SSNA109 - Tensile test with the model VISC_CIN2_CHAB

Summary:

This test of nonlinear quasi-static mechanics makes it possible to validate the model VISC_CIN2_CHAB in 2D in the case of an axisymmetric test-tube (homogeneous stress and strain state) subjected to a simple tensile test. The characteristic of the test (the model VISC_CIN2_CHAB being tested in addition) comes from the coefficients, which were identified on steel $10CD9-10$ with $545°C$, and for which the initial threshold of plasticity is very weak.

The modeling of the test-tube is carried out with an element 2D (QUA4).

1 Problem of reference

1.1 Geometry

The geometry is selected voluntarily simple, to translate a stress and strain state homogeneous, as it is the case in uniaxial traction. It is here about an element of volume represented by a square on side 0.01mm . Modeling is axisymmetric, and traction is done with imposed deformation.

1.2 Properties of material

The characteristics are the following ones:

Keyword ELAS :

YOUNG = $143006.0\,MPa$
NAKED = 0.33

Keyword CIN2_CHAB :

R0 = $0.01893467592\,MPa$
B = 0.2709891156
R_I = $0.04392231516\,MPa$
K = 2.751852265
W = -1.157794066
G1_0 = 211.5567568
G2_0 = 0.9105873193
C1_I = 3946.594428
C2_I = 49.33873423
A_I = 10.60515818

Keyword LEMAITRE

EXP_N = 14.97577311
ETA = 278.5754646
UN_SUR_K = $1/278.5754646$
UN_SUR_M = 0.0

1.3 Boundary conditions and loadings

$DY=0$ on the lower side
$DX=0$ on the left side

DY imposed on the top, such as:
$DY(t)=(EPS_{final}*H)/tmax*t$
With $EPS_{final}=0.01$
$H=0.01\,mm$
$Tmax=10000\text{s}$
This corresponds at a speed of deformation imposed of $0.01/10000=1.\text{E}-6/s$

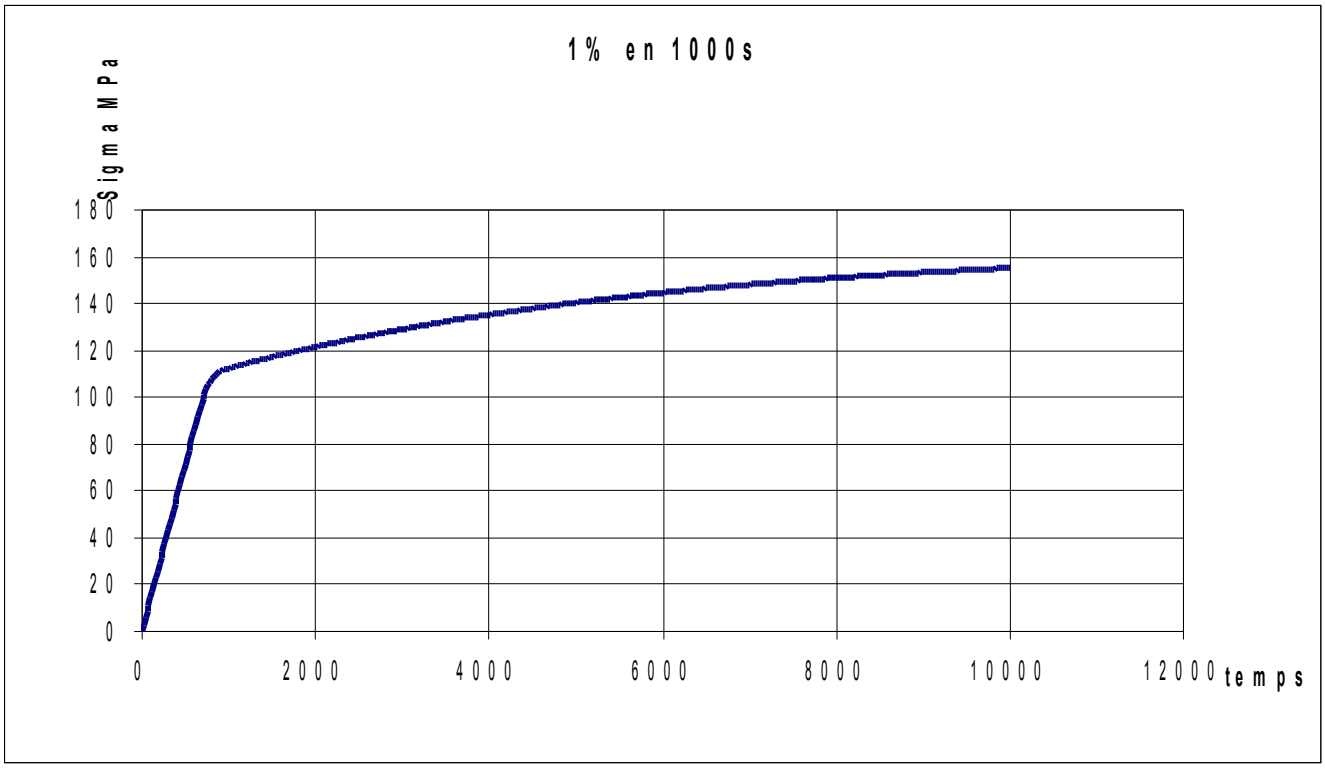
1.4 Initial conditions

Worthless constraints and deformations.

2 Reference solution

2.1 Method of calculating

Digital solution calculated by SIDOLO:



2.2 Sizes and results of reference

Evolution of the uniaxial component of the constraints according to the time (or of the deformation which is homothetic for him). This value is tested (MPa) at various moments:

Moment	Reference	*Aster*	% difference
100.2	14,315	14,329	0.01
1002	112,471	111,903	-0.5
10000	155,233	155,084	0.1

2.3 Uncertainties on the solution

Precision of the codes.

3 Modeling A

3.1 Characteristics of modeling

One uses 100 increments of identical sizes to calculate the time interval ($0,10000\mathrm{s}$).

3.2 Characteristics of the grid

Many nodes: 4
Many meshs and types: 1 (QUAD4)

3.3 Sizes tested and results

Constraints (MPa) at various moments:

Moment	Reference	*Aster*	% difference
100.2	14,315	14,329	0.01
1002	112,471	111,903	– 0.5
10000	155,233	155,084	0.1

3.4 Remarks

The noted variation is due to the discretization in time, which is relatively coarse. Calculation from reference (SIDOLO) is obtained with 500 increments.
By taking 500 increments, one obtains a maximum change of 0.06% .

4 Summary of the results

Results got by *Code_Aster* are close to the reference solution since the variation with the reference solution is lower than 0.5% . This variation is due to the discretization in time.