SSNP117 - Model of Rousselier in 2D - DP

Summary:

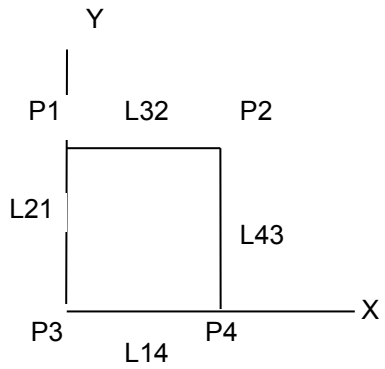
This test of nonlinear quasi-static mechanics makes it possible to validate the model of Rousselier in 2D plane deformations for the following configurations: elastoplastic basic model, model germination and viscoplastic model with theta-method for integration of the law of behavior.

Modeling is carried out with an element 2D quadratic, in plane deformation.

1 Problem of reference

1.1 Geometry

A mesh square is considered $2D$:



Sides $L21$, $L32$, $L43$, $L14$ measure each one $10 mm$.

1.2 Properties of material

One takes: $E=200 GPa$, and $\nu=0,3$.
The traction diagram employed is given in the following table:

ε	0.0001	0.00338	0.03	0.04	0.05	0.07	0.10	0.15	0.2	0.3	0.4
σ	27.30	222.72	519.58	580.94	633.48	721.82	828.96	970.19	1084.75	1269.57	1419.48

ε	0.5	0.7	1.0	1.5	2.0						
σ	1547.86	1763.72	2025.50	2370.59	2650.53						

The model of Rousselier is employed in three configurations with the following parameters:

Elastoplastic basic model (ROUSS_PR)	Elastoplastic model (ROUSS_PR) with germination	Viscoplastic model (VISCOROUSS) and theta-method
1) $D=2.$	1) $D=2.$	1) $D=2.$
2) $\sigma_1=600 MPa$	2) $\sigma_1=600 MPa$	2) $\sigma_1=600 MPa$
3) $\lambda=1.$	3) $\lambda=1.$	3) $\lambda=1.$
4) $f0=1.e-4$ (initial porosity)	4) $f0=1.e-4$	4) $f0=1.e-4$
5) $fc=1.$ (porosity criticizes)	5) $fc=1.$	5) $fc=1.$
6) $A=1.$	6) $A=1.$	6) $A=1.$
	7) $An=0.6$	7) $\sigma_0=27 MPa$
		8) $\varepsilon_0=1.e-2$
		9) $\theta=0.57$
		10) $m=2$

1.3 Boundary conditions and loadings

While referring to the figure of [§1.1] the boundary conditions are the following ones:

1) on the edge $L32$ displacement l imposed according to the direction OY (monotonous traction),
2) displacements of $L21$ blocked according to X,
3) displacements of $L14$ blocked according to Y.

Evolution temporal of lengthening l are deferred in the following table:

Time $[s]$	0.	10.
Displacement l $[mm]$	0.	10.

The evolution is linear between the two moments.

1.4 Initial conditions

Worthless constraints and deformations.

2 Reference solutions

2.1 Method of calculating

Without object.

2.2 Sizes and results of reference

Values of porosity at the final moment at the points of Gauss.

2.3 Uncertainties on the solution

Without object.

3 Modeling A

3.1 Characteristics of the grid

Many nodes: 8
Many meshs and types: 1 (QUA8)

3.2 Characteristics of modeling

Plane deformations with under-integration (DP_SI).

3.3 Sizes tested and results

Model	*Code_Aster*
	porosity f ($t = 10\text{s.}$)
Basic model	0.03257572
Model with nucleation	0.39058042
Viscoplastic model (θ = 0.57)	0.03352194

4 Summary of the results

Results got by *Code_Aster* show that the model of Rousselier functions and gives coherent results with the expected theoretical results.