

SDLS124 – Plate offset in bending under dynamic loading

Abstract:

The purpose of this test is comparing the taking into account of the eccentricity of the shells in Code_Aster and Europlexus. It is also used to provide to two cases tests of Europlexus of the results of reference for the validation of the offset shells.

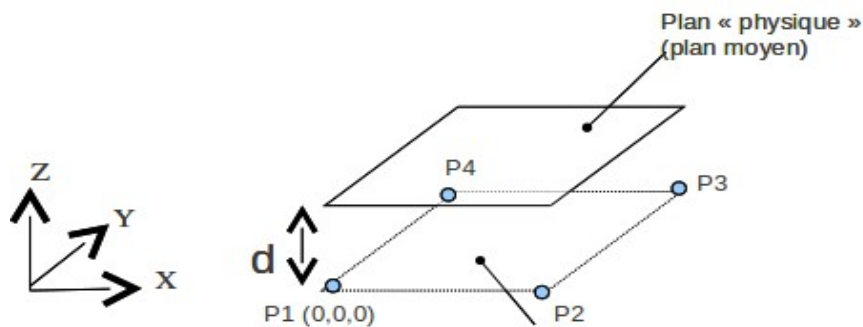
This comparison is made on an offset plate, embedded on a side, subjected to a dynamic loading inducing of bending. The comparisons are made for a mesh in quadrangle and a mesh in triangle.

The corresponding tests of Europlexus are *bm_str_q4gs_exce* for case QUAD4 and *bm_str_t3gs_exce* for case TRIA3 .

1 Description

1.1 Geometry

The model of study is a plate squares on side $c=1\text{m}$ and of thickness $ep=0.05\text{m}$. This plate is offset of $d=0.05\text{m}$.



1.2 Properties of the materials

the properties of steel for the plate are given in the following table.

Material	Steel
Modulus Young	$2 \times 10^{11} \text{ Pa}$
Poisson's ratio	0.2
Density	7800 kg/m^3

1.3 Boundary conditions and loadings

1.3.1 Boundary conditions

the side defined by segment P1P4 of the plate is blocked to 0 for the components DX , DZ and DRY , moreover the component DY is blocked in PI .

1.3.2 Loading:

The loading consists in applying a linear force according to Z to the segment $P2P3$, passing from 0 to 50000 N/m in 0.01 second then maintained constant thereafter.

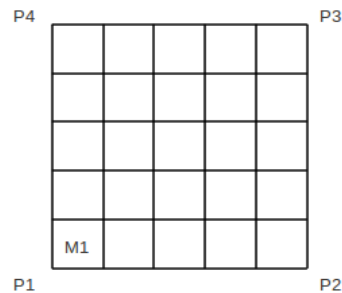
2 Reference solution

the reference solution is given by the results got for same computation with Europlexus.
It is specified that the tests Europlexus correspondings will use the results of Code_Aster like reference.

3 Modelization A

3.1 Characteristic of the modelization

the plate consists of 25 meshes of type QUAD4 modelled in DKT.

