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

Summary:

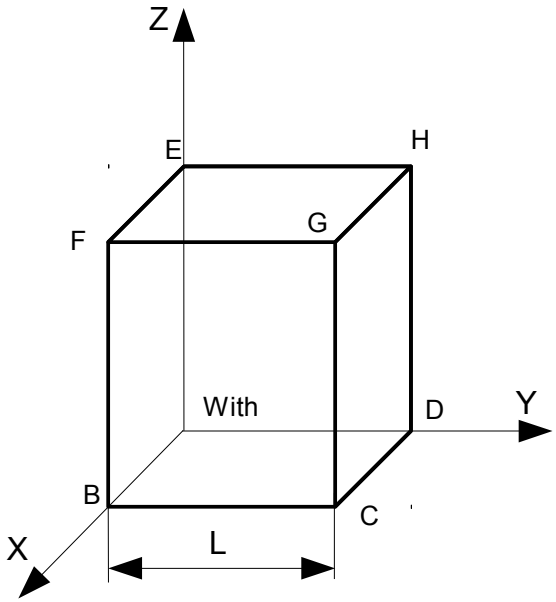
Modeling A this test makes it possible to test various possible configurations of damage of the law ENDO_ORTH_BETON in four stages and to check the good management of the various mechanisms:

- 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:

$E=32\,GPa$: Young modulus
$\nu=0.2$: Poisson's ratio

Law ENDO_ORTH_BETON

$k_0=300\,Pa$; $k_1=10{,}5\,MPa$; $k_2=7\times10^{-4}$; $\alpha=0{,}9$; $\gamma_b=1000\,Pa$; $\gamma_d=60000\,Pa$

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

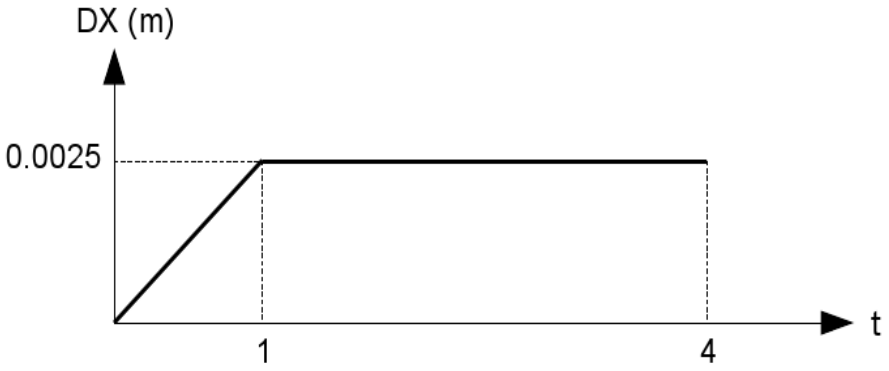
Many nodes: 8
Number of meshs and type: 1 HEXA8

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 $BCGF$: $DX=2{,}5\times10^{-3}$

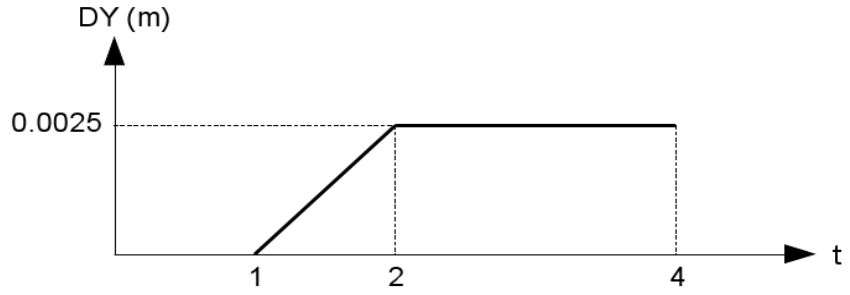
Displacement DX imposed on the face $BCGF$ vary gradually according to the function presented on the figure below. Once the maximum reaches with $t=1\text{s}$, displacement DX face $BCGF$ is then blocked for the following stages.



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 $DCGH$: $DY=2{,}5\times10^{-3}$

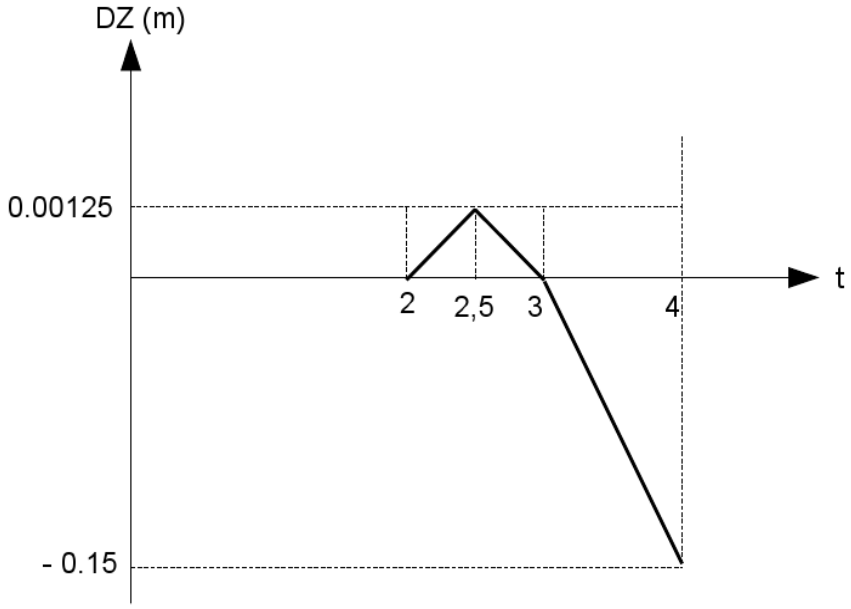
Displacement DY imposed on the face $DCGH$ vary gradually according to the function presented on the figure below. Once the maximum reaches with $t=2\text{s}$, displacement DY face $DCGH$ is then blocked for the following stages.



