SSLS113 - Offsetting of homogenized plates

Summary:

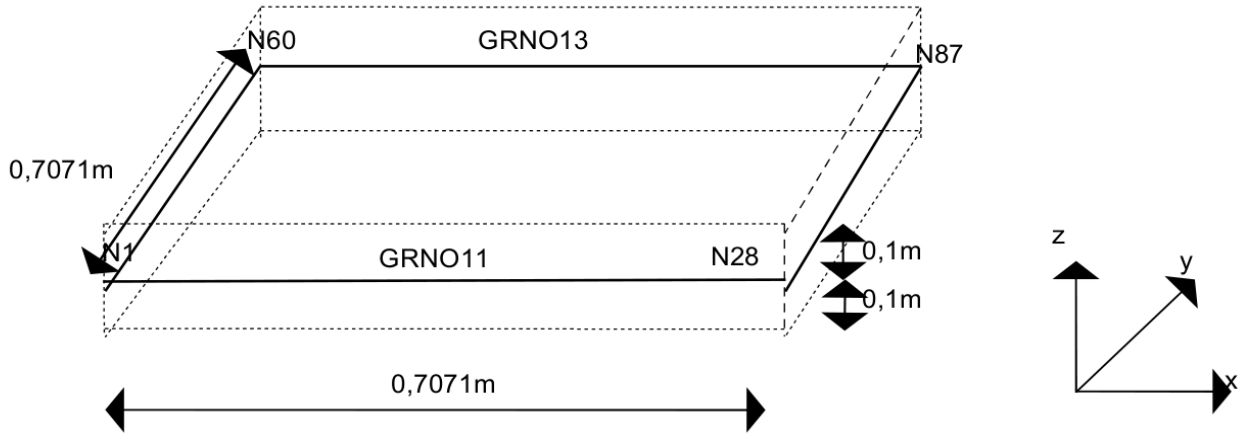
This test makes it possible to validate the offsetting of the plates having a behavior 'ELAS_COQUE'.

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:

$N1 \quad (0,0,0)$ $N87 \quad (0,7071,0.7071,0)$

$N28 \quad (0,7071,0,0)$ $N60 \quad (0,0.7071,0)$

1.2 Material properties

The material is double-layered.

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

$EL = 6800.Pa$ $ET = 6800.\text{Pa}$ $VLT = 0.35$ $GLT = 2530.\text{Pa}.$

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

$EL = 14000.\text{Pa}$ $ET = 14000.\text{Pa}$ $VLT = 0.144$ $GLT = 2070.\text{Pa}.$

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

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 $N1$ coordinates $(0,.0.,0.)$ (degree of freedom) and with the node $N10$ coordinates $(0.216760, 0.0764431, 0.)$,
- Of elastic energy on the mesh $M5$.

2.3 Uncertainty on the solution

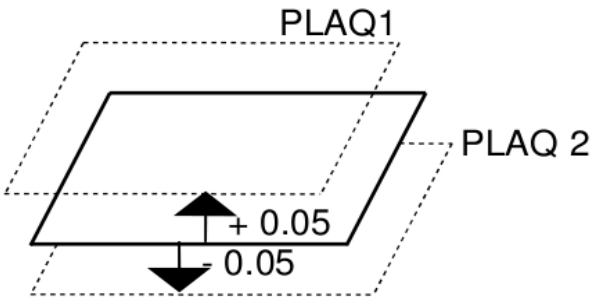
Worthless for displacements, since it is about the same calculation carried out by two different ways.

3 Modeling A

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 $-0.05m$ and $0.05m$. 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
DX ($N10$)	0.008962
DY ($N10$)	0.008170
DZ ($N10$)	0.163598
DRX ($N10$)	4.196430
DRY ($N10$)	–0.050793

Identification				Type of reference	Values of reference	Tolerance %
Size		Node	Mesh			
ENEL_ELNO	*TOTALE*	N1	M5	'NON_DEFINI'	9.427E-3	0.1
	MEMBRANE			'NON_DEFINI'	4.320E-3	0.1
	FLEXION			'NON_DEFINI'	3.806E-3	0.1
	CISAILLE			'NON_DEFINI'	1.457E-7	0.1
	COUPL_MF			'NON_DEFINI'	1.301E-3	0.1

Identification				Type of reference	Values of reference	Tolerance %
Size		Not	Mesh			
ENEL_ELGA	*TOTALE*	1	M5	'NON_DEFINI'	8.523E-3	0.1
	MEMBRANE			'NON_DEFINI'	4.320E-3	0.1
	FLEXION			'NON_DEFINI'	3.260E-3	0.1
	CISAILLE			'NON_DEFINI'	1.457E-7	0.1
	COUPL_MF			'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

The results show the good taking into account of offsetting for ELAS_COQUE .