

SSNV217 - Cubic in simple traction and compression with the law ENDO_ORTH_BETON

Summary:

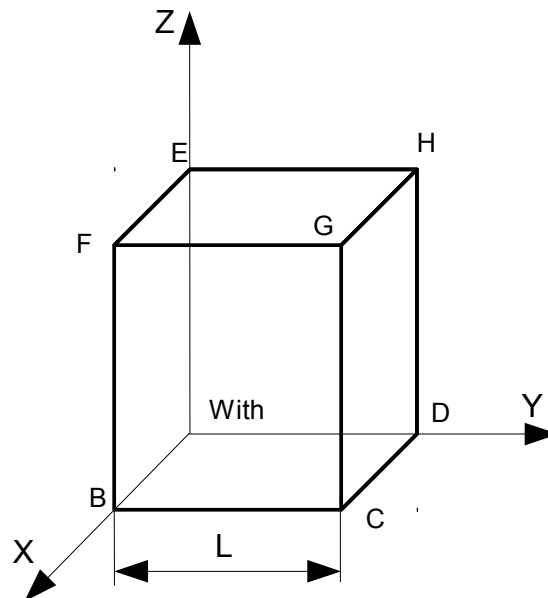
Modeling A this test makes it possible to test various possible configurations of damage of the law ENDO_ORTH_BETON in four stages and to check the good management of the various mechanisms:

- progressive damage of traction in the direction X until it is blocked
- progressive damage of traction in the direction Y until it is blocked, in the presence of a direction of damage blocked (according to X)
- progressive damage of traction in the direction Z , in the presence of two directions of damage blocked (according to X and according to Y)
- phase of discharge then progressive damage of compression according to Z

Modeling B differ from modeling A for the loading used at the time of the various phases. Moreover, modeling B adopt a nonlocal formalism by regularization of the gradient of deformation.

1 Problem of reference

1.1 Geometry



The cube is in space $[0.,1.] \times [0.,1.] \times [0.,1.]$.

Coordinates of the points (m) :

$$A: (0., 0., 0.)$$

$$G: (1., 1., 1.)$$

Geometry of the cube

$$L = 1\text{m}$$

1.2 Properties of material

Isotropic rubber band:

$$E = 32 \text{ GPa} : \text{Young modulus}$$

$$\nu = 0.2 : \text{Poisson's ratio}$$

Law ENDO_ORTH_BETON

$$k_0 = 300 \text{ Pa} ; k_1 = 10,5 \text{ MPa} ; k_2 = 7 \times 10^{-4} ; \alpha = 0,9 ; \gamma_b = 1000 \text{ Pa} ;$$

$$\gamma_d = 60000 \text{ Pa}$$

1.3 Boundary conditions and loadings

They consist into cubes displacements imposed on each face of the cube, and are expressed in meters.

1.4 Reference solution

This test is a test of nonregression.

2 Modeling A

2.1 Characteristics of modeling A

Modeling is 3D and uses the law ENDO_ORTH_BETON.

2.2 Characteristics of the grid

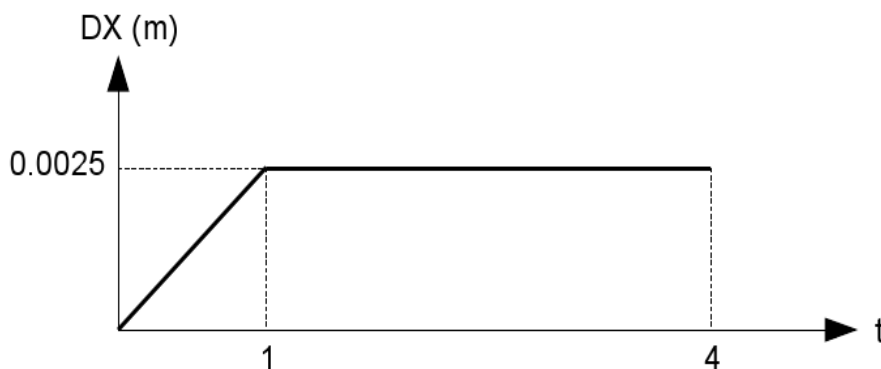
Many nodes: 8
Number of meshes and type: 1 HEXA8

2.3 Description of the loading

2.3.1 First stage: traction according to axis X

- face *ADHE* : $DX=0$
- face *ABFE* : $DY=0$
- face *ABCD* : $DZ=0$
- face *DCGH* : $DY=0$
- face *EFGH* : $DZ=0$
- face *BCGF* : $DX=2,5 \times 10^{-3}$

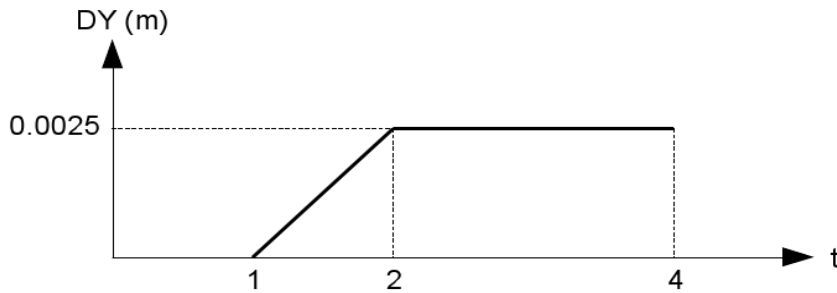
Displacement DX imposed on the face *BCGF* vary gradually according to the function presented on the figure below. Once the maximum reaches with $t=1s$, displacement DX face *BCGF* is then blocked for the following stages.



