

ZZZZ286 – The purpose of validation of the displacement imposed on an edge

Summarized

This test is validating the assignment of a loading of type displacement on an edge of a structure. It makes it possible to qualify key word `ARETE_IMPO` of operator `AFFE_CHAR_MECA`.

On some nodes tests displacements in mesh according to whether one subjected structure to a loading produced by `ARETE_IMPO` or an equivalent loading.

1 Problem of reference

1.1 Geometry

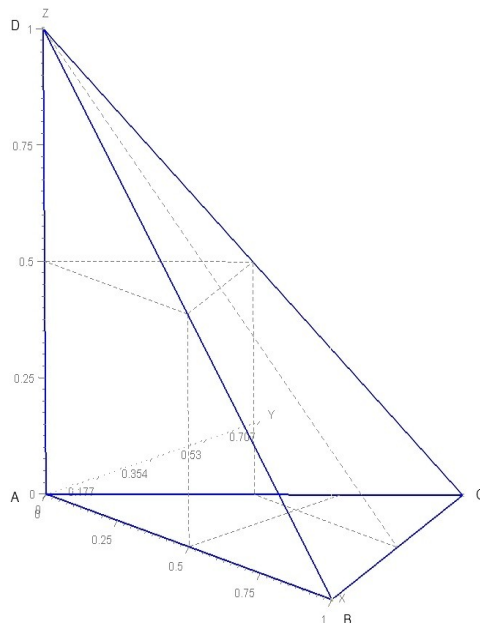


Figure 1.1-1: Representation of the geometry

Point: <i>A</i>	(0,0,0)
Point: <i>B</i>	(1,0,0)
Point: <i>C</i>	$(\frac{\sqrt{(2)}}{2}, \frac{\sqrt{(2)}}{2}, 0)$
Point: <i>D</i>	(0,0,1)

Table 1.1-1: Coordinated points

1.2 Properties of the material

the material is a steel:

$$E=2.04 \cdot 10^{11} \quad \nu=0.3 \quad \alpha=1.092 \cdot 10^{-5}.$$

1.3 Boundary conditions and loadings

1.3.1 Loading on a vertical edge (support of the one of the axes of the reference)

the validation of key word ARETE_IMPO must pass by the equivalence of the following conditions:

•1.3.1.1 conditions:

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Imposed *DBC* face: $DNOR=10$
Blocageaux points D, B, C : $DX=0, DY=0, DZ=0$
Déplacement imposé sur les nœuds de l'arête DA : $DZ=0$

- 1.3.1.2 conditions:
Imposed *DBC* face: $DNOR=10$
Blocageaux points D, B, C : $DX=0, DY=0, DZ=0$
Imposed *DA* edge: $DTAN=0$ except at the point D .

On va valider l'équivalence entre ces conditions en testant les déplacements avec le nœud A .

1.3.2 Loading on oblique edges

la validation du mot-clé `ARETE_IMPO` doit passer par l'équivalence des conditions suivantes :

- 1.3.2.1 conditions:
Blocageaux nœuds de la face ABC : $DX=0, DY=0, DZ=0$
Déplacement imposé sur les nœuds de l'arête DA : $DZ=-1$ (sauf aux points D et A)
Connexions obliques avec les nœuds de l'arête DB (sauf aux points D et B): $DX=1$, $ANGL_NAUT=(0,45,0)$
Connexions obliques avec les nœuds de l'arête DC (sauf aux points D et C): $DX=1$, $ANGL_NAUT=(45,45,0)$
- 1.3.2.2 Conditions:
Blocageaux nœuds de la face ABC : $DX=0, DY=0, DZ=0$
Imposed *DA* edge: $DTAN=1$ except at the points D and A .
Imposed *DB* edge: $DTAN=1$ except at the points D and B .
Imposed *DC* edge: $DTAN=1$ except at the points D and C .

On va valider l'équivalence entre ces conditions en testant les déplacements avec le nœud D .

2 Reference solution

2.1 Method of calculating used for the reference solution

les déplacements obtenus à partir des conditions de chargement 1.3.1.1 (ou 1.3.2.1) sont la référence pour les tests effectués sur les déplacements obtenus à partir des conditions de chargement 1.3.1.2 (ou 1.3.2.2).

3 Modelization A

3.1 Characteristic of the modelization

Finite elements 3D

3.2 Characteristic of the mesh

Many nodes: 286

Number of meshes and type: 62 SEG2, 186 TRIA3, 1041 TETRA4

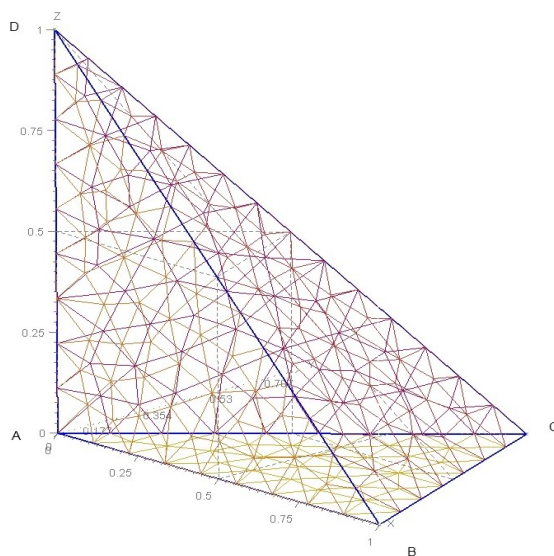


Table 3.2-1: Representation of the mesh

3.3 Quantities tested and Standard

Identification	results of reference	Value	Tolerance
DX to the node A (conditions of 1.3.1.2 loading)	"AUTRE_ASTER"	11.2562	0.001%
DY with the node A (conditions of 1.3.1.2 loading)	"AUTRE_ASTER"	4,9688	0.001%
DZ with the node A (conditions of 1.3.1.2 loading)	"AUTRE_ASTER"	0.0	0.001%
DX with the node D (conditions of 1.3.2.2 loading)	"AUTRE_ASTER"	0.443218	0.001%
DY with the node D (conditions of 1.3.2.2 loading)	"AUTRE_ASTER"	0.182208	0.002%
DZ with the node D (conditions of 1.3.2.2 loading)	"AUTRE_ASTER"	-1.00511	0.001%

Table 3.3-1: Summary

4 results of the results

the results are very good (error max lower than 0.002%).

The equivalence of the loadings is thus validated. Key word `ARETE_IMPO` of operator `AFFE_CHAR_MECA` is operational.