

SSLS122 - Rectangular isotropic homogeneous plate offset

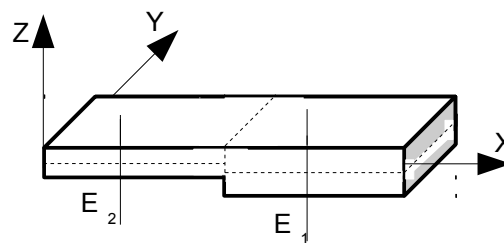
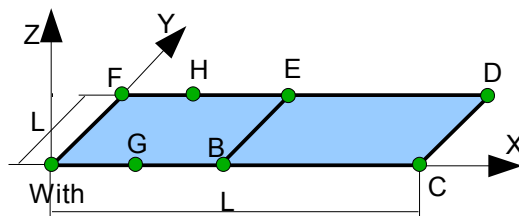
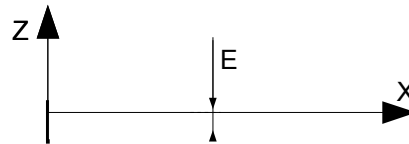
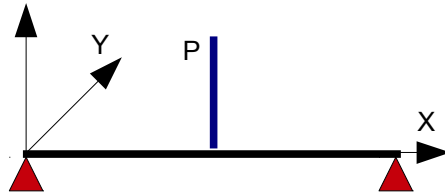
Summary:

This CAS-test makes it possible to test the eccentricity of the plates with modelings `DKT` and `DST`.

1 Problem of reference

1.1 Geometry

Inflection 3 points



Characteristics of the plates (m) :

Length: $L=10$

Width: $l=1$

Thickness 1: $e_1=0.1$

Thickness 2: $e_2=0.08$

Offsetting: $e=0.01$

Coordinates of the points (m) :

$A:(0,0)$	$E:(5,1)$
$B:(5,0)$	$F:(0,1)$
$C:(10,0)$	$G:(2.5,0)$
$D:(10,1)$	$H:(2.5,1)$

1.2 Properties of material

Rubber band

- $E=2.1 \times 10^{11} Pa$ Young modulus
- $\nu=0.3$ Poisson's ratio

1.3 Boundary conditions and loadings

Imposed displacement (m) :

- segment AF, CD : $DZ=0$
- segment FA : $DX=0$
- not A : $DX=DY=DRZ=0$

Loading

- Pressure on BE : $p=2.\times 10^5 N/m$ $P=pl$

2 Reference solution

2.1 Method of calculating used for the reference solution

Displacements:

- Points B and E

$$f = \frac{Pl^3}{96EI_1} + \frac{Pl^3}{96EI_2} \text{ with } I_i = \frac{b \times e_i^3}{12}$$

- Points G and H

$$f = -\frac{Pl^3}{192EI_1} \left(\frac{I_1}{I_2} + \frac{7}{2} \right)$$

- Bending moment:

$$M(x) = \frac{P \cdot x}{2}$$

2.2 Reference variable

- DZ following displacement z at the points B and G .
- MXX bending moment for $x = \frac{L}{2}$ and $x = \frac{L}{4}$

2.3 Size and result of reference

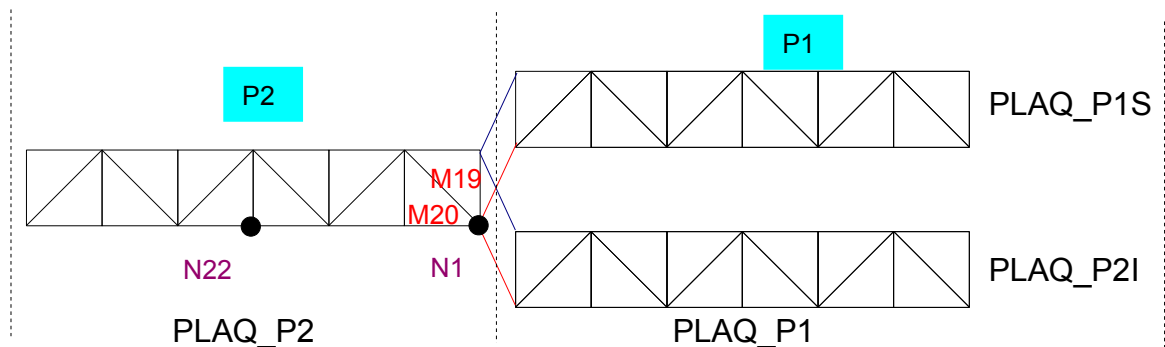
Not	Component	Reference
B	DZ	0.3515625 m
	DRZ	0.
	MXX	$-50 \times 10^4 \text{ m.N}$
G	DZ	-0.2629743 m
	DRZ	0.
	MXX	$-25. \times 10^4 \text{ m.N}$