2.3.2 Second phase: traction according to the axis Y

- face *ADHE* : $DX=0$
- face *ABFE* : $DY=0$
- face *ABCD* : $DZ=0$
- face *BCGF* : $DX=0$
- face *DCGH* : $DY=2,5 \times 10^{-3}$

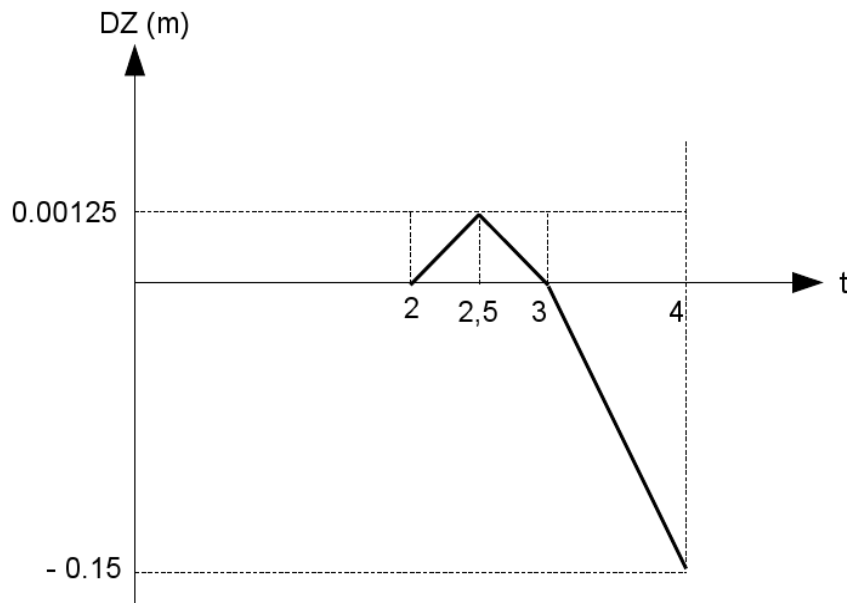
Displacement DY imposed on the face *DCGH* vary gradually according to the function presented on the figure below. Once the maximum reaches with $t=2s$, displacement DY face *DCGH* is then blocked for the following stages.



2.3.3 Third and fourth stage: load, discharge and compression according to axis Z

- face *ADHE* : $DX = 0$
- face *ABFE* : $DY = 0$
- face *ABCD* : $DZ = 0$
- face *BCGF* : $DX = 0$
- face *DCGH* : $DY = 0$
- face *EFGH* : $DZ \neq 0$

Displacement DZ imposed on the face *EFGH* vary gradually according to the function presented on the figure below:



2.4 Sizes tested and results

The results are read at the point of Gauss n°1.

Size	Sequence number	Reference	Code_Aster	Tolerance (%)
<i>V1</i>	2	Not regression	0,86689832	0,1
<i>SIXX (Pa)</i>	10	Not regression	8888,8889	0,1
<i>V2</i>	12	Not regression	0,85897368	0,1

$SIYY (Pa)$	20	Not regression	8333,2067	0,1
$V3$	22	Not regression	0,8668983158	0,1
$SIZZ (Pa)$	25	Not regression	24072,93439241	0,1
$V3$	31	Not regression	0,8916168	0,1
$SIZZ (Pa)$	40	Not regression	-533333,3333	0,1

Table 2.4-1

3 Modeling B

3.1 Characteristics of modeling B

Modeling is 3D and uses the law ENDO_ORTH_BETON with a nonlocal formalism by regularization of the gradient of deformation.

3.2 Characteristics of the grid

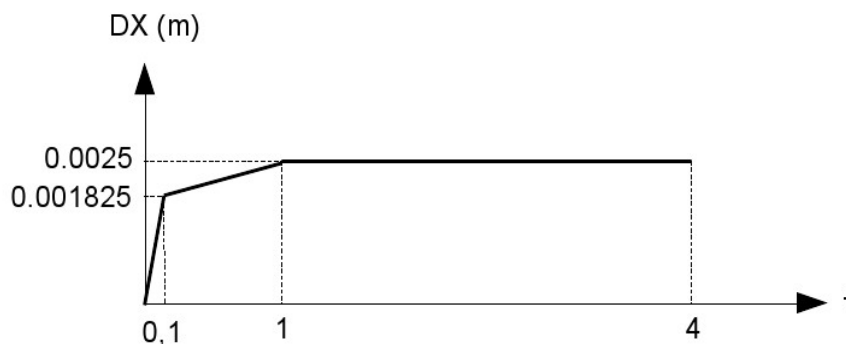
Many nodes: 8
Number of meshes and type: 1 HEXA8

