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## SSLS113 - Eccentring of homogenized plates

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### Summarized:

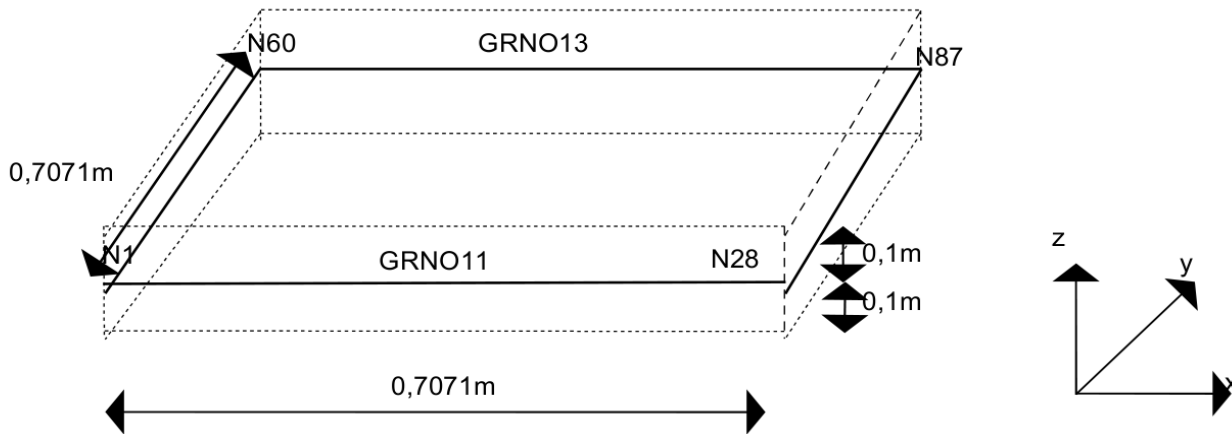
This test makes it possible to validate the eccentring of the plates having a behavior "ELAS\_COQUE" .

The reference is given by a first resolution where one models double-layered orthotropic having a material NON-symmetry compared to the average plane.

The validation is done in the second computation where one models the behavior of the preceding plate by 2 offset full-course plates having a behavior "ELAS\_COQUE" .

## 1 Problem of reference

### 1.1 Geometry



Coordinated of the points:

$$N1 (0,0,0)$$

$$N87 (0,7071,0.7071,0)$$

$$N28 (0,7071,0,0)$$

$$N60 (0,0.7071,0)$$

### 1.2 Material properties

the material is double-layered.

The material constituting the first layer is orthotropic and is characterized by the following data:

$$EL=6800.Pa$$

$$ET=6800.Pa$$

$$VLT=0.35$$

$$GLT=2530.Pa.$$

The material constituting the second layer is also orthotropic and is characterized by the following data:

$$EL=14000.Pa$$

$$ET=14000.Pa$$

$$VLT=0.144$$

$$GLT=2070.Pa.$$

### 1.3 Boundary conditions and loadings

the side  $N1N28$  (  $GRN011$  ) is clamped:

$$dx=0.$$

$$dy=0.$$

$$dz=0.$$

$$dRx=0.$$

$$dRy=0.$$

$$dRz=0.$$

One imposes the degrees of freedom  $dx$  and  $dy$  of the nodes on the side  $N80N60$  (  $GROUPO GRN013$  ) on the following values:

$$dx=0.07071 m$$

$$dy=0.07071 m$$

## 2 Reference solution

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### 2.1 Méthode de calcul used for the reference solution

the reference solution is resulting from the first computation with ASTER with the double-layered one describes in the problem of reference.

### 2.2 Results of reference

They are made up by the values of the field:

- Of displacement to the node  $NI$  of coordinates  $(0, .0, .0)$  (degree of freedom) and to the node  $N10$  of coordinates  $(0.216760, 0.0764431, 0)$ ,
- Of elastic strain energy on the mesh  $M5$ .

### 2.3 Uncertainty on the solution

Null for displacements, since it is about the same computation carried out by two different ways.

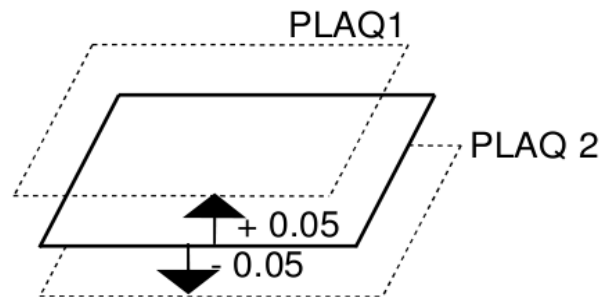
## 3 Modelization A

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### 3.1 Characteristic of the modelization

The model consists of 2 plates corresponding to the average plan of the 2 layers of the model of reference.

To represent these 2 plates, one leaves the mesh of the average plane of double-layered which one offsets distances  $-0.05m$  and  $0.05m$ . The elements used are shell elements  $DKT$ .



One assigns behavior "ELAS\_COQUE" to each one of these plates corresponding to the homogenized orthotropic behavior of the corresponding layer.

The values of the coefficients material introduced under "ELAS\_COQUE" were calculated directly [U4.43.01], page 27.

### 3.2 Characteristics of the mesh

The model has 87 triangular nodes and 140 elements  $DKT$ .

## 3.3 Values tested

Identification	Reference
DZ (N1)	- 0.169388
<i>DX ( N10 )</i>	0.008962
<i>DY ( N10 )</i>	0.008170
<i>DZ ( N10 )</i>	0.163598
<i>DRX ( N10 )</i>	4.196430
<i>DRY ( N10 )</i>	- 0.050793

Standard				Identification of reference	Values of reference	Tolerance %
Quantity		Node	Nets			
ENEL_ELNO	<i>TOTALE</i>	N1	M5	"NON_DEFINI"	9.427E-3	0.1
	<i>MEMBRANE</i>			"NON_DEFINI"	4.320E-3	0.1
	<i>FLEXION</i>			"NON_DEFINI"	3.806E-3	0.1
	<i>CISAILLE</i>			"NON_DEFINI"	1.457E-7	0.1
	<i>COUPL_MF</i>			"NON_DEFINI"	1.301E-3	0.1

Identification				Standard of reference	Values of reference	Tolerance %
Quantity		Not	Mesh			
ENEL_ELGA	<i>TOTALE</i>	1	M5	"NON_DEFINI"	8.523E-3	0.1
	<i>MEMBRANE</i>			"NON_DEFINI"	4.320E-3	0.1
	<i>FLEXION</i>			"NON_DEFINI"	3.260E-3	0.1
	<i>CISAILLE</i>			"NON_DEFINI"	1.457E-7	0.1
	<i>COUPL_MF</i>			"NON_DEFINI"	9.430E-4	0.1

Identification		Standard of reference	Values of reference	Tolerance %	
Quantity	Nets				
ENEL_ELEM	TOTALE	M5	"NON_DEFINI"	2.468E-5	0.1
	MEMBRANE		"NON_DEFINI"	1.193E-5	0.1
	FLEXION		"NON_DEFINI"	9.484E-6	0.1
	CISAILLE		"NON_DEFINI"	4.025E-10	0.1
	COUPL_MF		"NON_DEFINI"	3.264E-6	0.1

### 3.4 Remarks

No error compared to double-layered orthotropic.

## 4 Synthesis

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the results show the good taking into account of the eccentricing for ELAS\_COQUE .