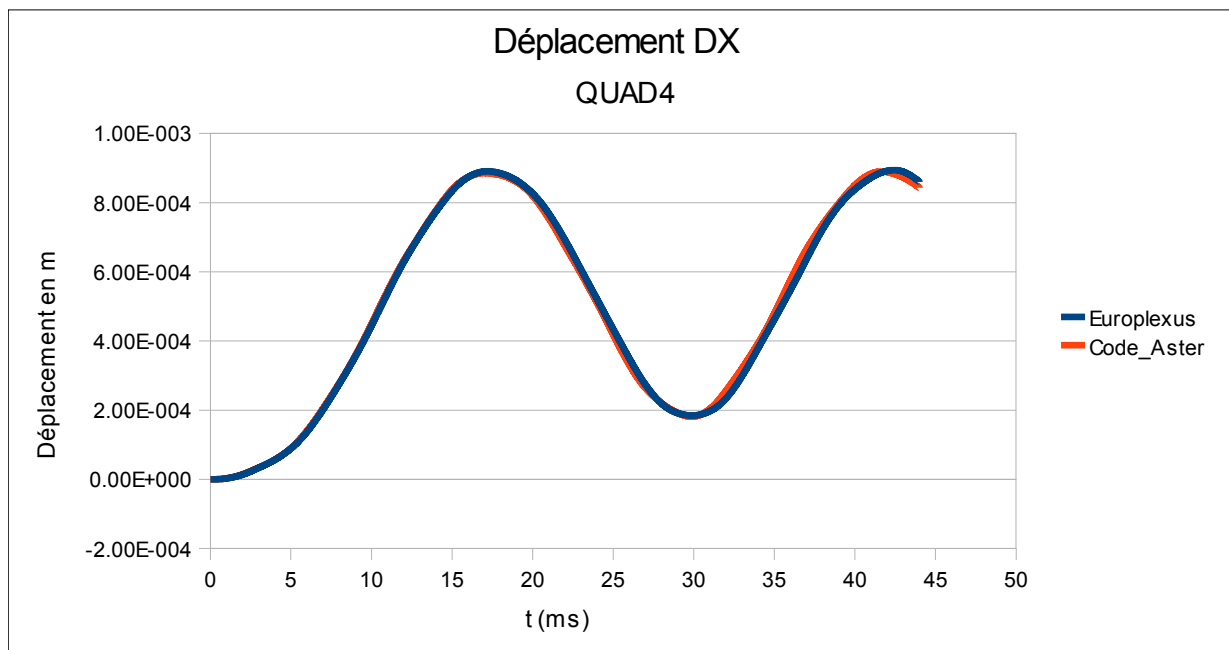


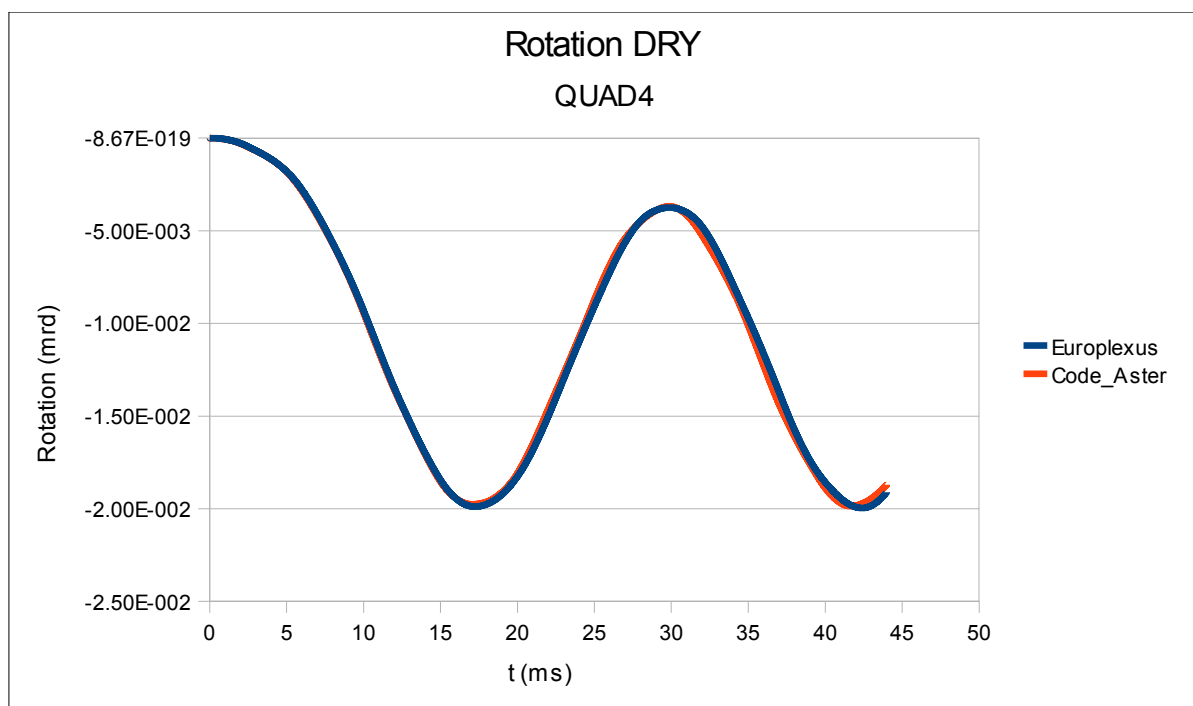