3.3 Description of the loading

3.3.1 First stage: traction according to axis X

- face *ADHE* : $DX = 0$
- face *ABFE* : $DY = 0$
- face *ABCD* : $DZ = 0$
- face *BCGF* : $DX = 2,5 \times 10^{-3}$

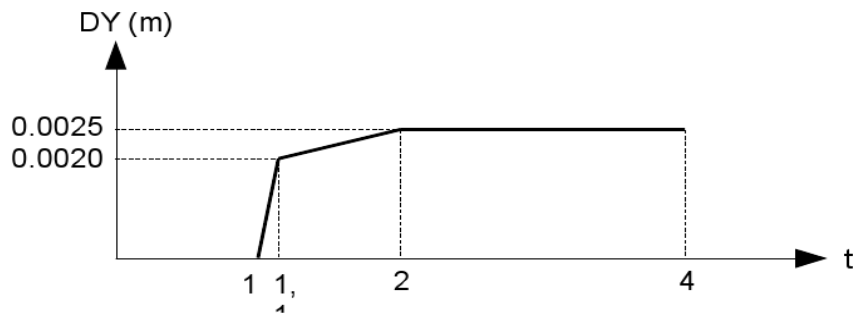
Displacement DX imposed on the face *BCGF* vary gradually according to the function presented on the figure below. Once the maximum reaches with $t = 1s$, displacement DX face *BCGF* is then blocked for the following stages.



3.3.2 Second phase: traction according to the axis Y

- face *ADHE* : $DX = 0$
- face *ABFE* : $DY = 0$
- face *ABCD* : $DZ = 0$
- face *BCGF* : $DX = 0$
- face *DCGH* : $DY = 2,5 \times 10^{-3}$

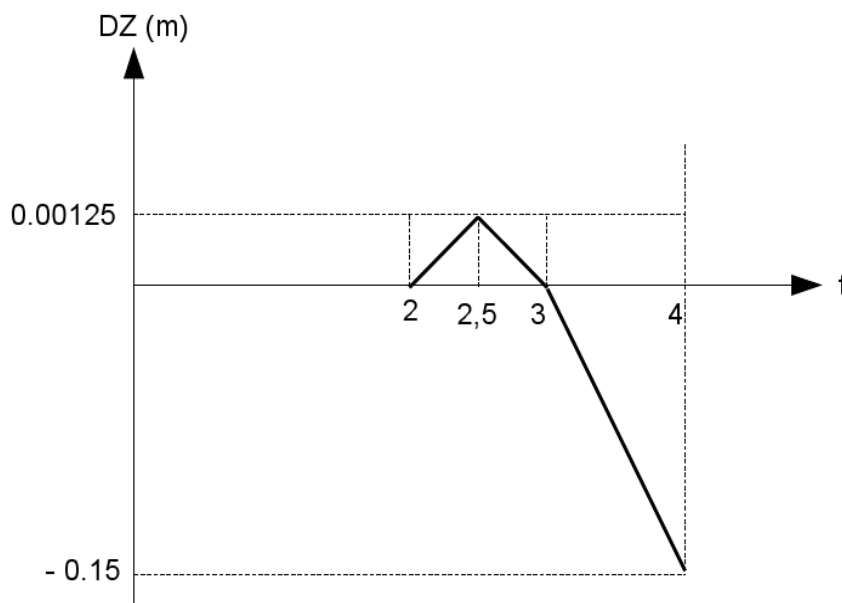
Displacement DY imposed on the face *DCGH* vary gradually according to the function presented on the figure below. Once the maximum reaches with $t = 2s$, displacement DY face *DCGH* is then blocked for the following stages.



3.3.3 Third and fourth stage: load, discharge and compression according to axis Z

- face $ADHE$: $DX = 0$
- face $ABFE$: $DY = 0$
- face $ABCD$: $DZ = 0$
- face $BCGF$: $DX = 0$
- face $DCGH$: $DY = 0$
- face $EFGH$: $DZ \neq 0$

Displacement DZ imposed on the face $EFGH$ vary gradually according to the function presented on the figure below:



3.4 Sizes tested and results

The results are read at the point of Gauss n°1.

Size	Sequence number	Reference	Code_Aster	Tolerance (%)
$V1$	2	Not regression	0,9887038	0,1
$S1XX (Pa)$	10	Not regression	7999,991	0,1
$V2$	11	Not regression	0,99	0,1

$SIYY (Pa)$	20	Not regression	8333,193	0,1
$V3$	22	Not regression	0,86689832	0,1
$SIZZ (Pa)$	25	Not regression	24072,934	0,1
$V3$	34	Not regression	0,97567	0,1
$SIZZ (Pa)$	40	Not regression	-533333,33	0,1

Table 3.4-1

4 Summary of the results

The got results check to it not regression of the code for the law ENDO_ORTH_BETON.