SSND104 - Validation of the behavior DRUCK_PRAG_N_A

Summary:

This test relates to it cases of a mesh alone for two modelings A and B. In each one of them, are present two modules STAT_NON_LINE to compare the Drucker-Prager behaviors in the associated and non-aligned version. In modeling A, the idea is to choose a parameter P_ULTM sufficient large so that the two laws are comparable to perfect plasticity. Consequently, a cross validation of these two behaviors is undertaken. In modeling B, the parameters materials are more ordinary and the goal is to have a validation in NON-REGRESSION.

1 Problem of reference

1.1 Geometry

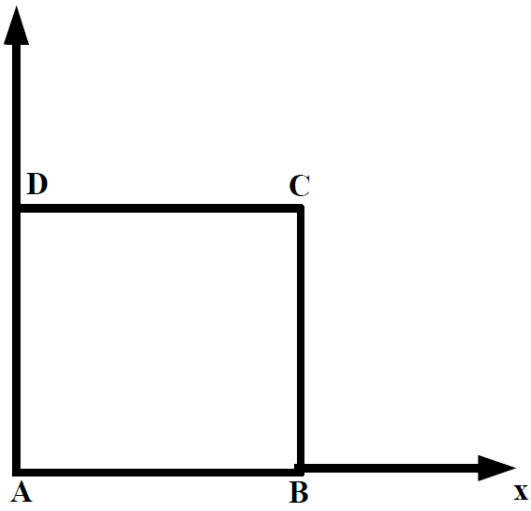

Figure 1.1-a

The geometry refers to only one isoparametric finite element of form square, the length of each edge is worth 1.

1.2 Properties of material

The solid mass consists of an elastoplastic material with linear isotropic work hardening:

- Isotropic elasticity Young Modulus: $E=10^9 Pa$
- Poisson's ratio: $\nu=0,3$
- Real constant density: $\rho=2764$
- Isotropic thermal dilation coefficient: $\alpha=0$

The characteristics of work hardening are then given by:

- Coefficient of dependence in pressure: $\alpha=0,328$
- Elastic limit: $\sigma_y=2.11\times10^6$
- Ultimate constraint: $\sigma_{yULT}=10^6$

For modeling a:
Ultimate cumulated plastic deformation: $P_{ULT}=2$
For modeling b:
Ultimate cumulated plastic deformation: $P_{ULT}=1.225\times10^{-2}$

1.3 Boundary conditions and loadings

One imposes a unit displacement according to the axis y on the segment CD, no one according to the axis y on the segment AB and no one according to the axis x on the segment AD.

In this case of test, concerning modeling A, we simulate a case of perfect plasticity with the two laws of Drucker-Prager behaviors in associated and non-aligned condition to check the data-processing coherence of the results. For that, it is enough to take large values for P_{ULT}.

2 Modeling A

2.1 Characteristics of modeling

Modeling is two-dimensional with plane deformations D_PLAN and non-linear statics.

2.2 Characteristics of the grid

Many nodes	4	
Number of SEG2		4
Number of QUAD4		1
Number of group of meshs		2

2.3 Sizes tested and results

The node $N4$ is located at the point C geometry.

DRUCK_PRAGER

Value tested	Moment	Node	Type	Reference	Precision
CONSTRAINT SIYY	1.75	N4	'NON_REGRESSION'	-5,5073.E+6	1.E-3
CONSTRAINT SIYY	2.5	N4	'NON_REGRESSION'	-6,4187.E+6	1.E-3
CONSTRAINT SIYY	3	N4	'NON_REGRESSION'	-6,4143.E+6	1.E-3
Internal variable V1	1.75	N4	'NON_REGRESSION'	2,1703E-03	1.E-3
Internal variable V1	2.5	N4	'NON_REGRESSION'	1,5577.E-2	1.E-3
Internal variable V1	3	N4	'NON_REGRESSION'	2,7490.E-2	1.E-3
Displacement DY	1.07	N4	'ANALYTICAL'	-5,5999.E-4	1.E-3
Displacement DY	1.16	N4	'ANALYTICAL'	-1,2800.E-3	1.E-3
Displacement DY	1.34	N4	'ANALYTICAL'	-2,7199.E-3	1.E-3
Displacement DY	1.53	N4	'ANALYTICAL'	-4,2399.E-3	1.E-3

DRUCK_PRAG_N_A

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3 Modeling B

3.1 Characteristics of modeling

Identical to modeling A.

3.2 Characteristics of the grid

Many nodes	4
Number of SEG2	4
Number of QUAD4	1
Number of group of meshs	2

3.3 Sizes tested and results

The node $N4$ is located at the point C geometry.

DRUCK_PRAGER

Value tested	Moment	Node	Type	Reference	Precision
CONSTRAINT SIYY	1.07	N4	'NON_REGRESSION'	-6,1538.E+5	1.E-3
CONSTRAINT SIYY	1.16	N4	'NON_REGRESSION'	-1,4066.E+6	1.E-3
CONSTRAINT SIYY	1.34	N4	'NON_REGRESSION'	-2,9890.E+6	1.E-3
CONSTRAINT SIYY	1.53	N4	'NON_REGRESSION'	-4,6058.E+6	1.E-3
Internal variable V1	1.07	N4	'NON_REGRESSION'	0.E+0	1.E-3
Internal variable V1	1.16	N4	'NON_REGRESSION'	0.E+0	1.E-3
Internal variable V1	1.34	N4	'NON_REGRESSION'	0.E+0	1.E-3
Internal variable V1	1.53	N4	'NON_REGRESSION'	1,0487.E-04	1.E-3
Displacement DY	1.07	N4	'ANALYTICAL'	-5,5999.E-4	1.E-3
Displacement DY	1.16	N4	'ANALYTICAL'	-1,2800.E-3	1.E-3
Displacement DY	1.34	N4	'ANALYTICAL'	-2,7199.E-3	1.E-3
Displacement DY	1.53	N4	'ANALYTICAL'	-4,2399.E-3	1.E-3

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Displacement DY	1.53	N4	'ANALYTICAL'	-4,2399.E-3	1.E-3

4 Summary of the results

This test makes it possible to have a validation crossed between two modelings, the idea was to fix in modeling A, a parameter P_ULTM sufficient large so that the two laws are comparable to perfect plasticity, on the other hand in modeling B, the parameters materials are more in coherence with typical data of the grounds. In this case, the validation is in NON-REGRESSION. This example of nonregression made it possible to test the influence of the parameter P_ULTM between two modelings.