

## SSLS118 - Square plate posed subjected to a sinusoidal pressure

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### Abstract:

One treats the case of a multi-layer full-course square plate then, simply supported and subjected to a sinusoidal pressure.

One calculates displacement in the center, the stresses  $\sigma_{xx}$   $\sigma_{yy}$   $\sigma_{xy}$   $\sigma_{xz}$ ,  $\sigma_{yz}$  with the lower interfaces average and higher, the forces of membrane  $N_{xx}$   $N_{yy}$   $N_{xy}$ , the shears  $T_x$ ,  $T_y$  and the moments  $M_{xx}$ ,  $M_{yy}$  and  $M_{xy}$ .

The test gathers 14 modelizations: with regard to the modelizations A with F, the got results are compared for modelizations DKQ, DSQ, DKT, DST, COQUE\_3D with the meshes triangular ones and COQUE\_3D with the meshes rectangular ones.

The modelizations G and H make it possible to test the results in a reference user different from the total reference.

The modelizations I and J measure the sensitivity of the results to the smoothness of the mesh, for configuration DSQ.

The modelizations K with N relate to the multi-layer plate, for modelizations DST and DSQ, in total reference and user. They make it possible to estimate the distribution of the plane stresses and transverse shears inside the plate.

The modelizations O with R validate element Q4G.

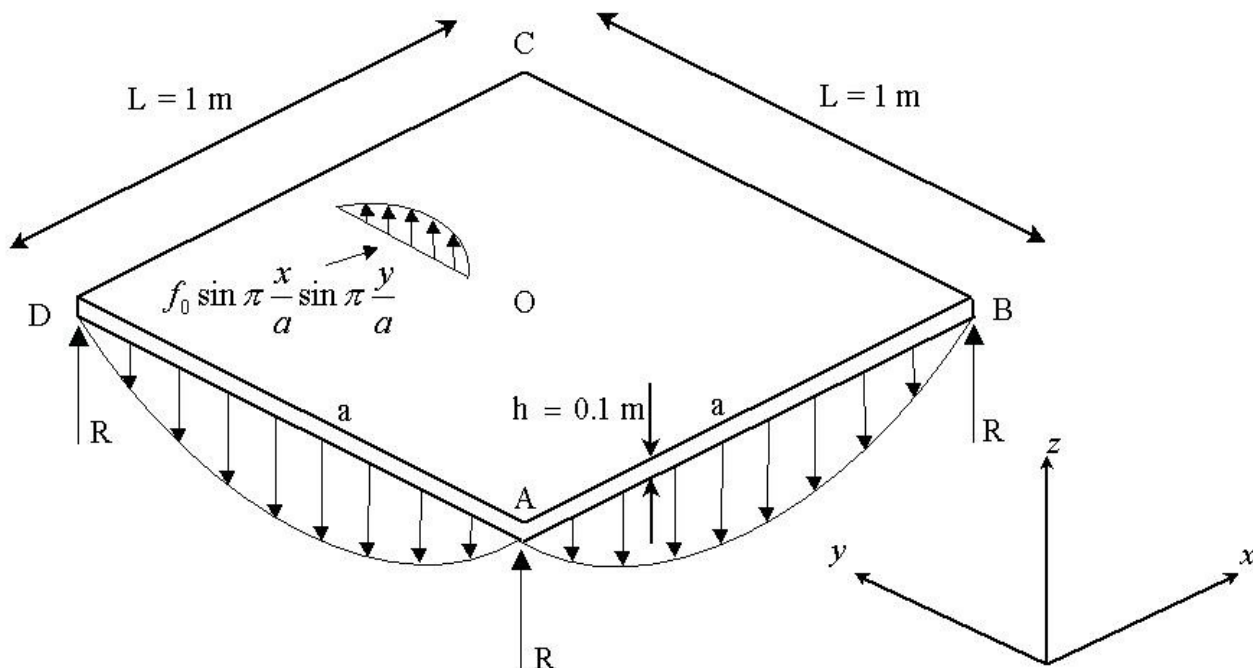
The modelizations S with T validate modelization Q4GG.

The modelization W element T3G validates.