3 Modeling A

3.1 Characteristics of modeling A

The grid of the plate is composed in two parts:

- $P1$, constituted of a nonexcentré grid
- $P2$, constituted by two superimposed grids:
 - $PLAQ_P1S$ excentré of 0.015m
 - $PLAQ_P1I$ excentré of $-0.035m$



Modeling DKT:

Many nodes	26			
Many meshes	39	That is to say:	SEG2	3
			TRIA3	36

Group of nodes:

- A, B, C, D, E, F, G, H

Group of meshes:

- $PLAQUE$: surface $ACDF$
- $PLAQ_P1$: surface $BCDE$
- $PLAQ_P2$: surface $ABEF$
- CD : segment CD
- FA : segment FA
- BE : segment BE

3.2 Result of modeling A

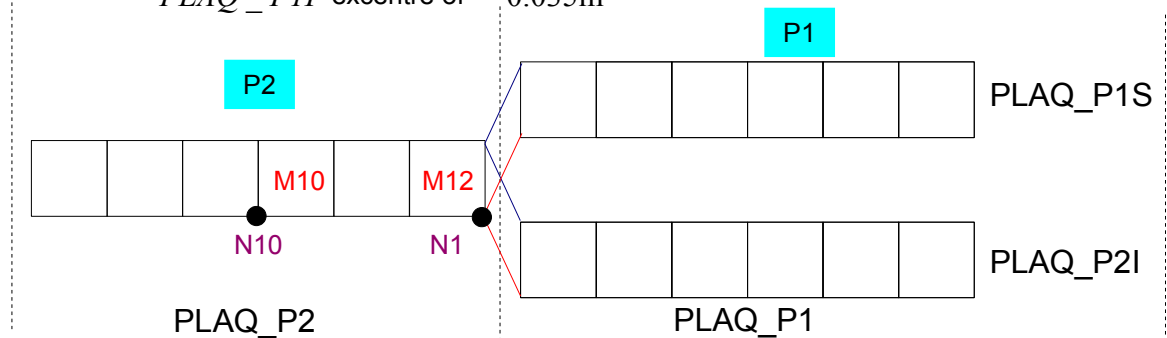
Not	Mesh	node	Component	Reference	Tolerance (%)
B		N1	DZ	0.3515625 m	1.
		N1	DRZ	0.	0.1
		M19	MXX	-500 000. m.N	3.
		M20	MXX	-500 000. m.N	5.
G		N22	DZ	-0.2629743 m	1.
		N22	DRZ	0.	0.1

4 Modeling B

4.1 Characteristics of modeling B

The grid of the plate is composed in two parts:

- $P1$, constituted of a nonexcentré grid
- $P2$, constituted by two superimposed grids:
 - $PLAQ_P1S$ excentré of 0.015m
 - $PLAQ_P1I$ excentré of $-0.035m$



Modeling DKT:

Many nodes	26			
Many meshes	21	That	SEG3	3
		is to		
		say:	QUAD4	18

Group of nodes:

- A, B, C, D, E, F, G, H

Group of meshes:

- $PLAQUE$: surface $ACDF$
- $PLAQ_P1$: surface $BCDE$
- $PLAQ_P2$: surface $ABEF$
- CD : segment CD
- FA : segment FA
- BE : segment BE

One tests in this modeling $COEF_RIGI_DRZ$ negative. In this case, the ddl DRZ has a physical direction of "drilling rotation" or rotation around the normal.

4.2 Result of modeling B

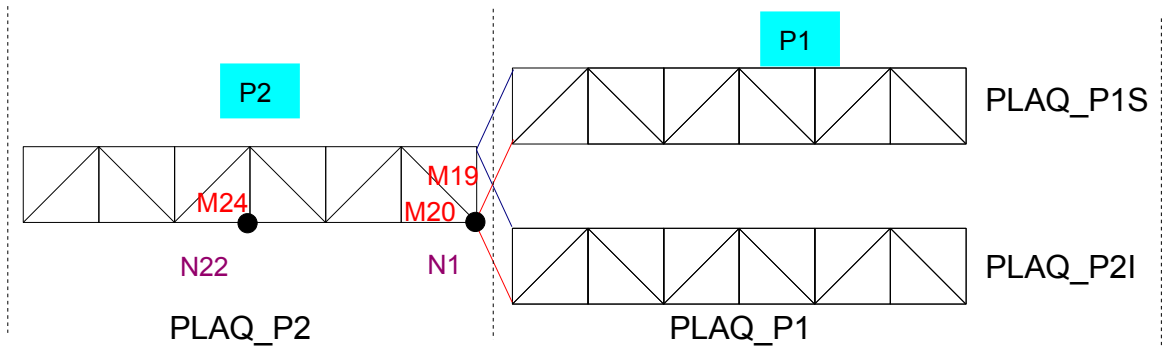
Not	Mesh	node	Component	Reference	Tolerance (%)
B		N1	DZ	0.3515625 m	1.
		N1	DRZ	0.	0.1
	M12	N1	MXX	-500 000. m.N	0.1
G		N10	DZ	-0.2629743 m	1.
		N10	DRZ	0.	0.1
	M10	N10	MXX	-250 000. m.N	0.1