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 (%)
$V1$	2	Not regression	0,86689832	0,1
$SIXX(Pa)$	10	Not regression	8888,8889	0,1
$V2$	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

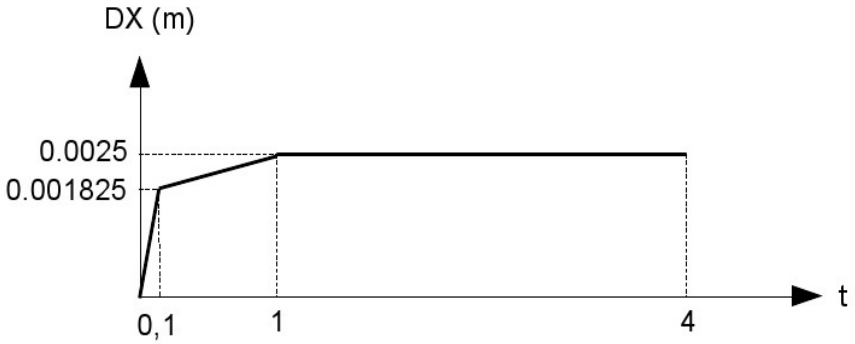
Many nodes: 8
Number of meshs and type: 1 HEXA8

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 $BCGF$: $DX=2{,}5\times10^{-3}$

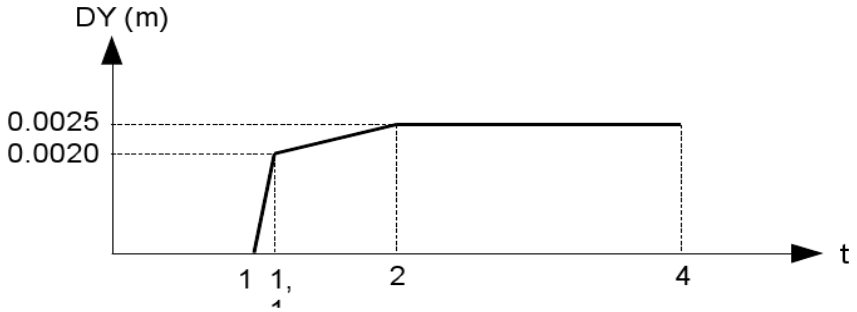
Displacement DX imposed on the face $BCGF$ vary gradually according to the function presented on the figure below. Once the maximum reaches with $t=1\text{s}$, displacement DX face $BCGF$ is then blocked for the following stages.



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 $DCGH$: $DY=2{,}5\times10^{-3}$

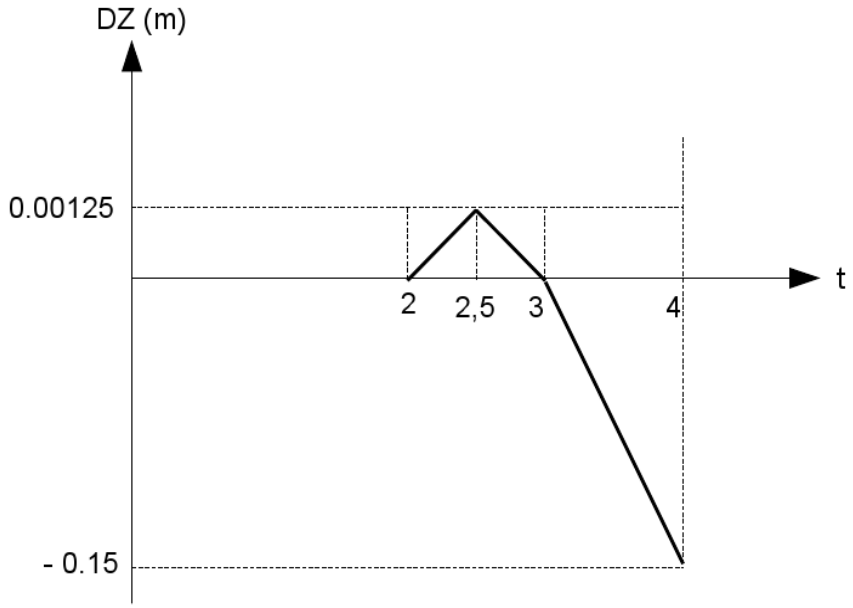
Displacement DY imposed on the face $DCGH$ vary gradually according to the function presented on the figure below. Once the maximum reaches with $t=2\text{s}$, displacement DY face $DCGH$ is then blocked for the following stages.



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
$SIXX(Pa)$	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.