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

## 1 Problem of reference

### 1.1 Geometry



### 1.2 Material properties

$$E = 25\text{ Pa}$$

$$\nu = 0.25$$

$$\rho = 1\text{ kg/m}^3$$

### 1.3 Boundary conditions and loadings

Plate bearing simple

$AB$	$DX = 0.$	$DZ = 0.$	$DRY = 0.$	$MY = 0.$	
$BC$	$DY = 0.$	$DZ = 0.$	$DRX = 0.$	$MX = 0.$	
$CD$	$DX = 0.$	$DZ = 0.$	$DRY = 0.$	$MY = 0.$	
$DA$	$DY = 0.$	$DZ = 0.$	$DRX = 0.$	$MX = 0.$	
Point $O$	$DX = 0.$	$DY = 0.$	$DRX = 0.$	$DRY = 0.$	$DRZ = 0.$

Loading:

FORCE\_COQUE                      sinusoidal Pressure                       $P$

With  $P = f_0 \sin \pi \frac{x}{a} \sin \pi \frac{y}{a}$ , where  $f_0 = 1$  and  $a = 1$

### 1.4 Initial conditions

Without object for the static analysis.

## 2 Reference solution

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

the analytical solution of reference is based on the theory of Coils-Kirchhoff, usually used for the plates known as "thin" [bib1].

Taking into account the problem and in any point of the plate, one has for the computation of the deflection:

$$w = \frac{f_0 a^4}{4 \pi^4 D} \sin \pi \frac{x}{a} \sin \pi \frac{y}{a}$$

with:

$$D = \frac{E h^3}{12(1-\nu^2)} \quad f_0 = 1, \quad a = 1 \quad \text{and} \quad \nu = 0.25$$

For the computation of the moments, the theory leads to the following statements:

$$\begin{aligned} M_{xx} &= \alpha(1+\nu) \sin \pi \frac{x}{a} \sin \pi \frac{y}{a} \\ M_{yy} &= M_{xx} \\ M_{xy} &= -\alpha(1-\nu) \cos \pi \frac{x}{a} \cos \pi \frac{y}{a} \end{aligned}$$

For the computation of the curvatures, the theory leads to the following statements:

$$\begin{aligned} \kappa_{xx} &= -\frac{f_0 a^2}{4 \pi^2 D} \sin \left( \pi \frac{x}{a} \right) \sin \left( \pi \frac{y}{a} \right) \\ \kappa_{yy} &= -\frac{f_0 a^2}{4 \pi^2 D} \sin \left( \pi \frac{x}{a} \right) \sin \left( \pi \frac{y}{a} \right) \\ \kappa_{xy} &= \frac{f_0 a^2}{4 \pi^2 D} \cos \left( \pi \frac{x}{a} \right) \cos \left( \pi \frac{y}{a} \right) \end{aligned}$$

$$\text{with } \alpha = \frac{f_0 a^2}{4 \pi^2}$$

For the shears, one obtains:

$$\begin{aligned} T_x &= \frac{f_0 a}{2 \pi} \cos \pi \frac{x}{a} \sin \pi \frac{y}{a} \\ T_y &= \frac{f_0 a}{2 \pi} \sin \pi \frac{x}{a} \cos \pi \frac{y}{a} \end{aligned}$$

For a homogeneous plate, the plane stresses are given by:

$$\begin{pmatrix} \sigma_{xx} \\ \sigma_{yy} \\ \sigma_{xy} \end{pmatrix} = z [A] \begin{pmatrix} M_{xx} \\ M_{yy} \\ M_{xy} \end{pmatrix}$$

with  $[A] = \frac{12}{h^3} [I]$  and  $z$  the position in the thickness of the transverse

plate and the shearing stresses by:

$$\begin{pmatrix} \sigma_x \\ \sigma_y \end{pmatrix} = [D_1(z)] \begin{pmatrix} T_x \\ T_y \end{pmatrix},$$

$$\text{with } [D_1(z)] = \frac{6}{h^3} \left( \left( \frac{h}{2} \right)^2 - z^2 \right)$$

For strain energy in bending, one obtains:

$$E_{flexion} = \frac{1}{2} \int_S [(M_{xx} \cdot \kappa_{xx} + M_{yy} \cdot \kappa_{yy} + M_{xy} \cdot \kappa_{xy})] dS$$

## 2.2 Results of reference

For each modelization, one calculates:

- in the center of the plate, displacement,
- in the center of the plate and in the middle of the side  $AB$ , the stresses  $\sigma_{xx}$ ,  $\sigma_{yy}$ ,  $\sigma_{xy}$ ,  $\sigma_{xz}$ ,  $\sigma_{yz}$  on the planes:
  - inferior, layer and superior of the plate in the full-course, lower
  - , average case and superior of each slice in the multi-layer case (5 layers),
- in the center, the corners and in the middle of the sides  $AB$  and  $AD$ , the forces of membrane  $N_{xx}$ ,  $N_{yy}$ ,  $N_{xy}$ , the shears  $T_x$ ,  $T_y$  and the moments  $M_{xx}$ ,  $M_{yy}$  and  $M_{xy}$ ,
- in the center (not O), at the point A, the strains of membrane  $e_{xx}$ ,  $e_{yy}$ ,  $e_{xy}$  and the curvatures  $\kappa_{xx}$ ,  $\kappa_{yy}$ ,  $\kappa_{xy}$ ,

For the modelization V, one calculates in the center (not O) strain energy  $TOTALE$ , of  $MEMBRANE$  and  $FLEXION$ .

