

## ZZZZ286 – Validation of the displacement imposed on an edge

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### Summary

The purpose of this test is to validate the assignment of a loading of type displacement on an edge of a structure. It makes it possible to qualify the keyword `ARETE_IMPO` of the operator `AFFE_CHAR_MECA`.

Displacements in certain nodes of the grid are tested according to whether one subjected the structure to a loading produced by `ARETE_IMPO` or by a loading are equivalent.

## 1 Problem of reference

### 1.1 Geometry

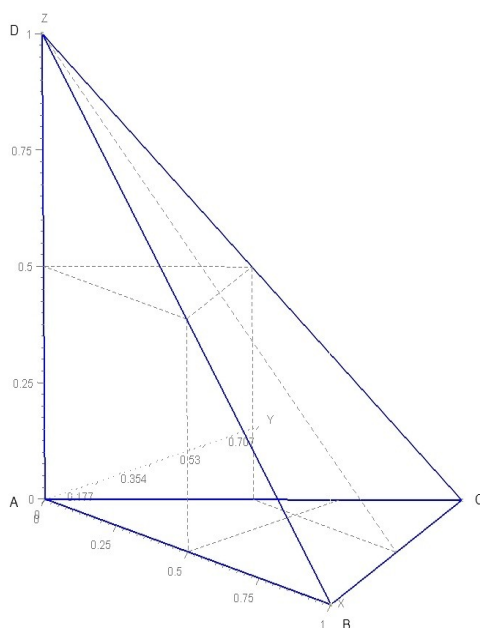


Figure 1.1-1: Representation of the geometry

Not $A$ :	$(0,0,0)$
Not $B$ :	$(1,0,0)$
Not $C$ :	$(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, 0)$
Not $D$ :	$(0,0,1)$

Table 1.1-1: Coordinates of the points

### 1.2 Properties of material

The material is a steel:

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

### 1.3 Boundary conditions and loadings

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

Validation of the keyword `ARETE_IMPO` must pass by the equivalence of the following conditions:

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- 1.3.1.1 conditions:  
Face  $DBC$  imposed:  $DNOR=10$   
Blocking at the points  $D, B, C$  :  $DX=0, DY=0, DZ=0$   
Displacement imposed on the nodes of the edge  $DA$  :  $DZ=0$
- 1.3.1.2 conditions:  
Face  $DBC$  imposed:  $DNOR=10$   
Blocking at the points  $D, B, C$  :  $DX=0, DY=0, DZ=0$   
Edge  $DA$  imposed:  $DTAN=0$  except at the point  $D$ .

One will validate equivalence between these conditions by testing displacements with the node  $A$ .

## 1.3.2 Loading on oblique edges

Validation of the keyword `ARETE_IMPO` must pass by the equivalence of the following conditions:

- 1.3.2.1 conditions:  
Blocking with the nodes of the face  $ABC$  :  $DX=0, DY=0, DZ=0$   
Displacement imposed on the nodes of the edge  $DA$  :  $DZ=-1$  (except at the points  $D$  and  $A$ )  
Connection obliques with the nodes of the edge  $DB$  (except at the points  $D$  and  $B$ ) :  
 $DX=1, ANGL\_NAUT=(0,45,0)$   
Connection obliques with the nodes of the edge  $DC$  (except at the points  $D$  and  $C$ ) :  $DX=1, ANGL\_NAUT=(45,45,0)$
- 1.3.2.2 conditions:  
Blocking with the nodes of the face  $ABC$  :  $DX=0, DY=0, DZ=0$   
Edge  $DA$  imposed:  $DTAN=1$  except at the points  $D$  and  $A$ .  
Edge  $DB$  imposed:  $DTAN=1$  except at the points  $D$  and  $B$ .  
Edge  $DC$  imposed:  $DTAN=1$  except at the points  $D$  and  $C$ .

One will validate equivalence between these conditions by testing displacements with the node  $D$ .

## 2 Reference solution

### 2.1 Method of calculating used for the reference solution

The displacements obtained starting from the conditions of loading 1.3.1.1 (or 1.3.2.1) are the reference to the tests carried out on the displacements obtained starting from the conditions of 1.3.1.2 loading (or 1.3.2.2).

## 3 Modeling A

### 3.1 Characteristics of modeling

Finite elements 3D

### 3.2 Characteristics of the grid

Many nodes: 286

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

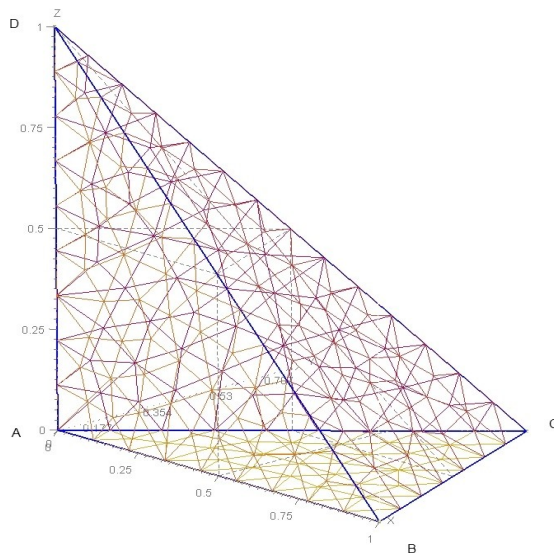


Table 3.2-1: Representation of the grid

### 3.3 Sizes tested and results

Identification	Type of reference	Value	Tolerance
$DX$ with 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: Results

## 4 Summary of the results

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

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