

## ZZZZ238 - Normal displacements imposed on curved sides of hexahedrons on 20 and 27 nodes and pentahedrons on 18 Summarized

---

### nodes:

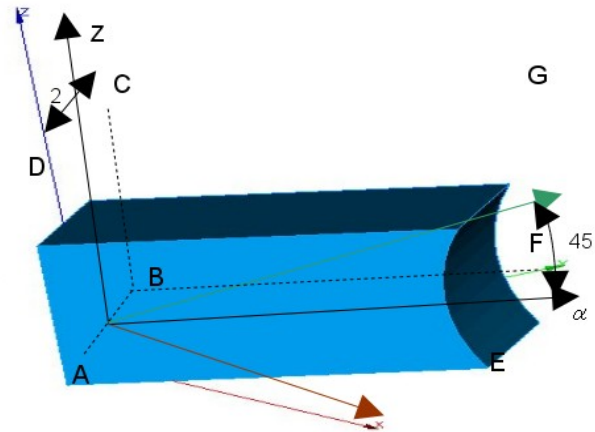
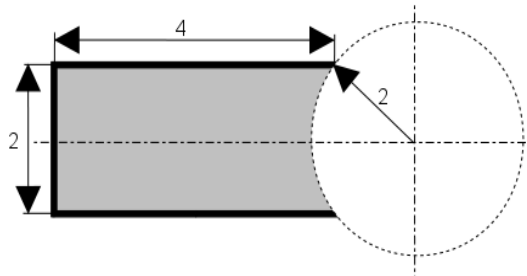
Validation of key word `DNOR` of factor key word `the` `FACE_IMPO` of operator `AFFE_CHAR_MECA`. This validation was carried out with the three following modelizations:

- Modelization a: mesh `HEXA20`, `DNOR` imposed on a curved face,
- Modelization b: mesh `HEXA27`, `DNOR` imposed on a curved face,
- Modelization C: mesh `PENTA18`, `DNOR` imposed on a curved face,

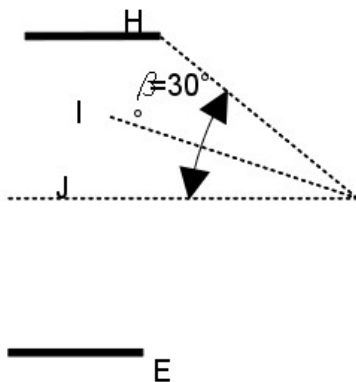
Comparison with analytical solution, and comparison `HEXA20` and `HEXA27` and `PENTA18`.

## 1 Problem of reference

### 1.1 Geometry



Dimensions in meters



Mesh groups:

GAUCHE : RIGHT *ABCD*  
face : face *EFGH*

the face *AEFB* is coplanar with the plane  
(*xy*)

the direction (*AE*) forms an angle  $\alpha = 45^\circ$   
with (*Ox*)

### 1.2 Properties of the material

- $E = 200\,000. N/mm^2$
- $\nu = 0.$

### 1.3 Boundary conditions and loadings

- Fixed support on the face *ABCD* :  $DX = DY = DZ = 0.$
- Normal displacement imposed on the face *EFGH* :  $DNOR = 0.15$

## 2 Reference solution

---

### 2.1 Method of calculating

Displacement to point:  $J$

- $DX = 0.15 \sin(45^\circ)$
- $DY = 0.15 \cos(45^\circ)$
- $DZ = 0.$

### 2.2 Results of reference

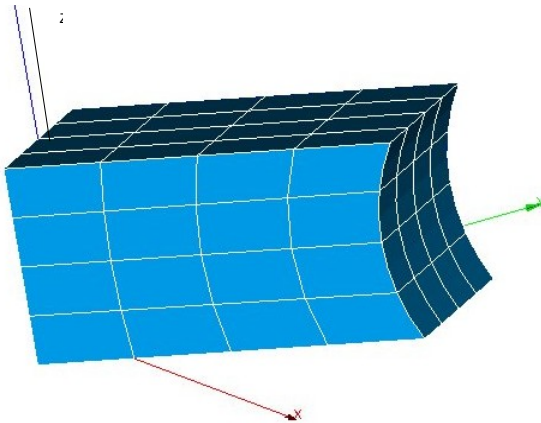
- $DX = 0.106066$
- $DY = 0.106066$
- $DZ = 0.$

### 2.3 Uncertainties

analytical Solution

## 3 Modelization A

### 3.1 Characteristic of the modelization A



Modelization in 3D: 64 elements HEXA20.

