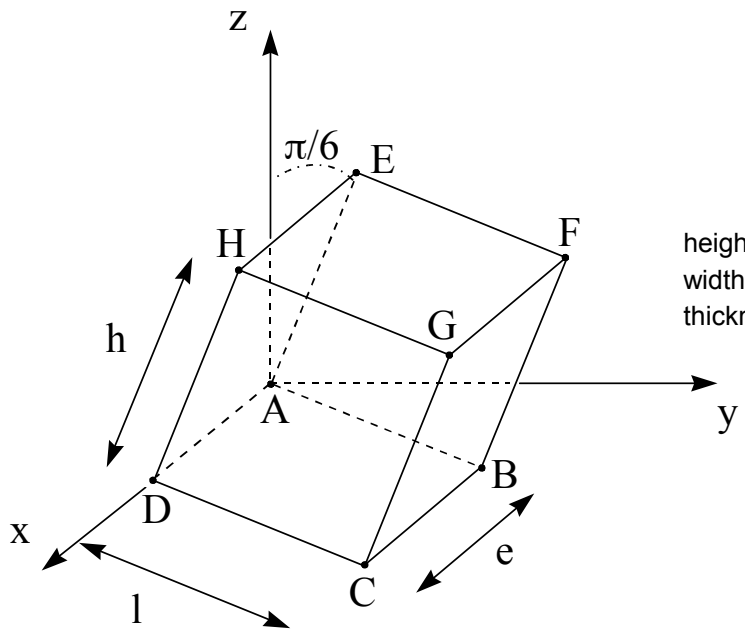
SSNV155 - Triaxial compression test drained on a turned sample of an angle of – PI/6 compared to axis X with model CJS (level 2)

Summary

This test makes it possible to supplement the validation of level 2 of model CJS already approached in the case test SSNV136. It corresponds to the digital simulation of the same test (drained triaxial compression test) on same material but with a different geometry. The sample tested is thus turned of an angle of $-\pi/6$ compared to the axis x. Consequently, directions x, y, z are not any more principal directions. That makes it possible to validate the operations of digital integration of the model which act on the nondiagonal terms of the tensors of the strains and the stresses.
As for the case test SSNV136, calculations are carried out only on the solid part of the ground, without hydro-mechanical coupling. 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 $400\,kPa$.
It is about a test of nonregression. The got results are compared with those provided by a calculation *Aster* with a grid whose axes of symmetry are the axes of coordinates. They correspond to them exactly with the rotation of angle $-\pi/6$ near.

1 Problem of reference

1.1 Geometry



height: $h=1\,m$
width: $l=1\,m$
thickness: $e=1\,m$

Coordinates of the points (in meters):

	A	B	C	D
x	0.	0.	1.	1.
y	0.	0.86602540378445	0.86602540378445	0.
z	0.	– 0.5	– 0.5	0.

1.2 Material property

$E=35{,}6616541\,10^{3}\,kPa$
$\nu=0{,}15037594$
Parameters CJS2: $\beta=-0{,}55$ $\gamma=0{,}82$ $R_m=0{,}289$ $R_c=0{,}265$ $n=0{,}6$
$K_o^p=25{,}5\,10^{3}\,kPa$ $A=0.25\,kPa$ $P_a=-100\,kPa$

1.3 Initial conditions, boundary conditions, and loading

Phase 1:
One brings the sample in a homogeneous state, by imposing the corresponding confining pressure on the faces $EFGH$, $CDHG$ and $BCGF$. Normal displacements are blocked on faces ABCD, $ADHE$ and $ABFE$.

Phase 2:
One maintains displacements normal blocked on the faces $ABCD$, $ADHE$ and $ABFE$; as well as the confining pressure on the faces $CDHG$ and $BCGF$. One applies a normal displacement imposed to the face $EFGH$, in order to obtain a deformation according to the normal direction equalizes with -20% (counted starting from the beginning of phase 2).

2 Reference solution

2.1 Method of calculating used for the reference solution

By taking account of the rotation of angle of the sample, results got by a calculation *Aster* with a grid whose axes of symmetry are the axes of coordinates, are used as reference.

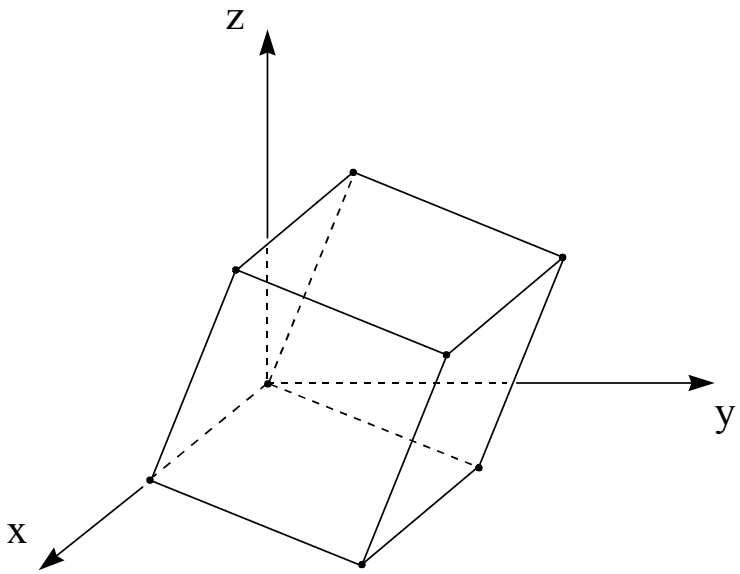
2.2 Results of reference

Constraints σ_{xx}, σ_{yy}, σ_{zz} and σ_{yx} at the point A.

3 Modeling A

3.1 Characteristics of modeling

3D :



Cutting: 1 in height, in width and thickness.

Loading of phase 1:
Confining pressure: $-400\,kPa$.
Level 2 of model CJS

3.2 Characteristic of the grid

Many nodes: 8
Many meshs and types: 1 HEXA8 and 6 QUA4

3.3 Sizes tested and results

For containment: $-400\,kPa$

Localization	Sequence number	axial deformation ε_{zz} (%)	Constraint (kPa)	Reference	*Aster*	% difference
Not A		– 2.0%	σ_{xx}	– 400.0	– 400,000	< 10^{-6}
		– 10.0%	σ_{xx}	– 400.0	– 400,000	< 10^{-6}
		– 20.0%	σ_{xx}	– 400.0	– 400,000	< 10^{-6}
		– 2.0%	σ_{yy}	– 54.0613	– 54.061292	< 10^{-6}
		– 10.0%	σ_{yy}	– 63.5278	– 63.527785	< 10^{-6}
		– 20.0%	σ_{yy}	– 65.0989	– 65.098864	< 10^{-6}
		– 2.0%	σ_{zz}	– 82.1839	– 82.18387	< 10^{-6}
		– 10.0%	σ_{zz}	– 110,583	– 110.58335	< 10^{-6}
		– 20.0%	σ_{zz}	– 115,297	– 115.29659	< 10^{-6}
		– 2.0%	σ_{yz}	– 24.3549	– 24.354871	< 10^{-6}
		– 10.0%	σ_{yz}	– 40.7513	– 40.751319	< 10^{-6}
		– 20.0%	σ_{yz}	– 43.4725	– 43.472508	< 10^{-6}

4 Summary of the results

The results are in perfect agreement with those of the reference.