5 Modeling C

5.1 Characteristics of modeling C

The grid of the plate is composed in two parts:

- $P1$, constituted of a nonexcentré grid
- $P2$, constituted by two superimposed grids:
 - $PLAQ_P1S$ excentré of 0.015m
 - $PLAQ_P1I$ excentré of $-0.035m$



Modeling DST:

Many nodes	26			
Many meshes	39	That is to say:	SEG3	3
			TRIA3	36

Group of nodes:

- A, B, C, D, E, F, G, H

Group of meshes:

- $PLAQUE$: surface $ACDF$
- $PLAQ_P1$: surface $BCDE$
- $PLAQ_P2$: surface $ABEF$
- CD : segment CD
- FA : segment FA
- BE : segment BE

5.2 Result of modeling C

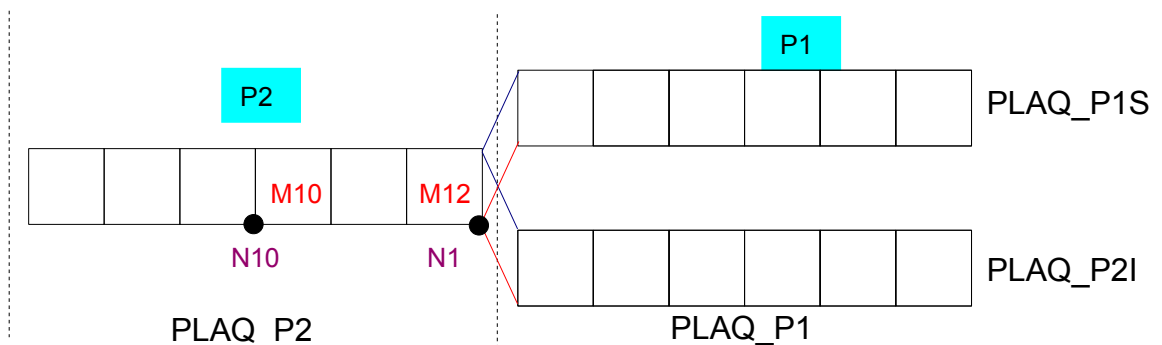
Not	Mesh	node	Component	Reference	Tolerance (%)
B		N1	DZ	0.3515625 m	0.5
		N1	DRZ	0.	0.1
	M19	N1	MXX	-500 000. m.N	2.
G		N22	DZ	-0.2629743 m	0.5
		N22	DRZ	0.	0.1
	M22	N22	MXX	-250 000. m.N	13.

6 Modeling D

6.1 Characteristics of modeling D

The grid of the plate is composed in two parts:

- $P1$, constituted of a nonexcentré grid
- $P2$, constituted by two superimposed grids:
 - $PLAQ_P1S$ excentré of 0.015m
 - $PLAQ_P1I$ excentré of $-0.035m$



Modeling DST :

Many nodes	26			
Many meshes	21	That is to say:	SEG3	3
			QUAD4	18

Group of nodes:

- A, B, C, D, E, F, G, H

Group of meshes:

- $PLAQUE$: surface $ACDF$
- $PLAQ_P1$: surface $BCDE$
- $PLAQ_P2$: surface $ABEF$
- CD : segment CD
- FA : segment FA
- BE : segment BE

6.2 Result of modeling D

Not	Mesh	node	Component	Reference	Tolerance (%)
B		$N1$	DZ	0.3515625 m	0.4
		$N1$	DRZ	0.	0.1
	$M12$	$N1$	MXX	$-500\,000. m.N$	0.1
G		$N10$	DZ	$-0.2629743 m$	0.4
		$N10$	DRZ	0.	0.1

	<i>M10</i>	<i>N10</i>	<i>MXX</i>	-250 000. <i>m.N</i>	0.1
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7 Summary of the results

The got results are satisfactory.