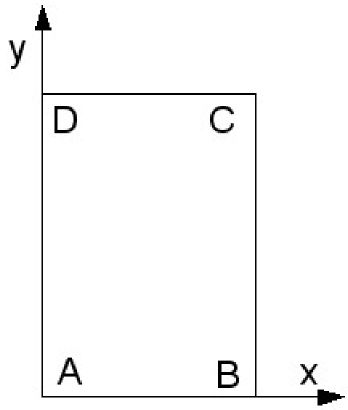
SSNP125 - Benchmark for the validation of option INDL_ELGA

Summarized:

This test aims to validate the indicator of localization INDL_ELGA by comparing behaviors DRUCK-PRAGER in its associated version (see Doc. R7.01.16). The modelization is of type D_PLAN and takes into account a material with a damage on the level of one only mesh which results in a loss of cohesion of 5% in this same mesh into question. One benefits from this test for also validating useful elementary computation PDIL_ELGA for the lenitive models associated with the mediums of second gradient of thermal expansion.

1 Problem of reference

1.1 Geometry



Coordinated of the items	X	Y
A	the 0	0.0,5
B		0.0,5.1,0
C		
D	0.1,0	

geometry is of form rectangular.

1.2 Properties of the material

For the modelization A, the solid mass consists of an elastoplastic material with linear negative hardening.

For the modelization B, the solid mass consists of an elastoplastic material with parabolic negative hardening.

The elastic parameters of the material are the following:

- Young modulus: $E=5800\ MPa$
- Poisson's ratio: $\nu=0,3$
- Real constant density: $\rho=2764$
- Isotropic thermal coefficient of thermal expansion: $\alpha=0$

The characteristics of hardening are then given by:

- Coefficient of dependence in pressure: $\alpha=0,33$
- Ultimate cumulated plastic strain: $P_{ULT}=0,01$
- Elastic limit: $\sigma_y=2.11\ 10^6$
- Elastic limit for the mesh concerned: $\sigma_y=2.\times10^6$

For modelization a:

- Hardening modulus for the group of mesh: $H=-200.\times10^6$

For ultimate modelization

- b: Forced: $\sigma_{yULT}=0.47\times10^6$

- Ultimate stress for the mesh concerned: $\sigma_{yULT}=0.44\times10^6$

1.3 Boundary conditions and loadings

a drained biaxial test is modelled (D_PLAN). Normal displacements with the study plan are thus null. One imposes a vertical displacement on $[DC]$ all while keeping the side pressure constant ($2\,MPa$) in the study plan. The boundary conditions are thus the following ones:

$u_y=0$ on $[AB]$ (group of mesh BAS)
$u_x=0$ on $[AD]$ (group of mesh $GAUCHE$)
$\sigma_n=2.\times10^6$ on $[BC]$ (group of mesh $EXTREM$)

a vertical displacement is then imposed on $[DC]$ (group of mesh $HAUT$) applying a vertical strain until 3% .

1.4 Results

the solutions post-are treated of kind to control the evolution of the quantities of INDL_ELGA and PDIL_ELGA into non regression.

2 Modelization A

2.1 Characteristic of the modelization

The modelization is two-dimensional with plane strains D_PLAN with a Drucker-Prager behavior associated with a linear negative hardening.

2.2 Characteristics of the mesh

Many nodes: 661
Many SEG3: 60
Many QUAD8: 200
Number of mesh group: 5

2.3 Quantities tested and results

Gauss points	Composing of field INDL_ELGA	Reference	Accuracy
1	INDEX	1,0	1E-3
1	DIR1	-32,0279	1E-3
2	INDEX	1,0	1E-3
2	DIR2	30,8960	1E-3
3	INDEX	1,0	1E-3
3	DIR3	-26,8726	1E-3
4	INDEX	1,0	1E-3
4	DIR4	-24,8401	1E-3
5	INDEX	1,0	1E-3
6	INDEX	1,0	1E-3
7	INDEX	1,0	1E-3
8	INDEX	1,0	1E-3
9	INDEX	1,0	1E-3
1	INDEX	1,0	1E-3
1	DIR1	31,4075	1E-3
1	INDEX	1,0	1E-3
1	DIR1	-32,6792	1E-3
2	INDEX	1,0	1E-3
2	DIR2	32,2241	1E-3
3	INDEX	1,0	1E-3
3	DIR3	21,9077	1E-3
4	INDEX	1,0	1E-3
4	DIR4	-17,7869	1E-3
5	INDEX	1,0	1E-3
6	INDEX	1,0	1E-3
7	INDEX	1,0	1E-3
8	INDEX	1,0	1E-3
9	INDEX	1,0	1E-3
1	INDEX	1,0	1E-3
1	DIR1	33,4990	1E-3

Gauss points	Composing of field PDIL_ELGA	Reference	Accuracy
1	A1_LC2	7.67142E+05	1E-3

3 Modelization B

3.1 Characteristic of the modelization

The modelization is two-dimensional with plane strains D_PLAN with a Drucker-Prager behavior associated with a parabolic negative hardening.

3.2 Characteristics of the mesh

Many nodes: 661
Many SEG3: 60
Many QUAD8: 200
Number of mesh group: 5

3.3 Quantities tested and results

Gauss points	Composing of field INDL_ELGA	Reference	Accuracy
1	INDEX	1,0	1E-3
2	INDEX	1,0	1E-3
3	INDEX	1,0	1E-3
4	INDEX	1,0	1E-3
5	INDEX	1,0	1E-3
6	INDEX	1,0	1E-3
7	INDEX	1,0	1E-3
8	INDEX	1,0	1E-3
9	INDEX	1,0	1E-3
1	INDEX	1,0	1E-3
NAP	INDEX	284,9488	1E-3
1	INDEX	1,0	1E-3
2	INDEX	1,0	1E-3
3	INDEX	1,0	1E-3
4	INDEX	1,0	1E-3
5	INDEX	1,0	1E-3
6	INDEX	1,0	1E-3
7	INDEX	1,0	1E-3
8	INDEX	1,0	1E-3
9	INDEX	1,0	1E-3
1	INDEX	1,0	1E-3
NAP	INDEX	332,2233	1E-3

the table gathers the values which correspond to the sums on the group of the mesh of the components of the indicator of localization INDL_ELGA. We thus have a slow evolution of the indicator which hardly evolves with each realization of this test.

4 Summary of the results

One traces in this benchmark the values obtained with criterion INDL_ELGA on an example of triaxial compression test in compression describes by a softening behavior of Drucker-Prager type. They are values into non regression. One also adds a computation of option PDIL_ELGA for the model Drucker-Prager. The values obtained are also tested in non_regression.