

SSNP122 - Traction. Model of Rousselier in versions local and nonlocal

Summary:

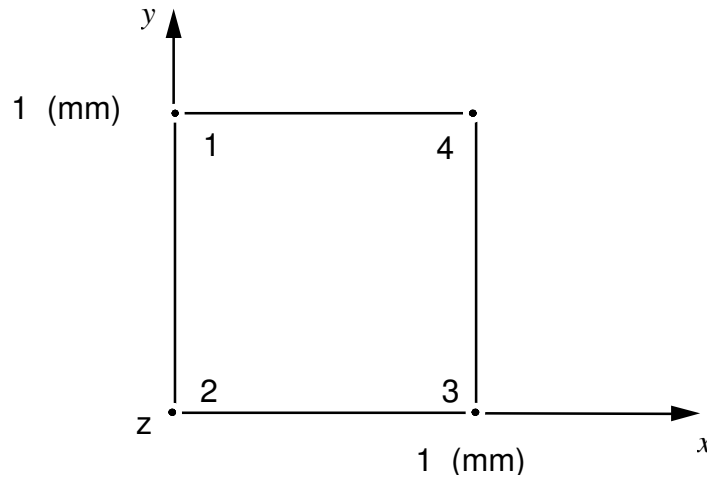
This quasi-static test consists in applying to a bar a loading of traction. One uses two versions of the model of Rousselier with the kinematics of the great deformations of Simo and Miehe: the local version and the nonlocal version (model with gradient of internal variables). For a tensile test, the terms in gradient are not activated: one thus finds the results of the local version, at least as long as the solution of the local version remains homogeneous (not localization).

The bar is modelled by a quadrangular element (QUAD8) in plane deformation.

The got results are results of nonregression. The two models give identical results as long as the solution of the local version does not locate. The solution of the model with gradient remains homogeneous throughout the way of loading.

1 Problem of reference

1.1 Geometry



1.2 Properties of material

Isotropic elasticity

Young modulus: $E = 200000 \text{ MPa}$

Coefficients of the model of Rousselier

Poisson's ratio: $\nu = 0.3$

Initial porosity: $f_0 = 0.01$

$D = 2$

$\sigma_1 = 500 \text{ MPa}$

Rational traction diagram

Deformation curve logarithmic Rational constraint (MPa)

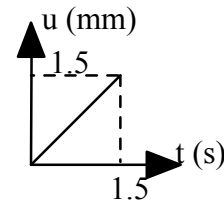
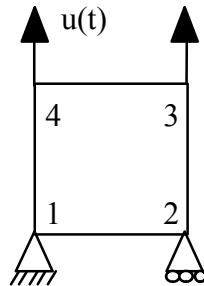
0.0	0.0
0,002	400.0
1,002	2400.0

Nonlocal model

Regularization of swelling: $C_GONF = 1\text{N}$

1.3 Boundary conditions and loadings

The bar, blocked in the direction Oy on the face $[1,2]$, is subjected to a displacement $u(t)$ on the face $[3,4]$.



1.4 Initial conditions

Worthless constraints and deformations with $t=0$.

2 Results of reference

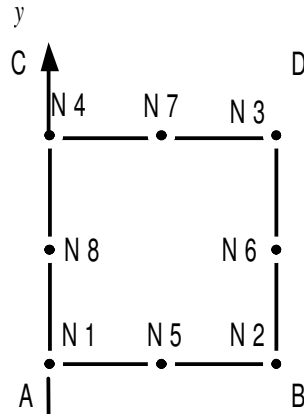
We do not have reference solution.

- As long as the solution of the local model remains homogeneous for the various points of Gauss, i.e. for $t=0.93s$, one will take as reference solution the results got with *Code_Aster* for this model. For the results of the model with gradient, one must find exactly the results got with the local version. At this moment, one will thus test, for the two models, the constraint of Cauchy σ_{yy} in the direction y , the constraint of Cauchy σ_{zz} in the direction z , cumulated plastic deformation p and porosity f , calculated at the point of Gauss n°1 of the mesh $[1,2,3,4]$.
- For the model with gradient, the answer must remain homogeneous in the points of Gauss throughout the way of loading. To test this result, one will adopt as reference solution, the constraint of Cauchy σ_{yy} in the direction there at the points from Gauss n°1, 2.3 and 4 of the mesh $[1,2,3,4]$ and at the final moment.

3 Modeling A

3.1 Characteristics of modeling

Modeling 2D : 1 quadrangle QUAD8



The imposed loading is the following:

- nodes $N1$, $N5$ and $N2$ are blocked according to the direction y ,
- the node $N1$ is blocked according to the direction x ,
- nodes $N4$, $N7$ and $N3$ undergo a displacement of 1.5mm in 1.5s distributed according to 50 increments.

3.2 Sizes tested and results

The values are calculated at the point of Gauss.

At the moment of calculation $t = 0.93 s$, one finds for the two models:

For the model of Rousselier in local version:

Identification	Type	Aster
At the point of Gauss n° 1		
σ_{yy}	NON_REGRESSION	942.702065474503
σ_{zz}	NON_REGRESSION	135.66771521734
p	NON_REGRESSION	0.6298511315011
f	NON_REGRESSION	0.22492981455403

For the model of Rousselier in nonlocal version:

Identification	Type	Aster
At the point of Gauss n° 1		
σ_{yy}	NON_REGRESSION	942.7047955569
σ_{zz}	NON_REGRESSION	135.66857672362
p	NON_REGRESSION	0.62985864189150
f	NON_REGRESSION	0.22492903398716

At the final moment $t = 1.5 \text{ s}$, one finds for the model with gradient:

Identification	Type	Aster
Max of: σ_{yy} on the element	NON_REGRESSION	721.68884425907
Min of: σ_{yy} on the element	NON_REGRESSION	721.68884425907

4 Summary of the results

As long as the solution of the local model remains homogeneous, the values obtained with the two versions of the model of Rousselier are identical.

For the model with gradient, the solution remains homogeneous throughout the loading.