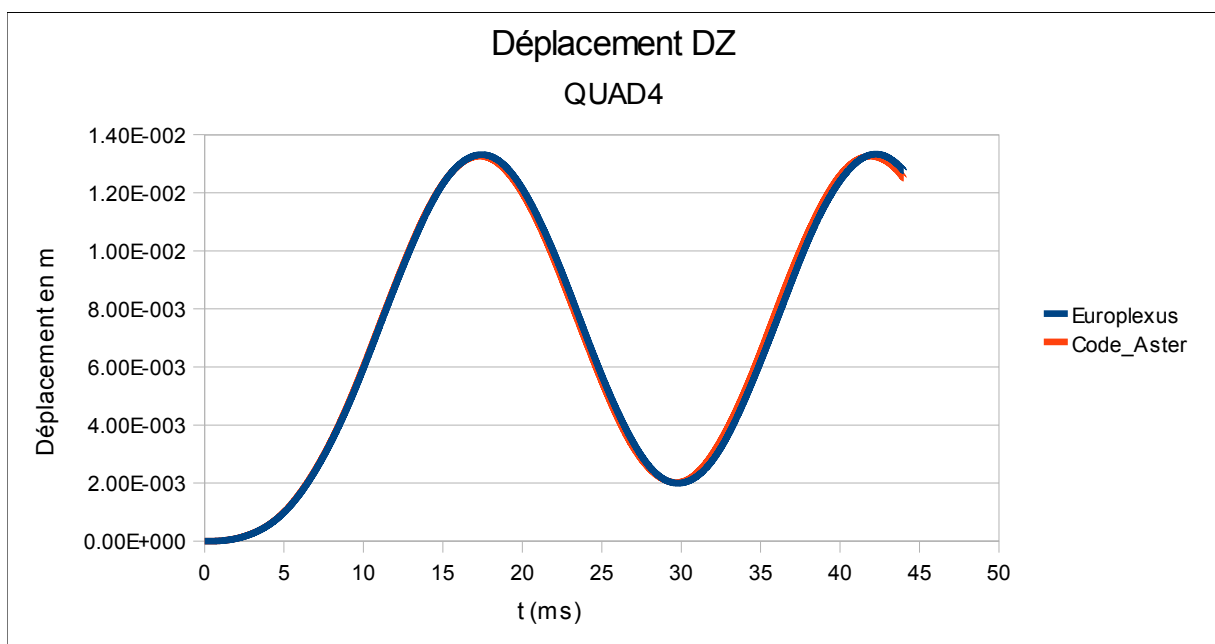
3.2 Comparisons and results

