

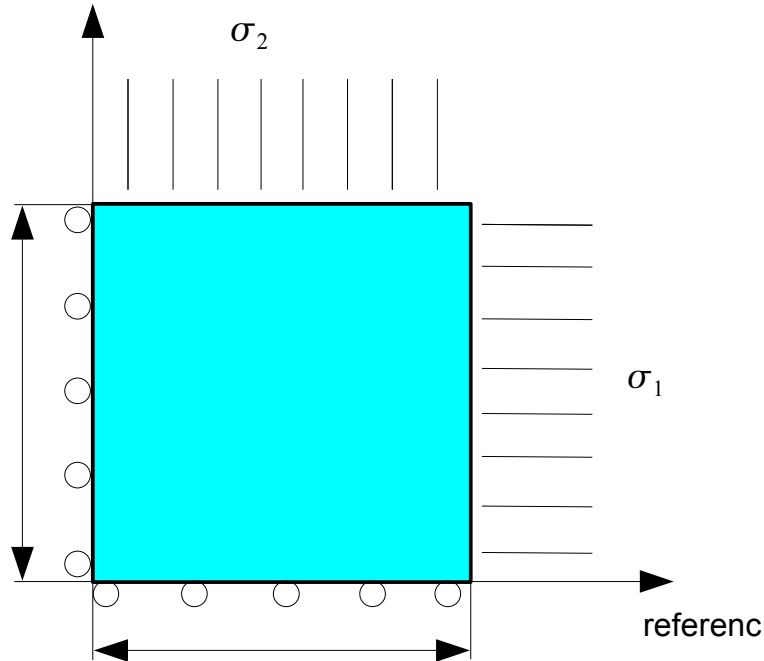
SSNP02 - Shell element in plane strains and biaxial tension (model of Norton)

Abstract:

This benchmark makes it possible to test the model of NORTON by means of the behavior model of LEMAITRE in the case of a plate in plane strains in biaxial tension. One is interested in plastic strains.

1 Problem of XYABACD11Géométrie

1.1



Coordinated of the points (m) :

- $A(0., 0.)$
- $B(1., 0.)$
- $C(1., 1.)$
- $D(0., 1.)$

1.2 Properties of the Elastic

material

- $E = 178\,000\text{ MPa}$ Modulus Young
- $\nu = 0.3$ Poisson's ratio

LEMAITRE

- $n = 9.7$
- $K = 1920.$
- $\frac{1}{m} = 0.$

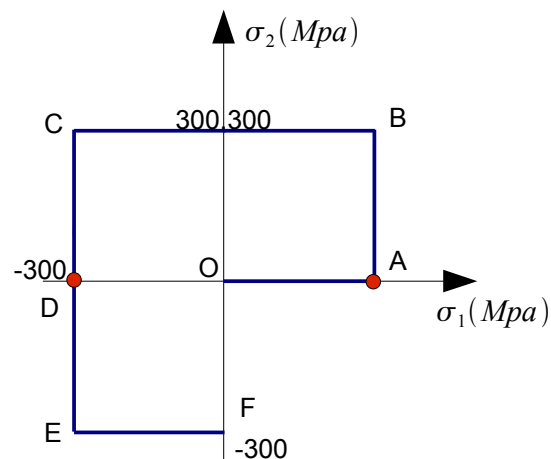
1.3 Boundary conditions and loadings

imposed Displacement (m) :

- AB : $DY=0$
- AD : $DX=0$

Uniform

- loading Pressure on BC : σ_1
- Uniform pressure on CD : σ_2
- Ways OA , AB , CD , DE and EF of period 30 second
- Way BC of period the 60 second
- Times of maintenance in A , B and D 3600 seconds



2 Reference solution

2.1 Méthode de calcul used for the reference solution

the reference solution was obtained with various codes computations finite elements using various explicit, semi-implicit or implicit algorithms [2]