The statement of these quantities at the points  $O, A, B, C, D$  gives:

	$w$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$	$\kappa_{xx}$	$\kappa_{yy}$	$\kappa_{xy}$
$O$	$\frac{3(1-\nu^2)}{\pi^4 E h^3}$	$\alpha(1+\nu)$	$\alpha(1+\nu)$	0	0	0	$\frac{-\alpha}{D}$	$\frac{-\alpha}{D}$	0
$A$	-	0	0	$-\alpha(1-\nu)$	0	0	0	0	$\frac{\alpha}{D}$
$B$	-	0	0	$\alpha(1-\nu)$	0	0	-	-	-
$BI$	-	0	0	0	0	$1/2 \pi$	-	-	-
$C$	-	0	0	$-\alpha(1-\nu)$	0	0	-	-	-
$D$	-	0	0	$\alpha(1-\nu)$	0	0	-	-	-

numerical Application:

$$\frac{3(1-\nu^2)}{\pi^4 E h^3} = 1.154923$$

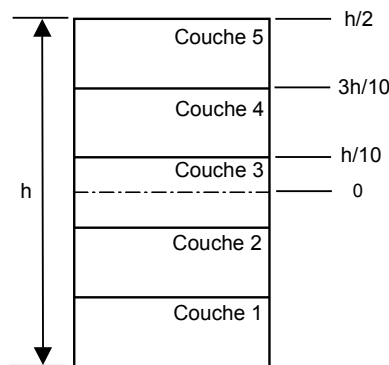
$$\alpha(1+\nu) = 0.0316629$$

$$\alpha(1-\nu) = 0.0189972$$

$$1/2 \pi = 0.159155$$

The distribution of the plane stresses and shears at the points  $O$  and  $BI$  inside the plate is the following one:

$O$	$\sigma_{xx}$	$\sigma_{yy}$	$\sigma_{xy}$	$\sigma_{xz}$	$\sigma_{yz}$
$h/2$	18.9972	18.9972	0	0	0
$3h/10$	11.3983	11.3983	0	0	0
$h/10$	3.7994	3.7994	0	0	0
0	0	0	0	0	0
$-h/10$	-3.7994	-3.7994	0	0	0
$-3h/10$	-	-	0	0	0
	11.3983	11.3983			
$-h/2$	-	-	0	0	0
	18.9972	18.9972			



$BI$	$\sigma_{xx}$	$\sigma_{yy}$	$\sigma_{xy}$	$\sigma_{xz}$	$\sigma_{yz}$
$h/2$	0	0	0	0	0
$3h/10$	0	0	0	0	1.5278
$h/10$	0	0	0	0	2.3777
0	0	0	0	0	2.3873
$-h/10$	0	0	0	0	2.3777
$-3h/10$	0	0	0	0	1.5278
$-h/2$	0	0	0	0	0

## 2.3 Uncertainty on the analytical

solution Solution.

## 2.4 Bibliographical references

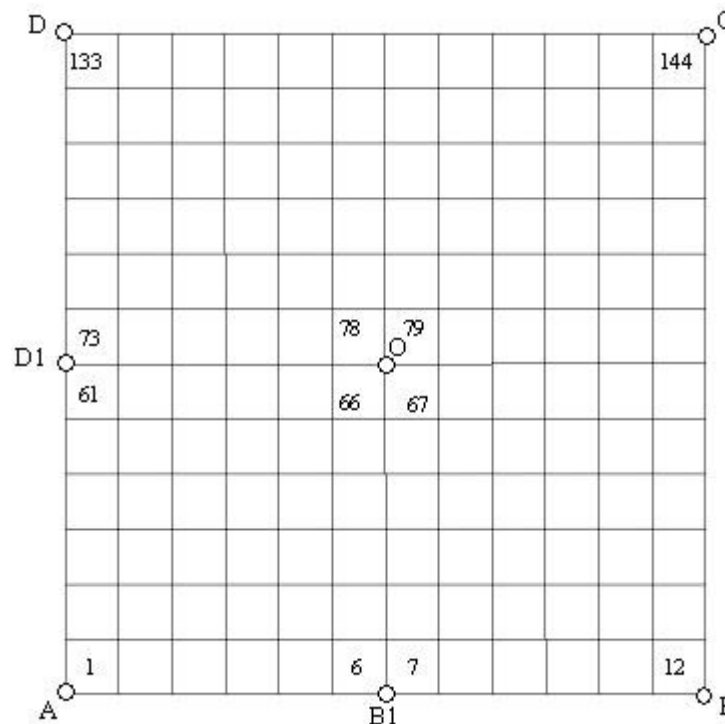
- 1) BATOZ and DHATT. Modelization of structures by finite elements. Beams and Plates. Volume 2 HERMES, 1990.

