SSNA109 - Traction test with the model VISC_CIN2_CHAB

Summarized:

This test of nonlinear quasi-static mechanics makes it possible to the model validate VISC_CIN2_CHAB in 2D the case of an axisymmetric test-tube (stress state and of homogeneous strain) subjected to a simple traction test. The characteristic of 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 modelization of the test-tube is realized with an element 2D (QUA4).

1 Problem of reference

1.1 Geometry

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

1.2 Properties of the material

the characteristics are the following ones:

Key word ELAS :

YOUNG = $143006.0\,MPa$
NU = 0.33

Key word 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

Key word 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 an imposed strainrate of $0.01/10000=1.\text{E}-6/s$

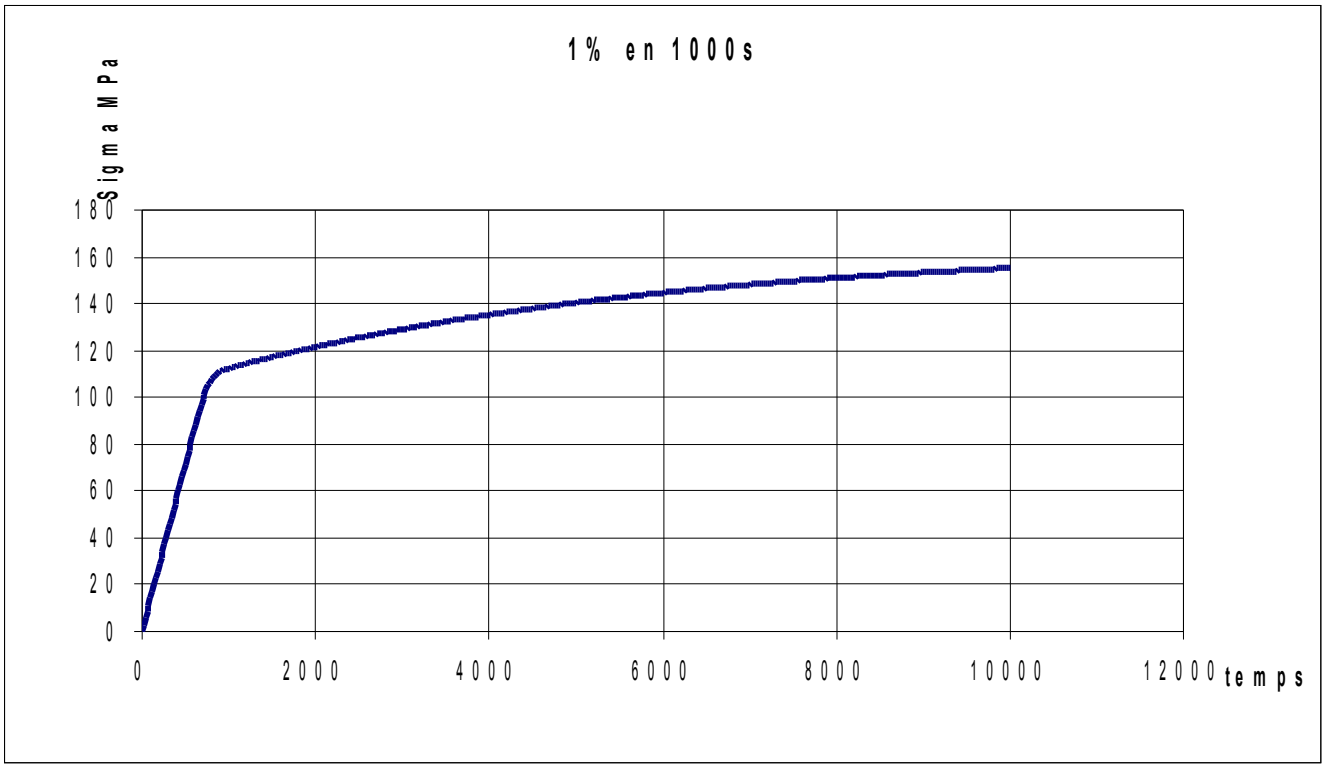
1.4 Forced

Initial conditions and null strains.

2 Reference solution

2.1 numerical

Method of calculating Solution calculated by SIDOLO:



2.2 Quantities and results of reference

Evolution of the uniaxial component of the stresses according to the time (or of the strain which is homothetic for him). One tests this value (MPa) at various times:

Time	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

Accuracy of the codes.

3 Modelization A

3.1 Characteristic of the modelization

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

3.2 Characteristics of the mesh

Many nodes: 4
Number of meshes and types: 1 (QUAD4)

3.3 Quantities tested and results

Forced (MPa) at various times:

Time	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. The computation 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

the 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.