2.2 reference Variables

$EPXX$: plastic strain according to X

$EPYY$: plastic strain according to Y

2.3 Quantity and result of reference

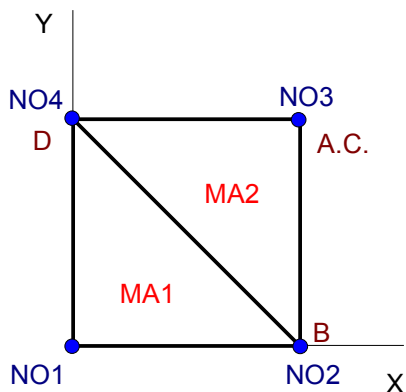
Time (s)	Component	Reference
30.	<i>EPXX</i>	6.125×10^{-7}
	<i>EPYY</i>	-4.684×10^{-7}
3630.	<i>EPXX</i>	7.056×10^{-4}
	<i>EPYY</i>	-5.720×10^{-4}
3660.	<i>EPXX</i>	7.061×10^{-4}
	<i>EPYY</i>	-5.724×10^{-4}
7260.	<i>EPXX</i>	7.061×10^{-4}
	<i>EPYY</i>	-5.724×10^{-4}
7320.	<i>EPXX</i>	-2.443×10^{-5}
	<i>EPYY</i>	1.377×10^{-4}
7350.	<i>EPXX</i>	-7.788×10^{-4}
	<i>EPYY</i>	8.423×10^{-4}
11010.	<i>EPXX</i>	-1.534×10^{-3}
	<i>EPYY</i>	1.432×10^{-3}

2.4 Bibliographical references

- [1] Guides Validation of the Software packages of Computations of Structures: SFM, technical AFNOR, ISBN: 2-12-486611-7
- [2] Validation of computer codes in viscoplasticity: Ratio of a scientific interest group. (GIS), ONERA France, 1989

3 Modelization A

3.1 Characteristic of modelization A



Modelization D_PLAN :

Many nodes	4		
Number of meshes	4	Are:	
		SEG2	2
		TRIA3	2

Mesh group:

- *DROITE* : segment BC
- *HAUT* : segment CD

3.2 Quantities tested and results

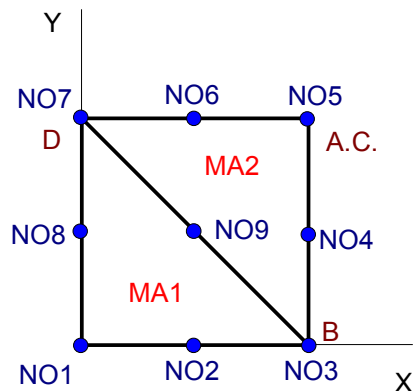
Do not net		Urgent (s)	Component	Reference	Tolerance (%)
MA1	1	30.	EPXX	6.125×10^{-7}	0.2
			EPYY	-4.684×10^{-7}	0.2
MA1	1	3630.	EPXX	7.056×10^{-4}	0.2
			EPYY	-5.720×10^{-4}	0.2
MA1	1	3660.	EPXX	7.061×10^{-4}	0.2
			EPYY	-5.724×10^{-4}	0.2
MA1	1	7260.	EPXX	7.061×10^{-4}	0.2
			EPYY	-5.724×10^{-4}	0.2
MA1	1	7320.	EPXX	-2.443×10^{-5}	0.2
			EPYY	1.377×10^{-4}	0.2
MA1	1	7350.	EPXX	-7.788×10^{-4}	0.2
			EPYY	8.423×10^{-4}	0.2
MA1	1	11010.	EPXX	-1.534×10^{-3}	0.2

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

			EPYY	1.432×10^{-3}	0.2
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4 Modelization B

4.1 Characteristic of the modelization B



Modelization D_PLAN:

Many nodes	9	
Number of meshes	4	Are:
		SEG3 2
		TRIA6 2

Mesh group:

- DROITE : segment BC
- HAUT : segment CD

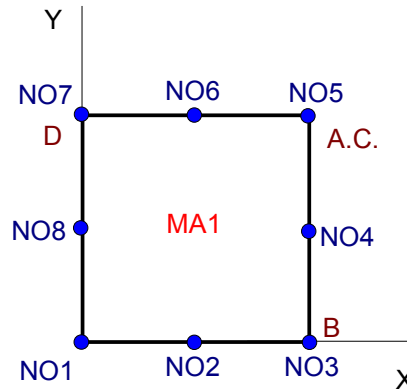
4.2 Quantities tested and results

Do not net		Urgent (s)	Component	Reference	Tolerance (%)
MAI	1	30.	EPXX	6.125×10^{-7}	0.2
			EPYY	-4.684×10^{-7}	0.2
MAI	1	3630.	EPXX	7.056×10^{-4}	0.2
			EPYY	-5.720×10^{-4}	0.2
MAI	1	3660.	EPXX	7.061×10^{-4}	0.2
			EPYY	-5.724×10^{-4}	0.2
MAI	1	7260.	EPXX	7.061×10^{-4}	0.2
			EPYY	-5.724×10^{-4}	0.2
MAI	1	7320.	EPXX	-2.443×10^{-5}	0.2
			EPYY	1.377×10^{-4}	0.2
MAI	1	7350.	EPXX	-7.788×10^{-4}	0.2
			EPYY	8.423×10^{-4}	0.2

