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Titre : SSLS122 - Plaque homogène isotrope rectangulaire e[...]
Responsable : Thomas DE SOZA

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*Clé : V3.03.122   Révision : 2870*

SSLS122 - Rectangular isotropic homogeneous plate offset
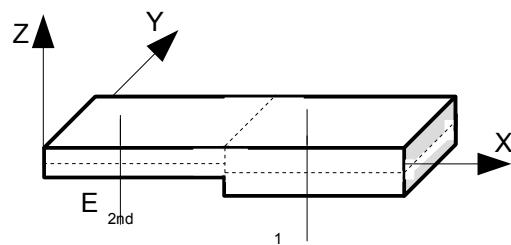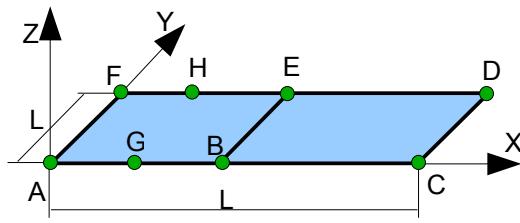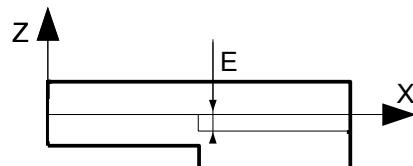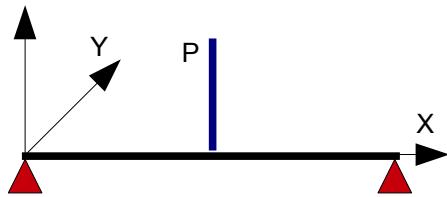
Summarized:

This benchmark makes it possible to test the eccentricity of the plates with modelizations DKT and DST.

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1   Problem of reference

1.1   Geometry

Bending 3 points

Characteristic of the plates (m) :
    Length: $L=10$
    Width: $l=1$
    Thickness 1: $e_1=0.1$
    Thickness 2: $e_2=0.08$
    Eccentring: $e=0.01$

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 the Elastic

material
* $E=2.1\times10^{11}Pa$ Modulus Young
* $v=0.3$ Poisson's ratio

1.3   Boundary conditions and loadings

imposed Displacement (m) :
*   segment $AF,CD : DZ=0$
*   segment FA $: DX=0$
*   point: A $DX=DY=DRZ=0$

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Loading

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

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2 Reference solution

2.1 Method of calculating used for the reference solution

Displacements:
- Points B and E

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

- Points G and H

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

- Bending moment:

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

2.2 Reference variable

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

2.3 Quantity and result of reference
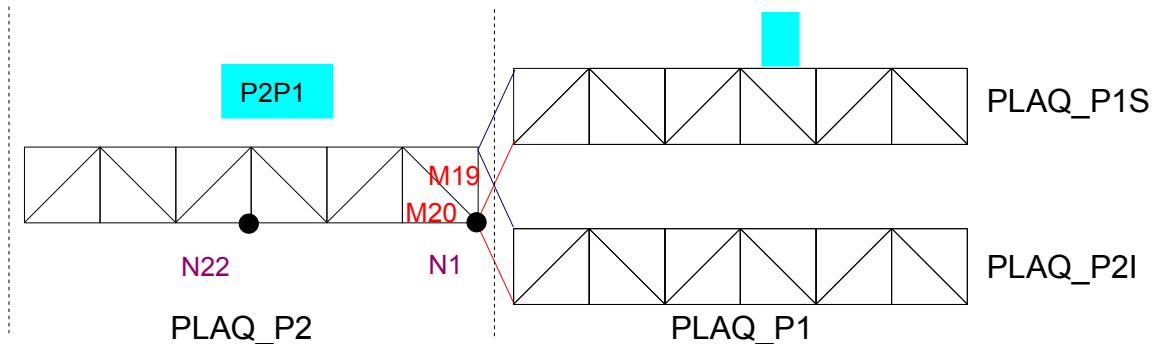
Not	Component	Reference
	DZ	$0.3515625\,m$
B	DRZ	$0.$
	MXX	$-50 \times 10^4\,m.N$
	DZ	$-0.2629743\,m$
G	DRZ	$0.$
	MXX	$-25. \times 10^4\,m.N$

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3 Modelization A

3.1 Characteristic of the modelization A

The mesh of the plate is composed in two parts:
* $P1$, constituted of a nonexcentré mesh
* $P2$, made up by two superimposed meshes:
    - $PLAQ \_ P1S$ excentré of 0.015m
    - $PLAQ \_ P1I$ excentré of -0.035m

Modelization DKT:

Many nodes	26	
Number of meshes	39	Are: SEG2 3
		TRIA3 36

Nodes group:
* $A , B , C , D , E , F , G , H$

Mesh group:
* $PLAQUE$: surface $ACDF$
* $PLAQ \_ P1$: surface $BCDE$
* $PLAQ \_ P2$: surface $ABEF$
* CD : segment CD
* FA : segment FA
* BE : segment BE

