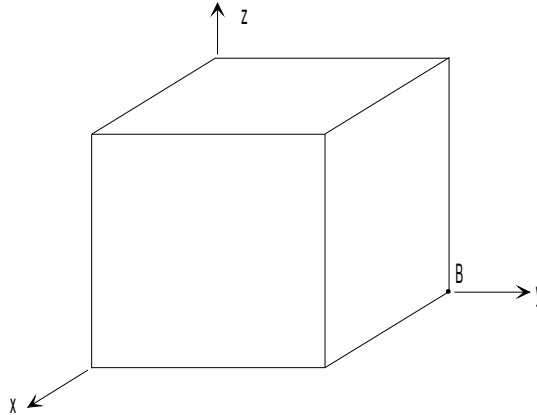
One applies a displacement forced to the higher face in order to obtain a deformation $\varepsilon_{zz} = -20\%$ (counted starting from the beginning of phase 2). On the front faces and side right-hand side, one imposes boundary conditions in total constraint:

$$\sigma.n = \sigma^0 (=8MPa)$$

2 Modeling A

2.1 Characteristics of modeling

3D :



Cutting: 1 in height, in width and thickness.

Loading of phase 1:

Confining pressure: $\sigma_{xx}^0 = \sigma_{yy}^0 = \sigma_{zz}^0 : -8 \text{ MPa}$.

Coefficient of biot: 1

UN_SUR_K water: 0

Modeling: 3D_HM

2.2 Characteristic of the grid

Many nodes: 20

Many meshes and types: 1 HEXA20 and 6 QUA8

2.3 Sizes tested and results

Localization	Sequence number	Constraint (MPa)	Aster
Not <i>D</i>	1	σ_{xx}	- 6.91788E+06
	2	σ_{xx}	- 5.44150E+06
	3	σ_{xx}	- 3.96513E+06
	4	σ_{xx}	- 2.64978E+06
	8	σ_{xx}	-8.68544E+06
	23	σ_{xx}	- 1.22666E+07
	1	σ_{yy}	- 6.91788E+06
	2	σ_{yy}	- 5.44150E+06
	3	σ_{yy}	- 3.96513E+06
	4	σ_{yy}	- 2.64978E+06
	8	σ_{yy}	- 8.68544E+06
	23	σ_{yy}	- 1.22666E+07
	1	σ_{zz}	- 1.01642E+07
	2	σ_{zz}	- 1.31170E+07
	3	σ_{zz}	- 1.60697E+07
	4	σ_{zz}	- 1.87406E+07
	8	σ_{zz}	- 3.21306E+07
	23	σ_{zz}	- 3.68000E+07
	1	pressure water	1.08211E+06
	2	pressure water	2.55849E+06

3 Summary of the results

This case test is a test of nonregression developed to validate the model of Laigle with hydraulic coupling.