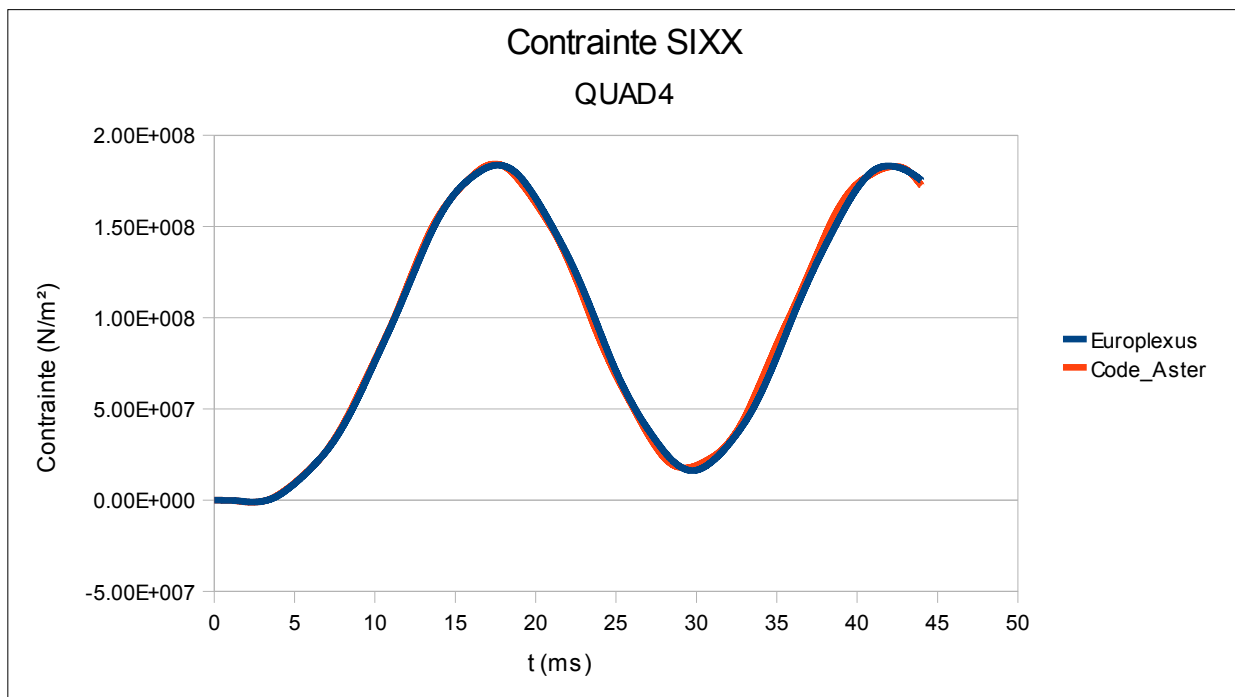
3.2.1 Comparisons

the comparisons are made on the components DX , DZ and DRY of the displacement of the point $P2$ like on the components $SIXX$ of the stresses of the mesh MI (POINT1, SOUS_POINT 1, this subpoint is at the lower end in the thickness of the shell).

The 4 following figures compare the evolutions of these values in the course of time for the two computer codes.







3.2.2 Results tested

the results tested correspond to the values compared above with the second peak, i.e. for times around 0,042ms (times are slightly different according to the quantities).

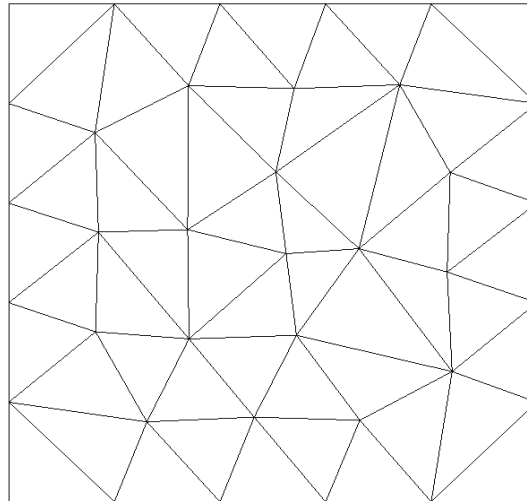
Node	Field	Component	Order	Value of ref. (m)	Accuracy	Reference
P3	DEPL	DX	5204	8.93912E-4	5.0E-3	SOURCE_EXTERNE
P3	DEPL	DZ	5250	1.3327E-2	6.0E-3	SOURCE_EXTERNE
P3	DEPL	DRY	5210	-1.99599E-2	6.0E-3	SOURCE_EXTERNE

Nets	Field	comp., Not, S-P	Order	Value of ref. (N/m²)	Accuracy	Reference
MI	SIEF_ELGA	SIXX, 1,1	5312	1.8317556E+8	3.0E-3	SOURCE_EXTERNE

4 Modelization B

4.1 Characteristic of the modelization

the plate consists of 54 meshes of TRIA3 modelled in DKT .