MAI	1	11010.	EPXX	-1.534×10^{-3}	0.2
			EPYY	1.432×10^{-3}	0.2

5 Modelization C

5.1 Characteristic of modelization C



Modelization D_PLAN :

Many nodes 8

Number of meshes 3

Are:

SEG3 2

QUAD8 1

Mesh group:

- DROITE : segment BC
- HAUT : segment CD

5.2 Quantities tested and results

Do not net		Urgent (s)	Component	Reference	Tolerance (%)
MAI	1	30.	EPXX	6.125×10^{-7}	0.2
			EPYY	-4.684×10^{-7}	0.2
MAI	1	3630.	EPXX	7.056×10^{-4}	0.2
			EPYY	-5.720×10^{-4}	0.2
MAI	1	3660.	EPXX	7.061×10^{-4}	0.2
			EPYY	-5.724×10^{-4}	0.2
MAI	1	7260.	EPXX	7.061×10^{-4}	0.2
			EPYY	-5.724×10^{-4}	0.2
MAI	1	7320.	EPXX	-2.443×10^{-5}	0.2
			EPYY	1.377×10^{-4}	0.2
MAI	1	7350.	EPXX	-7.788×10^{-4}	0.2

			<i>EPYY</i>	8.423×10^{-4}	0.2
<i>MAI</i>	1	11010.	<i>EPXX</i>	-1.534×10^{-3}	0.2
			<i>EPYY</i>	1.432×10^{-3}	0.2

6 Modelization D

6.1 Characteristic of the modelization D

Identical to modelization A. the behavior used is Norton, with implicit integration (NEWTON_PERT) the reference solution is identical to modelization A.

6.2 Grandeurs testées et résultats

Does not net		Instantformul e (s)	Component	Reference	Tolerance (%)
<i>MAI</i>	1	30.	<i>EPXX</i>	6.125×10^{-7}	0.6
			<i>EPYY</i>	-4.684×10^{-7}	0.6
<i>MAI</i>	1	3630.	<i>EPXX</i>	7.056×10^{-4}	0.2
			<i>EPYY</i>	-5.720×10^{-4}	0.2
<i>MAI</i>	1	3660.	<i>EPXX</i>	7.061×10^{-4}	0.2
			<i>EPYY</i>	-5.724×10^{-4}	0.2
<i>MAI</i>	1	7260.	<i>EPXX</i>	7.061×10^{-4}	0.2
			<i>EPYY</i>	-5.724×10^{-4}	2
<i>MAI</i>	1	7320.	<i>EPXX</i>	-2.443×10^{-5}	0.3
			<i>EPYY</i>	1.377×10^{-4}	0.3
<i>MAI</i>	1	7350.	<i>EPXX</i>	-7.788×10^{-4}	0.3
			<i>EPYY</i>	8.423×10^{-4}	0.3
<i>MAI</i>	1	11010.	<i>EPXX</i>	-1.534×10^{-3}	0.2
			<i>EPYY</i>	1.432×10^{-3}	0.2

7 Modelization E

7.1 Characteristic of the modelization E

Identical to modelization A. the behavior used is Norton, with integration explicite (RUNGE_KUTTA) the reference solution is identical to modelization A.

7.2 Grandeurs testées et résultats

Does not net		Instantformul e (s)	Component	Reference	Tolerance (%)
<i>MAI</i>	1	30.	<i>EPXX</i>	6.125×10^{-7}	0.2

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			<i>EPYY</i>	-4.684×10^{-7}	0.2
<i>MAI</i>	1	3630.	<i>EPXX</i>	7.056×10^{-4}	0.2
			<i>EPYY</i>	-5.720×10^{-4}	0.2
<i>MAI</i>	1	3660.	<i>EPXX</i>	7.061×10^{-4}	0.2
			<i>EPYY</i>	-5.724×10^{-4}	0.2
<i>MAI</i>	1	7260.	<i>EPXX</i>	7.061×10^{-4}	0.2
			<i>EPYY</i>	-5.724×10^{-4}	0.2
<i>MAI</i>	1	7320.	<i>EPXX</i>	-2.443×10^{-5}	0.2
			<i>EPYY</i>	1.377×10^{-4}	0.2
<i>MAI</i>	1	7350.	<i>EPXX</i>	-7.788×10^{-4}	0.2
			<i>EPYY</i>	8.423×10^{-4}	0.2
<i>MAI</i>	1	11010.	<i>EPXX</i>	-1.534×10^{-3}	0.2
			<i>EPYY</i>	1.432×10^{-3}	0.2

8 Summary of the results

the got results are satisfactory.