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## SSLS113 - Offsetting of homogenized plates

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### Summary:

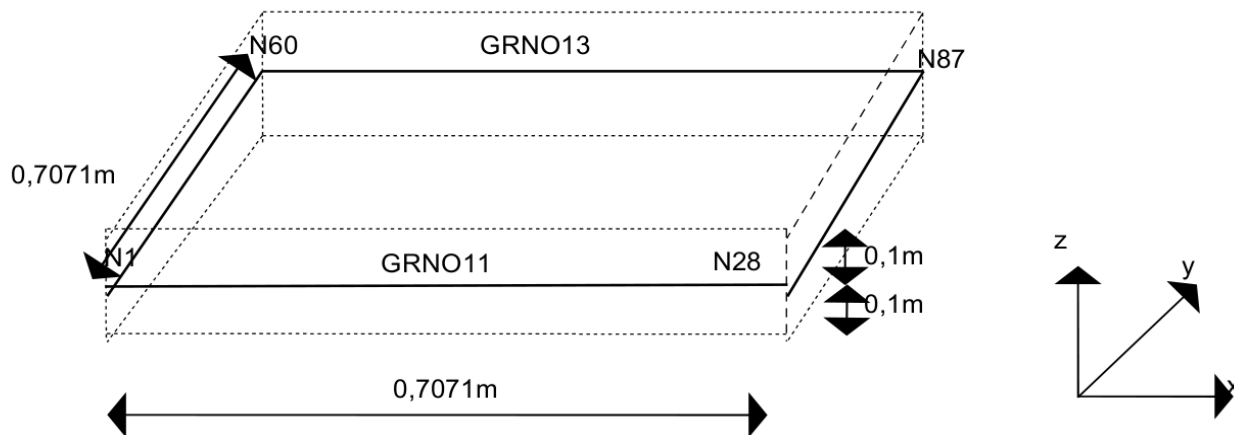
This test makes it possible to validate the offsetting of the plates having a behavior `'ELAS_COQUE'` .

The reference is given by a first resolution where one models double-layered orthotropic having a material not-symmetry compared to the average plan.

The validation is done in the second calculation 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



Coordinates 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 embedded:

$$dx = 0.$$

$$dy = 0.$$

$$dz = 0.$$

$$dRx = 0.$$

$$dRy = 0.$$

$$dRz = 0.$$

The degrees of freedom are imposed  $dx$  and  $dy$  nodes on the side  $N80N60$  ( $GROUPNO GRN013$ ) with the following values:

$$dx = 0.07071 m$$

$$dy = 0.07071 m$$

## 2 Reference solution

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

The reference solution is resulting from the first calculation 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  $NI$  coordinates  $(0, .0, .0.)$  (degree of freedom) and with the node  $NI0$  coordinates  $(0.216760, 0.0764431, 0.)$ ,
- Of elastic energy on the mesh  $M5$ .

### 2.3 Uncertainty on the solution

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

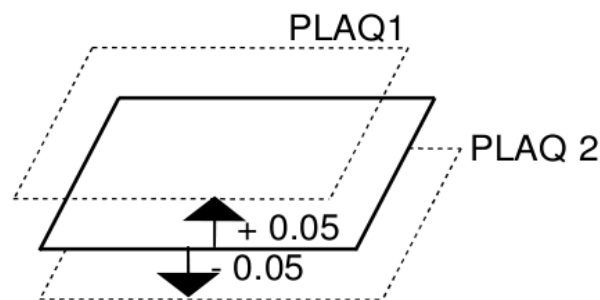
## 3 Modeling A

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### 3.1 Characteristics of modeling

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 grid of the average plan of double-layered which one offsets distances  $-0.05\text{ m}$  and  $0.05\text{ m}$ . The elements used are elements of plate  $DKT$ .



The behavior is affected 'ELAS\_COQUE' with each one of these plates corresponding to the homogenized orthotropic behavior of the corresponding layer.

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

### 3.2 Characteristics of the grid

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

Identification				Type of reference	Values of reference	Tolerance %
Size	Node	Mesh				
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				Type of reference	Values of reference	Tolerance %
Size	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		Type of reference	Values of reference	Tolerance %	
Size	Mesh				
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

Pas d' error compared to double-layered orthotropic.

## 4 Synthesis

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