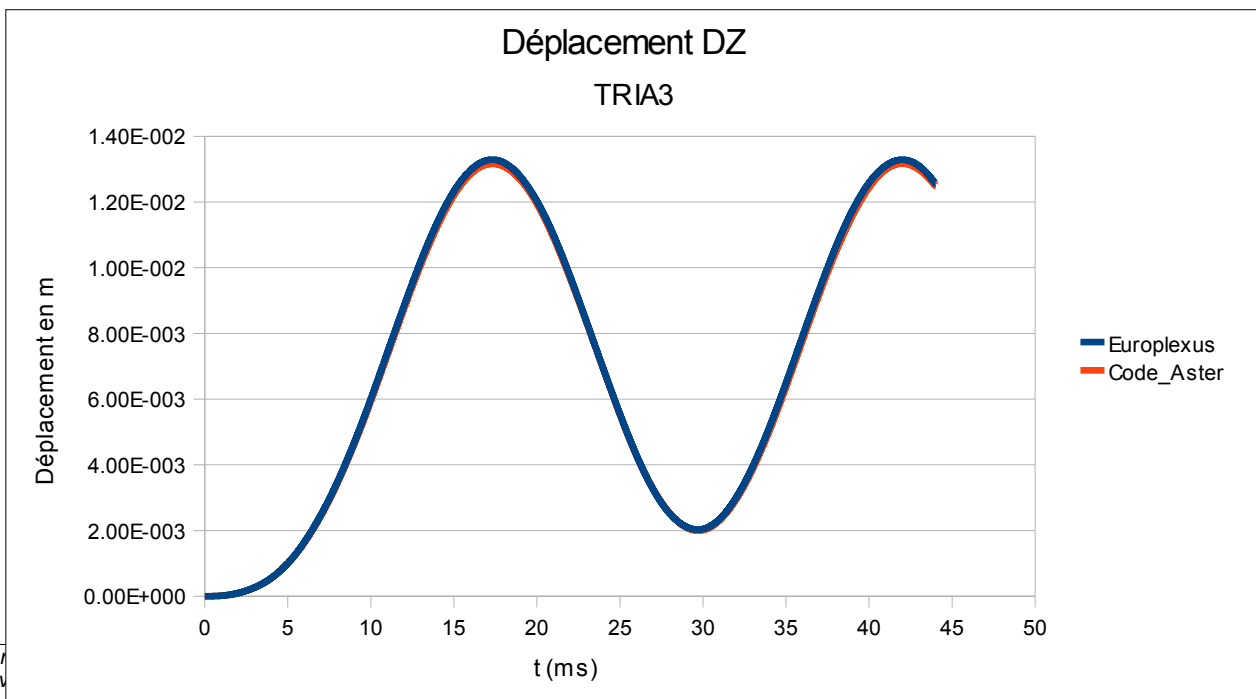
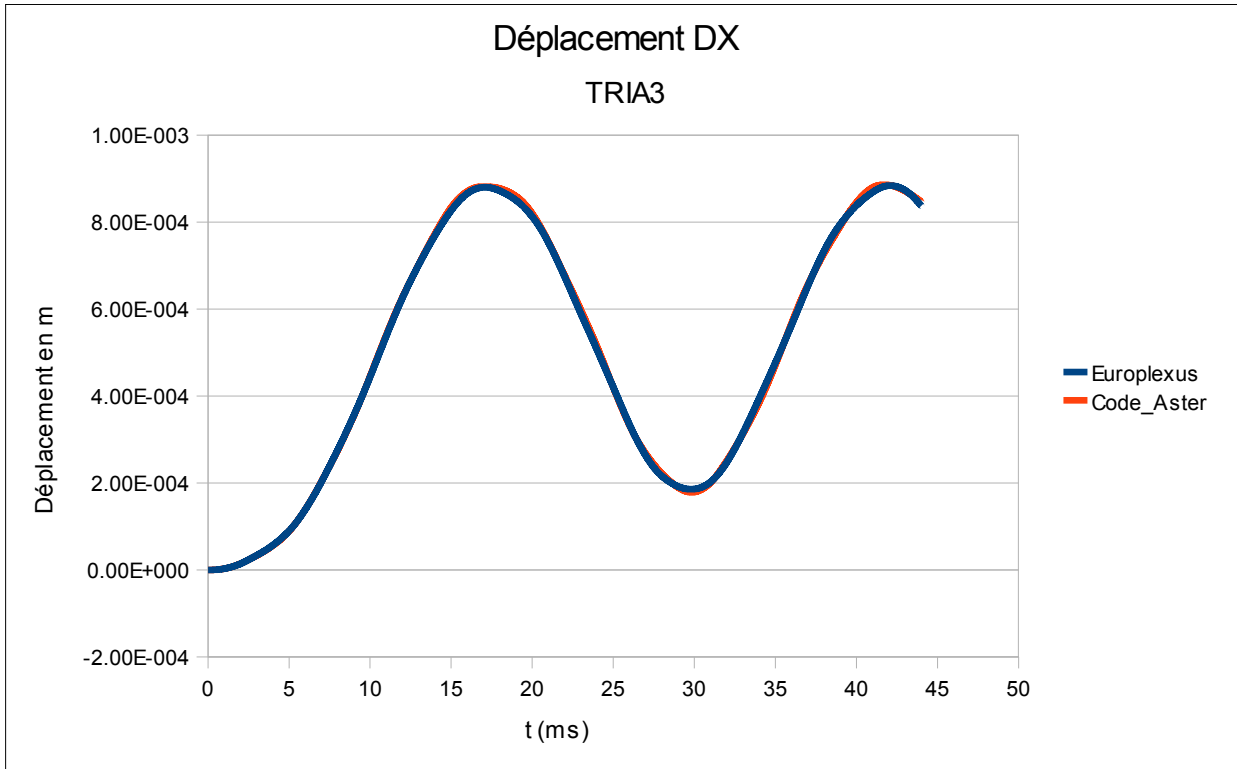