### 3.2 Functionalities tested

Command	Option
AFFE_MODELE	MODELISATION 3D
AFFE_CHAR_MECA	FACE_IMPO DNOR 0.15
MECA_STATIQUE	

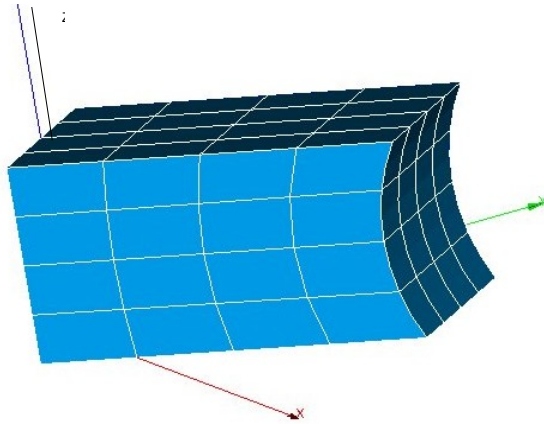
### 3.3 Results

Points	Quantity	Reference	Code_Aster	relative Error (%)
<i>H</i>	<i>DX</i> *	1.126635E- 1	1.126635E -1	1.16E- 5
	<i>DY</i> *	1.144527E-1	1.144527E- 1	1.91E- 5
	<i>DZ</i> *	-2.177228E-2	-2.177228E- 2	6.27E- 6
<i>I</i>	<i>DX</i> *	1.073518E-1	1.073518E- 1	6.91E- 6
	<i>DY</i> *	1.071796E-1	1.071796E- 1	4.72E- 6
	<i>DZ</i> *	-1.341602E-2	-1.341602E- 2	1.16E- 4
<i>J</i>	<i>DX</i>	0.106066	1.060872E-1	0.020
	<i>DY</i>	0.106066	1.060449E-1	- 0.020
	<i>DZ</i>	0.0	3.74492E-16	3.74E-16

\* Values the non regression ones obtained with Code\_Aster in version 9.2.25.

## 4 Modelization B

### 4.1 Characteristic of the modelization B



Modelization in 3D: 64 elements HEXA27.

### 4.2 Functionalities tested

Command	Option
AFFE_MODELE	MODELISATION 3D
AFFE_CHAR_MECA	DDL_IMPO DNOR 0.15
MECA_STATIQUE	

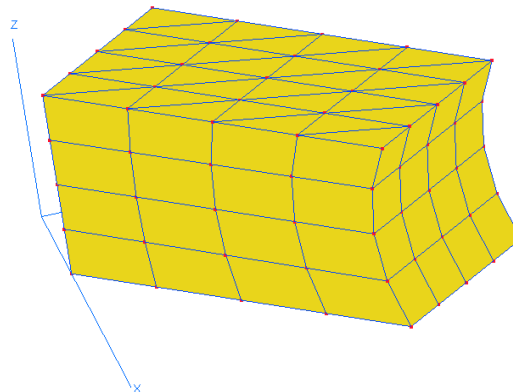
### 4.3 Results

Points	Quantity	Reference	Code_Aster	relative Error (%)
<i>H</i>	<i>DX</i> *	1.126635E-1	1.129919D-1	0.291
	<i>DY</i> *	1.144527E-1	1.129919D- 1	-1.276
	<i>DZ</i> *	-2.177228E-2	-2.316107D- 2	6.379
<i>I</i>	<i>DX</i> *	1.073518E-1	1.072795D- 1	-0.067
	<i>DY</i> *	1.071796E-1	1.072795D- 1	0.093
	<i>DZ</i> *	-1.341602E-2	-1.334324D- 2	-0.542
J	<i>DX</i>	0.106066	1.060660D-1	1.62E- 5
	<i>DY</i>	0.106066	1.060660D-1	1.62E- 5.0.0
	<i>DZ</i>		-4.18783 9D-17	-4.19E-17

\* Values the non regression ones obtained with the modelization A (Meshes HEXA20)

## 5 Modelization C

### 5.1 Characteristic of the modelization C



Modelization in 3D: 128 elements PENTA18.

### 5.2 Functionalities tested

Command	Option
AFFE_MODELE	MODELISATION 3D
AFFE_CHAR_MECA	DDL_IMPO DNOR 0.15
MECA_STATIQUE	

### 5.3 Results

Points	Quantity	Reference	Code_Aster	relative Error (%)
H	$DX^*$	1.0986534E-1	1.0968894D-1	0.16
	$DY^*$	1.0975895E-1	1.0972729D- 1	0.03
	$DZ^*$	-1.7046775E-2	-1.7401956D- 2.2.1	
I	$DX^*$	1.0734417E-1	1.0739643D- 1	0.049
	$DY^*$	1.072603E-1	1.0733993D- 1	0.074
	$DZ^*$	-1.3223189E-2	-1.28751799D- 2.2.6	
J	$DX$	0.106066	1.06137138D-1	0.067
	$DY$	0.106066	1.05994896D-1	0.067
	$DZ$	0.0	-1.42247D-16	1.4E-16

\* Values the non regression ones obtained with meshes PENTA15

## 6 Summary of the results

---

the results with *Code\_Aster* for HEXA20, HEXA27 and PENTA18 are in very good agreement with the analytical solution at the point of observation *J*.

For the other points of observation the comparison of displacements between the HEXA20 and HEXA27 on the curved face is correct: One notes a maximum change of 6.4%.