3.2 Result of the modelization A

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

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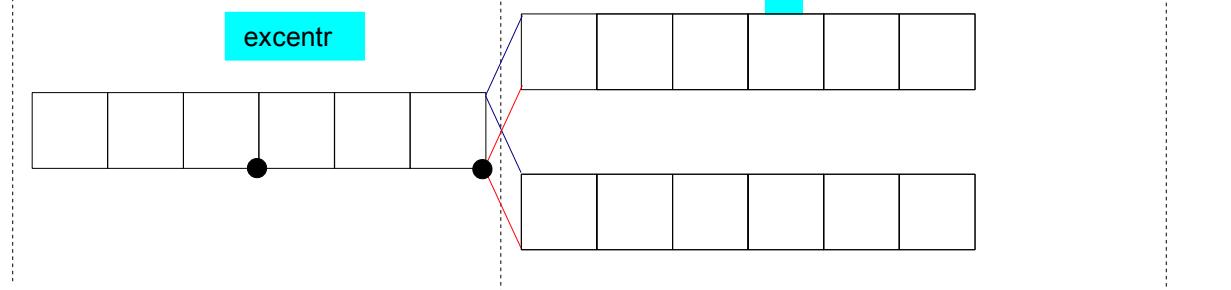
4   Modelization B

4.1   Characteristic of the modelization B

The mesh of the plate is composed in two parts:

- $P1$, constituted of a nonexcentré mesh
- $P2$, made up by two superimposed meshes:
    - $PLAQ\_P1S$ excentré of $0.015m$
    - $PLAQ\_P1I$ P2P1PLAQ_P2PLAQ_P1PLAQ_P1SPLAQ_P2IM12M10N1N10   of $-0.035m$

excentr

Modelization DKT:
Many nodes   26
Number of meshes   21   Are: SEG3   3
                                     QUAD4   18

Nodes group:
- A,B,C,D,E,F,G,H

Mesh group:
- $PLAQUE$: surface $ACDF$
- $PLAQ\_P1$: surface $BCDE$
- $PLAQ\_P2$: surface $ABEF$
- CD : segment CD
- FA : segment FA
- BE : segment BE

4.2   Result of the modelization B

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

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5 Modelization C

5.1 Characteristic of the modelization C

The mesh of the plate is composed in two parts:
* $P1$, constituted of a nonexcentré mesh
* $P2$, made up by two superimposed meshes:
  - $PLAQ\_P1S$ excentré of 0.015m
  - $PLAQ\_P1I$ excentré of -0.035m

Modelization DST:

Many nodes   26

Number of meshes   39   Are: SEG3   3
                                    TRIA3   36

Nodes group:
* $A , B , C , D , E , F , G , H$

Mesh group:
* $PLAQUE$: surface $ACDF$
* $PLAQ\_P1$: surface $BCDE$
* $PLAQ\_P2$: surface $ABEF$
* CD : segment CD
* FA : segment FA
* BE : segment BE

## 5.2 Result of the modelization C
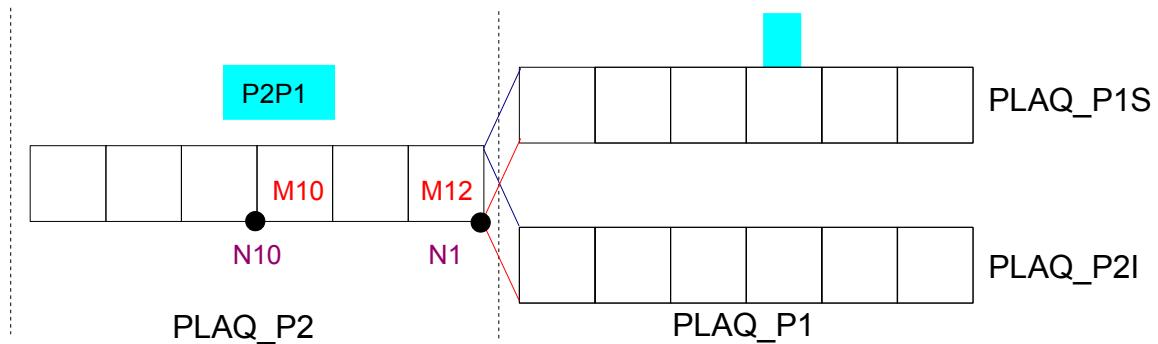
Not	Mesh	node	Component	Reference	Tolerance (%)
B		$N1$	DZ	$0.3515625\,m$	0.5
		$N1$	DRZ	$0.$	0.1
	$M19$	$N1$	MXX	$-500\,000.\,m.N$	2.
G		$N22$	DZ	$-0.2629743\,m$	0.5
		$N22$	DRZ	$0.$	0.1
	$M22$	$N22$	MXX	$-250\,000.\,m.N$	13.

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6 Modelization D

6.1 Characteristic of the modelization D

The mesh of the plate is composed in two parts:

- *P1* , constituted of a nonexcentré mesh
- *P2* , made up by two superimposed meshes:
  - *PLAQ _ P1S* excentré of 0.015m
  - *PLAQ _ P1I* excentré of −0.035m

Modelization DST :

Many nodes   26

Number of meshes   21   Are: SEG3   3
                                   QUAD4   18

Nodes group:
- *A , B , C , D , E , F , G , H*

Mesh group:
- *PLAQUE*   : surface *ACDF*
- *PLAQ _ P1*   : surface *BCDE*
- *PLAQ _ P2*   : surface *ABEF*
- *CD*   : segment *CD*
- *FA*   : segment *FA*
- *BE*   : segment *BE*

6.2 Result of the modelization D

Not	Mesh	node	Component	Reference	Tolerance (%)
		N1	*DZ*	$0.3515625\,m$	0.4
B		*N1*	*DRZ*	0.	0.1
	M12	*N1*	*MXX*	$-500\,000.\,m.N$	0.1
		N10	*DZ*	$-0.2629743\,m$	0.4
G		*N10*	*DRZ*	0.	0.1
	M10	*N10*	*MXX*	$-250\,000.\,m.N$	0.1

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7   Summary of the results

the got results are satisfactory.