
WTNV129 - Triaxial compression test not drained with the model of Hoek-Brown modified in total stresses

Summarized

This test makes it possible to validate the elastoplastic constitutive law of Hoek-Brown modified in total stresses is `HOEK_BROWN_TOT` 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. For reasons of symmetry, one is interested only in the eighth of a sample subjected to a triaxial compression test.

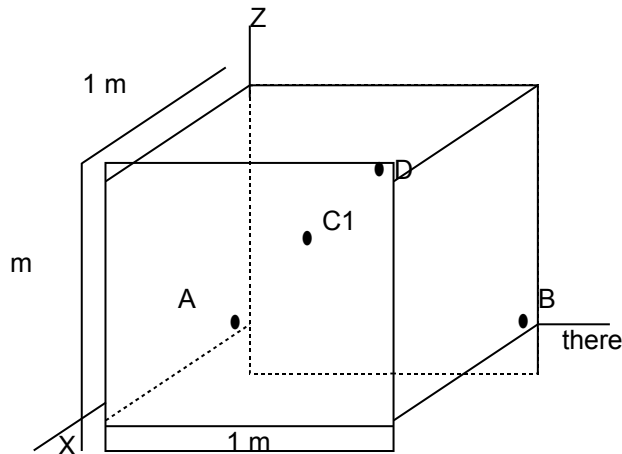
The level of containment applied is of 5 MPa .
It is about a test of non regression.

The modelization A is a modelization of the type `3D_HM` with integration with Gauss points.
The modelization B is a modelization of the type `3D_HMS` with integration with Gauss points or the nodes (see Doc. [R7.01.10]).

1 Problem of reference

1.1 Geometry

One considers a cube of dimension here $1\text{m} \times 1\text{m} \times 1\text{m}$.



Coordinates of the points (in m):

	<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		1

1.2 Properties of the material

Parameters of the elastic constitutive law:

$$E = 4500 \text{ MPa}$$

$$\nu = 0.3$$

Parameters of the model of Hoek-Brown modified:

$$\gamma^{rup} = 0.005$$

$$\gamma^{res} = 0.017$$

$$(S \sigma_c^2)^{end} = 225 \text{ MPa}^2$$

$$(S \sigma_c^2)^{rup} = 482.5675 \text{ MPa}^2$$

$$(m \sigma_c^2)^{end} = 13.5 \text{ MPa}$$

$$(m \sigma_c^2)^{rup} = 83.75 \text{ MPa}$$

$$\beta = 3 \text{ MPa}$$

$$\phi^{rup} = 15^\circ$$

$$\phi^{res} = 30^\circ$$

$$\alpha = 3.3$$

1.3 Initial conditions, in extreme cases and loading

the test breaks up into two phases:

- 1) Initially, one brings the sample in a homogeneous state $\sigma_{xx}^0 = \sigma_{yy}^0 = \sigma_{zz}^0$. For that, the corresponding confining pressure is imposed on the front sides ($x = 1$), side right ($y = 1$) and higher ($z = 1$), the water pressures are taken null everywhere and the displacements are taken null on the sides postpones ($u_x|_{x=0} = 0$), side left ($u_y|_{y=0} = 0$) and lower ($u_z|_{z=0} = 0$).
- 2) Once the homogeneous state obtained, displacements are maintained blocked on the sides postpones, side left and lower. The hydraulic flux are null on all the sides. A displacement is forced on the upper face ($u_z(t)$) in order to obtain a strain ε_{zz} equal to -25% starting from the beginning of the second phase, by constant increments of strain $\Delta\varepsilon_{zz} = -2.5E-4$. On the front sides and side right, one imposes boundary conditions in total stress: $\sigma \cdot n = \sigma^0 = -5MPa$.

2 Modelization A

2.1 Characteristic of the modelization

Modelization 3D

Cutting: 1m in height, 1m width

Loading of phase 1: $\sigma_{xx}^0 = \sigma_{yy}^0 = \sigma_{zz}^0 = -5 \text{ MPa}$ (confining pressure)

Boundary conditions: $u_x|_{x=0} = u_y|_{y=0} = u_z|_{z=0} = 0$

Coefficient of Biot: 1

UN_SUR_K of water: 0 (coefficient of incompressibility of water)

Modelization: 3D_HM

2.2 Characteristic of the mesh

Many nodes: 20

Number of meshes and types: 6 QUAD8 and 1 HEXA20

2.3 Quantities tested and results

Localization	Sequence number	Forced (MPa)	Code_Aster
Point <i>D</i>	16	σ'_{xx}	1,14121
	28	σ'_{xx}	1,94894
	36	σ'_{xx}	1,49781
	44	σ'_{xx}	-2,69068
	52	σ'_{xx}	-1,24045 101
	80	σ'_{xx}	-3,72255 101
	16	σ'_{yy}	1,14121
	28	σ'_{yy}	1,94894
	36	σ'_{yy}	1,49781
	44	σ'_{yy}	-2,69068
	52	σ'_{yy}	-1,24045 101
	80	σ'_{yy}	-3,72255 101
	16	σ'_{zz}	-1,74245 101
	28	σ'_{zz}	-2,23066 101
	36	σ'_{zz}	-2,62168101
	44	σ'_{zz}	-2,95247 101
	52	σ'_{zz}	-3,24666 101
	80	σ'_{zz}	-5,2947 101
	16	Pressure water	6,14121
	44	Pressure water	2,30931
	80	Pressure water	-3,2225 101

3 Modelization B

3.1 Characteristic of the modelization

Modelization 3D

Cutting: 1m in height, 1m width

Loading of phase 1: $\sigma_{xx}^0 = \sigma_{yy}^0 = \sigma_{zz}^0 = -5 \text{ MPa}$ (confining pressure)

Boundary conditions: $u_x|_{x=0} = u_y|_{y=0} = u_z|_{z=0} = 0$

Coefficient of Biot: 1

UN_SUR_K of water: 0 (coefficient of incompressibility of water)

Modelization: 3D_HMS

3.2 Characteristics of the mesh

Many nodes: 20

Number of meshes and types: 6 QUAD8 and 1 HEXA20

3.3 Quantities tested and results

Localization	Sequence number	Forced (MPa)	Code_Aster
Point <i>D</i>	16	σ'_{xx}	1,14121
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	80	σ'_{xx}	-3,72255 101
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	36	σ'_{yy}	1,49781
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	52	σ'_{yy}	-1,24045 101
	80	σ'_{yy}	-3,72255 101
	16	σ'_{zz}	-1,74245 101
	28	σ'_{zz}	-2,23066 101
	36	σ'_{zz}	-2,62168 101
	44	σ'_{zz}	-2,95247 101
	52	σ'_{zz}	-3,24666 101
	80	σ'_{zz}	-5,2947 101
	16	Pressure water	6,14121
	44	Pressure water	2,30931
	80	Pressure water	-3,2225 101

4 Summary of the results

This case test are a test of NON-regression developed to validate the model of Hoek-Brown modified in total stresses, HOEK_BROWN_TOT with hydraulic coupling.

One 3D_HM finds the same results with the two modelizations and 3D_HMS.