

## SSND111 - Effect of memory in a Summarized cyclic

### test:

One carries out, on a problem reduced to the material point, several cycles of traction and compression, until stabilization of the response in terms of imposed stress-strain curve. The taking into account of the effect of memory of greatest 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.

Modelization a: this modelization makes it possible to validate behaviors `VISCOCHAB` and `VISC_CIN2_MEMO` with `SIMU_POINT_MAT`.

## 1 Problem of reference

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### 1.1 Geometry

It acts of a material point, representative of a stress state and strains homogeneous.

### 1.2 Properties of the 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 flow model 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 model of hardening VISC\_CIN2\_MEMO

```
MEMO_ECRO=_F (MU = 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 are in imposed strains: 13.5 cycles of amplitude:  $\varepsilon_{yy}=\pm 0.3\%$   
Each cycle lasts 3s , the total period of loading is thus of 40.5s .

Time step for the numerical resolution is for each of 3 computations of 0.015s .

## 1.4 Forced

initial conditions and null strains.

## 2 Reference solution

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

## 3 Modelization A

### 3.1 Characteristic of the modelization

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

### 3.2 Quantities tested and results

#### 3.2.1 Values tested

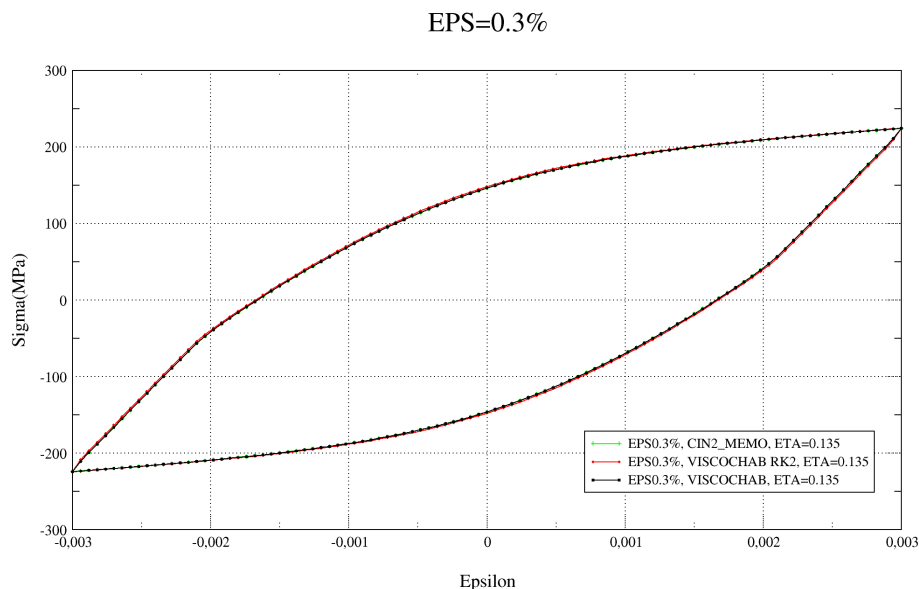
Behavior `VISC_CIN2_MEMO`

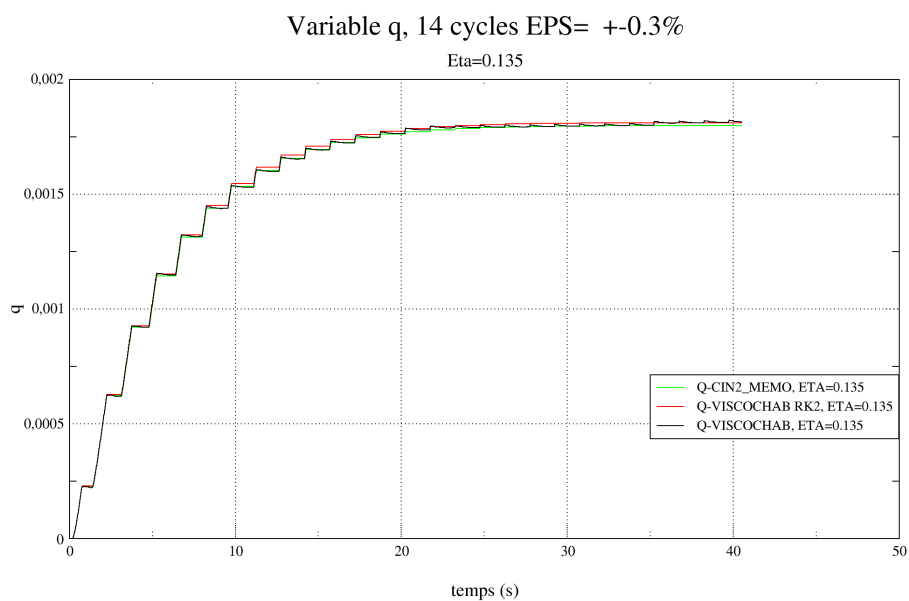
Variable	Times (s)	Reference	Tolerance
$\sigma_{yy}$ (MPa)	39.75	224.31	0.10%
$q$	40.5	1.81114E-03	0.90%

0,90% Behavior `VISCOCHAB`

Variable	Times (s)	Reference	Tolerance
$\sigma_{yy}$ (MPa)	39.75	224.31	0.20%
$q$	40.5	1.81114E-03	0.50%

the response provided by the three models are the following one, with the last cycle:





## 4 Summary of the results

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