SSNP117 - Model of Rousselier in 2D - DP

Résumé:

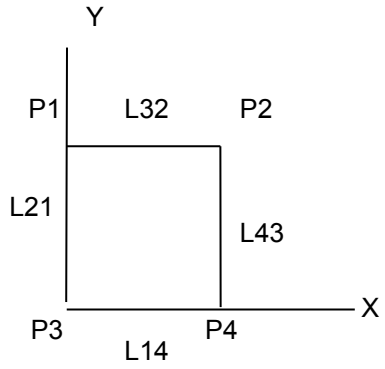
This test of nonlinear quasi-static mechanics makes it possible to validate the model of Rousselier in 2D plane strains for the following configurations: model basic elastoplastic, models germination and models viscoplastic with theta-method for integration of the constitutive law.

The modelization is realized with a quadratic 2D element, in plane strain.

1 Problem of reference

1.1 Geometry

One considers a mesh square $2D$:



the sides $L21$ $L32$ $L43$, $L14$ measure each one $10\,mm$.

1.2 Properties of the material

One takes: $E=200\,GPa$, and $\nu=0,3$.
Curve of tension 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:

Model basic elastoplastic (ROUSS_PR)	**Models elastoplastic (ROUSS_PR) with viscoplastic**	**Model germination (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) $f0=1.\mathrm{e}-4$ (initial porosity)	4) $f0=1.\mathrm{e}-4$	4) $f0=1.\mathrm{e}-4$
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) $\varepsilon_0=1.\mathrm{e}-2$
		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 tension),
2) displacements of $L21$ blocked according to X,
3) displacements of $L14$ blocked according to Y.

The 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 two times.

1.4 Forced

initial conditions and null strains.

2 Reference solutions

2.1 Method of calculating

Without object.

2.2 Quantities and results of reference

Values of porosity to final moment to Gauss points.

2.3 Uncertainties on the solution

Without object.

3 Modelization A

3.1 Characteristic of the mesh

Many nodes: 8
Number of meshes and types: 1 (QUA8)

3.2 Characteristic of the modelization

Plane strains with under-integration (DP_SI).

3.3 Quantities tested and results

Models	*Code_Aster*
	porosity f ($t=10\text{s.}$)
Models basic	0,03257572
Models with nucleation	0,39058042
Models viscoplastic (θ = 0,57)	0,03352194

4 Summary of the results

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