
SSND111 - Effect of memory in a cyclic test

Summary:

One carries out, on a problem reduced to the material point, several cycles of traction and compression, until stabilization of the answer in terms of imposed stress-strain curve. The taking into account of the effect of memory of greatest work hardening modifies the stabilized curve. This test highlights this effect of memory for the behaviors of Code_Aster which make it possible to model it.

Modeling a: this modeling makes it possible to validate the behaviors `VISCOCHAB` and `VISC_CIN2_MEMO` with `SIMU_POINT_MAT`.

1 Problem of reference

1.1 Geometry

It is about a material point, representative of a stress and strain state homogeneous.

1.2 Properties of materials

1.2.1 Coefficients relating to isotropic elasticity

The Poisson's ratio: $\nu = 0.33$,
Young modulus: $E = 184000.MPa$

1.2.2 Coefficients of the law of flow VISCOCHAB

```
VISCOCHAB=_F (Q_M=270.5400631,  
              G_R=0.0,  
              ETA=0.135  
              C1=1.823924371 E5,  
              G2_0=178.6588221,  
              B=51.31782615,  
              K_0=156.860705,  
              K=97.82907013,  
              N=6.835707681,  
              C2=1.66796546 E4,  
              A_I=0.5817571069,  
              G1_0=3079.148555,  
              MU=10.00231083,  
              Q_0=-86.18795281,)
```

1.2.3 Coefficients of the law of work hardening VISC_CIN2_MEMO

```
MEMO_ECRO=_F (DRIVEN = 10.00231083,  
              Q_M = 270.5400631,  
              Q_0 = -86.18795281,  
              ETA = 0,135),  
CIN2_CHAB=_F (B=51.31782615,  
              C2_I=1.66796546 E4,  
              C1_I=1.823924371 E5,  
              G2_0=178.6588221,  
              G1_0=3079.1485551,  
              R_I=0.0,  
              W=0.0,  
              R_0=97.829070131,  
              K=1.0,  
              A_I=0.58175710691),  
LEMAITRE=_F (UN_SUR_K=6.375082911937697 E-3, (=1. /156.860705)  
              UN_SUR_M=0.0,  
              N=6.835707681),
```

1.3 Boundary conditions and loadings

The loading is in imposed deformations: 13.5 cycles of amplitude: $\varepsilon_{yy} = \pm 0.3\%$
Each cycle lasts 3s , the total duration of loading is thus of 40.5 s .

The step of time for the digital resolution is for each of 3 calculations of 0.015s .

1.4 Initial conditions

Worthless constraints and deformations.

2 Reference solution

It consists in comparing the various models, by taking for reference the model `VISCOCHAB` integrated by `RUNGE-KUTTA` and a step of very fine time. The behavior `VISCOCHAB` is described in [R5.03.12] (explicit and implicit integration). The behavior `VISC_CIN2_MEMO` is described in [R5.03.04]. One will compare in particular the maximum value of the constraints with the last cycle, as well as the variable q relating to the effect of memory.

3 Modeling A

3.1 Characteristics of modeling

A material point subjected to 13.5 cycles with imposed deformation, from which one extracts the last. Three successive calculations are carried out with the behaviors `VISCOCHAB` with integration `IMPLICIT`, `VISCOCHAB` with integration `RUNGE_KUTTA` (used as reference solution) and `VISC_CIN2_CHAB` with integration `IMPLICIT`.

3.2 Sizes tested and results

3.2.1 Values tested

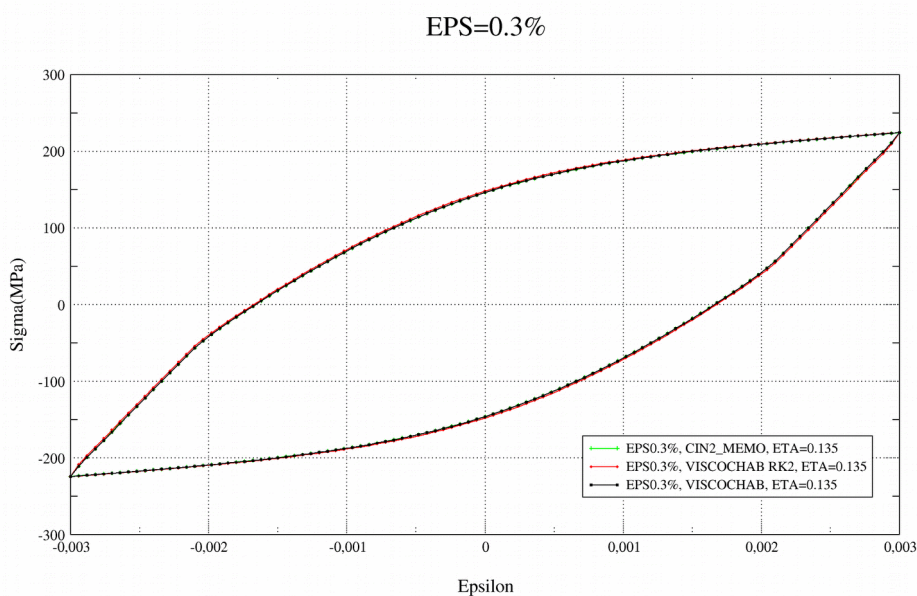
Behavior `VISC_CIN2_MEMO`

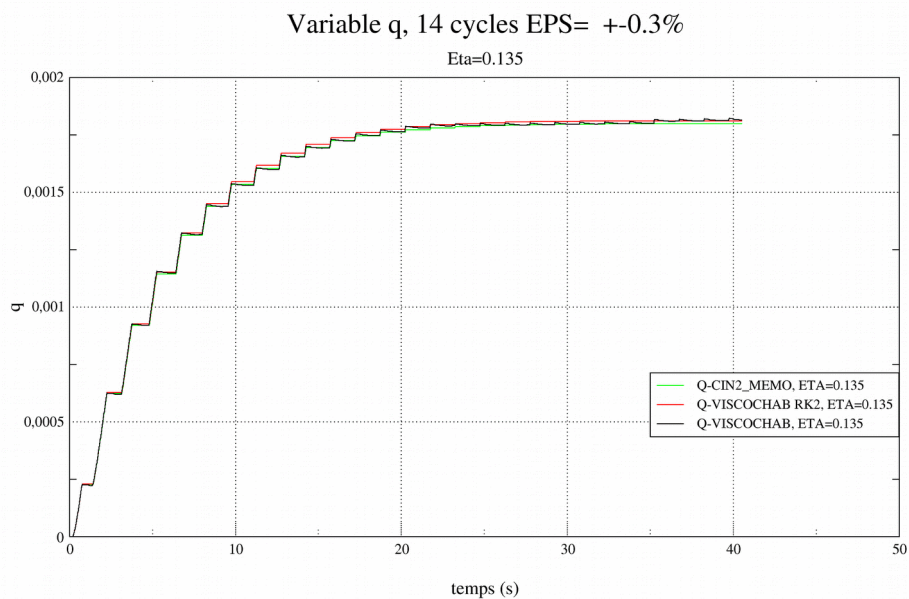
Variable	Moments (s)	Reference	Tolerance
σ_{yy} (MPa)	39.75	224.31	0,10%
q	40.5	1.81114E-03	0,90%

Behavior `IMPLICIT VISCOCHAB`

Variable	Moments (s)	Reference	Tolerance
σ_{yy} (MPa)	39.75	224.31	0,20%
q	40.5	1.81114E-03	0,50%

The answer provided by the three models is the following one, with the last cycle:





4 Summary of the results

The results are satisfactory and validate the behaviors taking of account the effect of memory of greatest work hardening.