SSNV225 – Constitutive law HAYHURST : test of Summarized

creep:

This document presents a test of creep in large deformations making it possible to validate the capacities of the model of behavior HAYHURST, to represent primary education, secondary and tertiary creep.

The various modelizations make it possible to test all the integration methods:

- integration clarifies by Runge_Kutta (modelization A);
- implicit integration with jacobian matrix obtained by disturbance (modelization B);
- implicit integration with analytical jacobian matrix (modelization C).

1 Problem of Reference

1.1 Geometry

Material point.

1.2 Property of the materials

They are defined in $600\,°C$.

```
YOUNG = 145000. ;
POISSON = 0.34;
BIGA=9.707593E-08,
H1ST=0.33,
H2ST=1.0,
K=9.691
H1=3.E4,
H2=-280.0,
SIG0=27.9317,
ALPHAD=0.5,
EPS0=5.82516E-11
```

Parameters managing the computation options:
`DELTA1=1.0,`
`DELTA2=0.0,`
`S_EQUI_D=0.0` (one uses the first principal stress for the computation of damage)
`KC=0` (account of the variable is not taken ϕ)

1.3 Boundary conditions and loadings

One applies a constant stress of $160\mathrm{MPa}$ since time $0{,}2\,h$ until time $4000\mathrm{h}$.

2 Reference solution

Case test of NON-regression (modelization A)

Intercomparison of the modelization A with the modelizations B and C.

3 Modelization A

3.1 Characteristic of the modelization

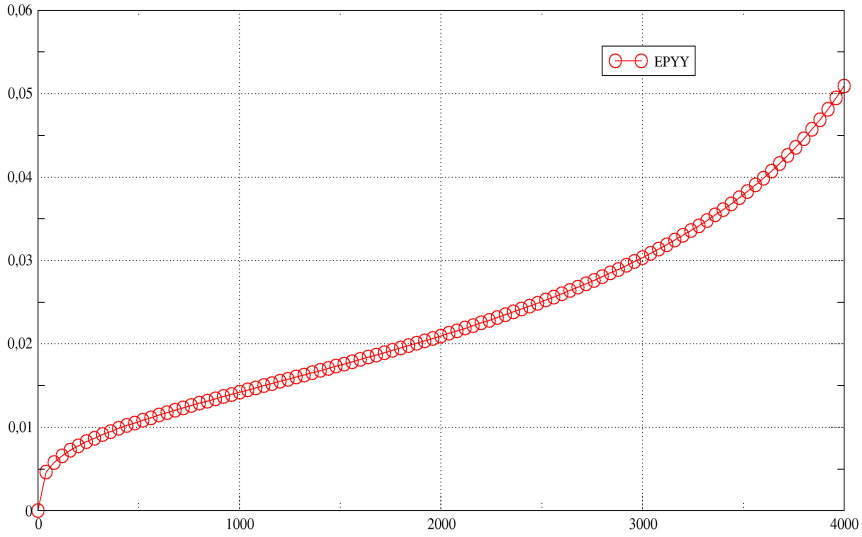
Modelization material point, in large deformations. ALGO_INTE=' RUNGE_KUTTA'.

3.2 Quantities tested and results

Identification	Times (h)	Reference	Aster	Tolerance
$EPYY$	2000	NON-regression	0,020968	Without object
$EPYY$	4000	NON-regression	0,05093	Without object
$V11(endo)$	2000	NON-regression	0,0323	Without object
$V11(endo)$	4000	NON-regression	0,06808	Without object
$dEPYY/dt$	1520	NON-regression	6,6539E-006	Without object

the curve of creep obtained with this model is the following one (the modelization of the large deformations using PETIT_REAC provides in this case same the results as GDEF_LOG) .

Espilon = f(INST)



4 Modelization B

4.1 Characteristic of the modelization

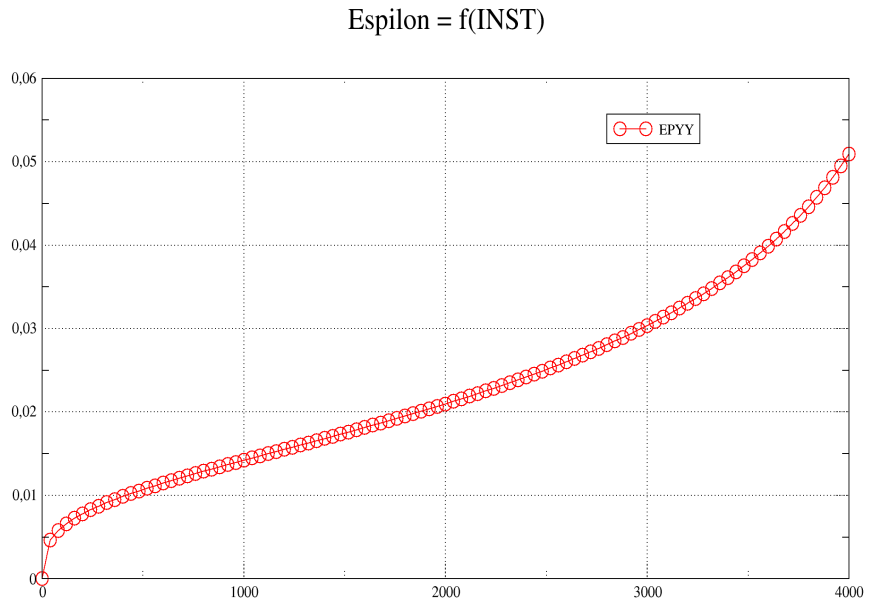
Modelization material point, in large deformations, with implicit integration (ALGORITHME_INTE=' NEWTON_PERT').

4.2 Quantities tested and Comparison

results with modelization a:

Identification	Times (h)	Reference	Tolerance
$EPYY$	2000	0,020968	1,2 %
$EPYY$	4000	0,05093	2 %
$V11(endo)$	2000	0,0323	0,1 %
$V11(endo)$	4000	0,06808	0,2 %
$dEPYY/dt$	1520	6,6539E-006	1,5 %

the curve of creep obtained with this model is the following one (the modelization of the large deformations using PETIT_REAC provides in this case same the results as GDEF_LOG) .



5 Modelization C

5.1 Characteristic of the modelization

Modelization material point, in large deformations, with implicit integration (ALGORITHME_INTE='NEWTON').

5.2 Quantities tested and Comparison

results with modelization a:

Identification	Times (h)	Reference	Tolerance
$EPYY$	2000	0,020968	1,2 %
$EPYY$	4000	0,05093	2 %
$V11(endo)$	2000	0,0323	0,1 %
$V11(endo)$	4000	0,06808	0,2 %
$dEPYY/dt$	1520	6,6539E-006	1,5 %

6 Summary of the results

the results calculated by *Code_Aster* make it possible to obtain curves of creep of satisfactory pace, and a correct value velocity of creep secondary. The two modelizations make it possible to validate by intercomparison the two algorithms of resolution.