

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

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### Abstract

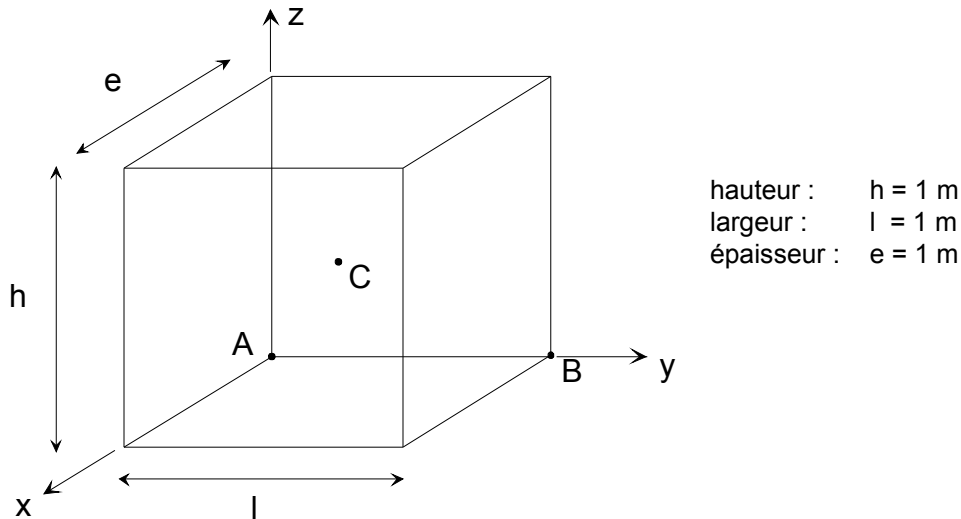
This test makes it possible to validate the model of Laigle with hydraulic coupling. It is about a triaxial compression test in not drained condition. The aspect not drained is modelled by a voluminal strain null squelette and the hydraulic coupling is taken into account, the sample is completely saturated, the incompressible squelette 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  $8\text{ MPa}$ .

## 1 Problem of reference

### 1.1 Geometry



Coordinated of the points (in meters):

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>x</i>	0.	0.	0.5	1.
<i>y</i>	0.	1.	0.5	1.
<i>z</i>	0.	0.	0.5	0.

### 1.2 Material property

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

$$\nu = 0,27$$

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

$$\gamma_e = 0.005;$$

$$m_{ult} = 2.0;$$

$$m_e = 7.0;$$

$$a_e = 0.65;$$

$$m_{pic} = 15.0;$$

$$a_{pic} = 0.5;$$

$$\eta = 0.45;$$

$$\xi = 0.25;$$

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

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

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

## 1.3 Initial conditions, boundary conditions, and loading

### 1.3.1 Modelization 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 stagnation pressure on the front, side right and higher sides and by imposing null water pressures everywhere. Displacements are blocked on the sides postpones ( $u_x = 0$ ), side left ( $u_y = 0$ ) and lower ( $u_z = 0$ ).

#### Phase 2:

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

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

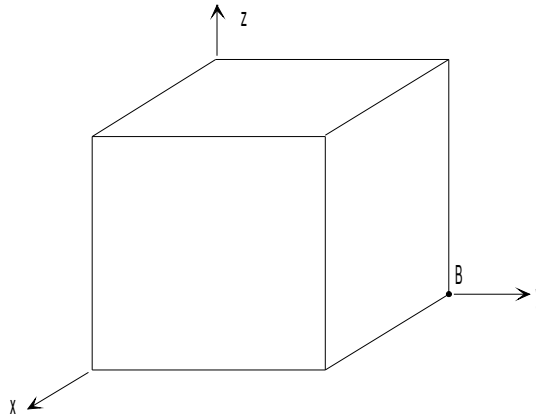
$$\sigma.n = \sigma^0 (= 8MPa)$$

## 2 Modelization A

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### 2.1 Characteristic of the modelization

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 of water: 0

Modelization: 3D\_HM

### 2.2 Characteristic of the mesh

Many nodes: 20

Number of meshes and types: 1 HEXA20 and 6 QUA8

## 2.3 Quantities tested and results

Localization	Sequence number	Forced ( MPa )	Aster
Point <i>D</i>	1	$\sigma_{xx}$	- 6.91788E+06
	2	$\sigma_{xx}$	- 5.44150E+06
	3	$\sigma_{xx}$	- 3.96513E+06
	4	$\sigma_{xx}$	- 2.64978E+06
	8	$\sigma_{xx}$	-8.68544E+06
	23	$\sigma_{xx}$	- 1.22666E+07
	1	$\sigma_{yy}$	- 6.91788E+06
	2	$\sigma_{yy}$	- 5.44150E+06
	3	$\sigma_{yy}$	- 3.96513E+06
	4	$\sigma_{yy}$	- 2.64978E+06
	8	$\sigma_{yy}$	- 8.68544E+06
	23	$\sigma_{yy}$	- 1.22666E+07
	1	$\sigma_{zz}$	- 1.01642E+07
	2	$\sigma_{zz}$	- 1.31170E+07
	3	$\sigma_{zz}$	- 1.60697E+07
	4	$\sigma_{zz}$	- 1.87406E+07
	8	$\sigma_{zz}$	- 3.21306E+07
	23	$\sigma_{zz}$	- 3.68000E+07
	1	pressure water	1.08211E+06
	2	pressure water	2.55849E+06

## 3 Summary of the results

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