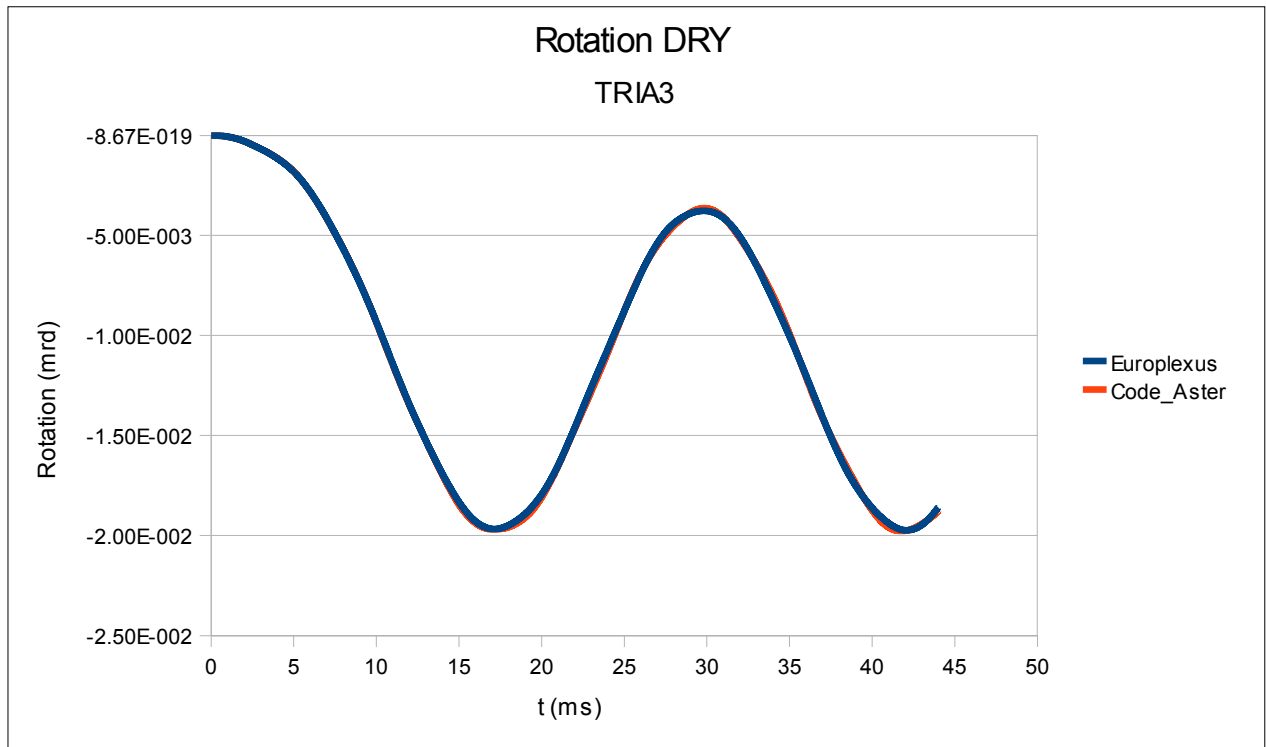
4.2 Comparisons and results

4.2.1 Comparisons

the comparisons are made on the components DX , DZ and DRY of the displacement of the point $P2$. Contrary to the modelization A, there is no here comparison of stresses, because Europlexus does not make it possible to calculate the stresses on several layers with the meshes triangular ones (modelization T3GS).

The 3 following figures compare the evolutions of these values in the course of time for the two computer codes.





4.2.2 Results tested

the results tested correspond to the values compared above with the second peak, i.e. for times around $0,042\text{ ms}$ (times are slightly different according to the quantities).

Node	Field	Component	Order	Value of ref. (m)	Accuracy	Reference
P3	DEPL	DX	5214	$8.83837\text{E}-4$	$3.0\text{E}-3$	SOURCE_EXTERNE
P3	DEPL	DZ	5250	$1.32879\text{E}-2$	$9.0\text{E}-3$	SOURCE_EXTERNE
P3	DEPL	DRY	5220	$-1.97352\text{E}-2$	$2.0\text{E}-3$	SOURCE_EXTERNE

5 Synthesis

One notes by looking at the curves that the results of the two computer codes are very close. In the modelization A, one can see a light phase shift on the curves of displacement. In the modelization B, there is not that phase shift but the error in DZ with the second peak approaches 1%.

One can conclude that the processing of the eccentricity in Code_Aster corresponds to what is made in Europlexus.