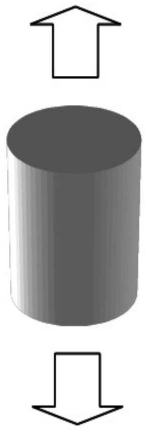
ZZZZ159 - Retiming of one elastoplastic constitutive law on a Summarized

traction test:

One tests macro retiming MACR_RECAL on the simple case of the identification of elastoplastic constitutive law of Von Mises on a simple traction test controlled in displacements. The readjusted parameters are the Young modulus, the elastic limit and the hardening slope from the knowledge of the stresses and the plastic strain cumulated in the test-tube.

1 Problem of reference

1.1 Geometry



Tension of $5.E-3\,mm$

1.2 Properties of the material

the initial values of the parameters are the following ones:

- $E=100000.\,MPa$
- $\sigma_y=1000.\,MPa$
- $E_T=30.\,MPa$

The values which one wishes to obtain are (see method of calculating of the reference solution):

- $E=200000.\,MPa$
- $\sigma_y=200.\,MPa$
- $E_T=2000.\,MPa$

1.3 Boundary conditions and loadings

a homogeneous stress state is sought: one imposes only one vertical displacement of $5.10^{-3}\,mm$.

2 Reference solution

2.1 Method of calculating

This computation is a validation macro MACR_RECAL. With this intention, the approach is the following one:

- one chooses a value (known as "value to be identified") for each parameter and one calculates. One thus obtains a history of stress and of cumulated plastic strain,
- one supposes now that the values to be identified preceding are unknown for us. Our only information is the history of stress and of cumulated plastic strain that we will thus regard as an experimental measurement,
- one then launches optimization on this pseudonym measures experimental by taking for each parameter an arbitrary value,
- one checks that the values identified by the algorithm are well the values to be identified.

This approach is very classical in optimization where it makes it possible to validate the algorithms.

2.2 Quantities and results of reference

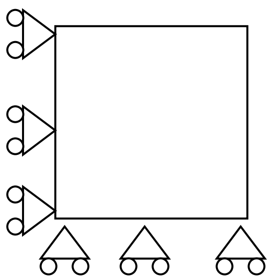
the reference variables are the values of the parameters with convergence is:

- $E = 200000. MPa$
- $\sigma_y = 200. MPa$
- $E_T = 2000. MPa$

3 Modelizations

3.1 Characteristic of the modelizations

axisymmetric Modelization on the following mesh:



In these modelizations, the initial values and the acceptable fields of the various parameters are:

- Young modulus: $100000. \in [50000., 500000.]$
- Slope of hardening: $1000. \in [500., 10000.]$
- Elastic limit: $30. \in [5., 500.]$

3.2 Characteristics of the mesh

Many nodes: 4
Numbers and types of meshes: 4 SEG2, 1 QUAD4

3.3 Alternatives

The modelization A use the mode by default (inclusion).

The modelization B is based on A but share of a different starting point, uses the distributed mode but has stopping criteria on functional calculus (TOLE_FONC) voluntarily very high (0.9) in order to make only one iteration.

The modelization C is based on A but uses different weights on the two experimental curves.

The modelization D is based on C but generates graphs with format XMGRACE.

The modelization E is based on C but uses the algorithm of BFGS (FMINBFGS).

The modelization F is particular because it does not use MACR_RECAL but the EXTERNAL mode : it uses same computation slave as the other modelization but the command file zzzz159f.comm uses programming Python to handle the profile and to simulate a call in external mode with the routine recal.py. The modelization

G is based on D but the slave computations are launched in MPI. Quantities

3.4 tested and Quantities results

tested analytical	**Values Young**
Modulus 200000.00	Elastic limit
2000.00	Slope
of hardening 200.00	Summary

4 of the results the results

of optimization are got in a small number of iterations (5) and are of very good quality.