## 3 Modelization A

### 3.1 Characteristic of the quadrangular

modelization Shell element DKQ.

The reference user is confused with orthotropic reference.



Boundary conditions:

DDL\_IMPO

(GROUP\_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
 (GROUP\_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
 (GROUP\_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
 (GROUP\_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
 (GROUP\_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
 DRZ: 0.)

FORCE\_ARETE

(GROUP\_NO: AB MY: 0.)  
 (GROUP\_NO: BC MX: 0.)  
 (GROUP\_NO: CD MY: 0.)  
 (GROUP\_NO: DA MX: 0.)

### 3.2 Characteristics of the mesh

Many nodes: 171

Number of meshes and type: 144 QUAD4

### 3.3 Quantities tested and Identification

results

Not  $O$  (M78)  $\sigma_{xx}$   $\sigma_{yy}$   $\sigma_{xy}$   $\sigma_{xz}$  ,  $\sigma_{yz}$  on averages inferior, medium and superior

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Marks with arrows vertical  $w = DZ$

Point BI (M6)  $\sigma_{xx} \sigma_{yy} \sigma_{xy} \sigma_{xz}, \sigma_{yz}$  on averages inferior, medium and higher

### Identification

	(M78)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x T_y$
Not	(M79)	$T_x T_y$
O	(M66)	$T_x T_y$
	(M67)	$T_x, T_y$

### Identification

Not	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
A		
Not	(M12)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
B		

### Identification

Not	(M144)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
C		
Not	(M133)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
D		

### Identification

Not	(M6)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x, T_y$
BI		
	(M7)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

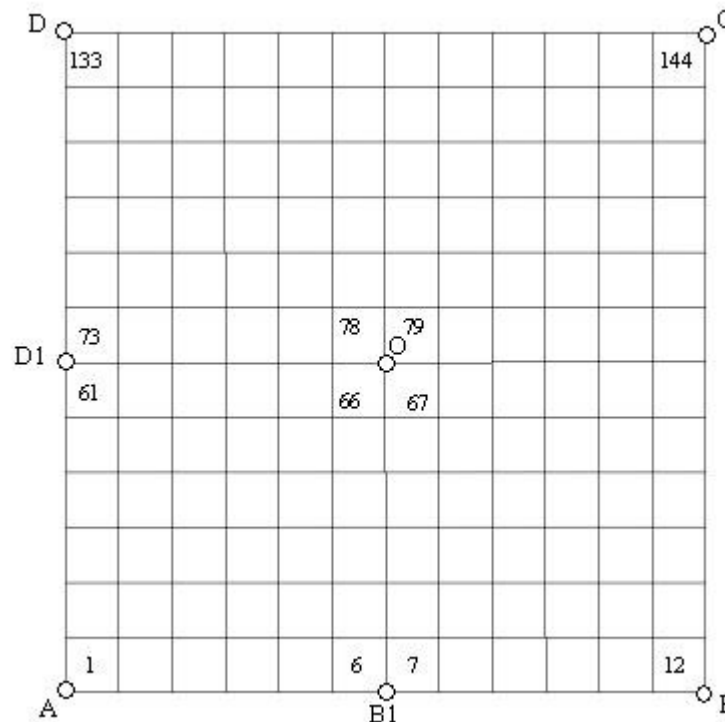
Not	(M61)	$T_x T_y$
DI	(M73)	$N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x, T_y$

## 4 Modelization B

### 4.1 Characteristic of the quadrangular

modelization Shell element DSQ.

The reference user is confused with orthotropic reference.



Boundary conditions:

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY:
0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX:
0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY:
0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX:
0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX:
0. , DRY: 0. , DRZ: 0.)
```

```
FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 4.2 Characteristics of the mesh

Many nodes: 171



Number of meshes and type: 144 QUAD4

## 4.3 Quantities tested and Identification

### results

<b>Not O M78</b>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and superior
	Marks with arrows vertical $w = DZ$
<b>Not B1 (M6)</b>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

	(M78) $N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not O	(M79) $T_x, T_y$
	(M66) $T_x, T_y$
	(M67) $T_x, T_y$

### Identification

Not A	(M1) $N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M12) $N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not C	(M144) $N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M133) $N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(M6) $N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M7) $N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

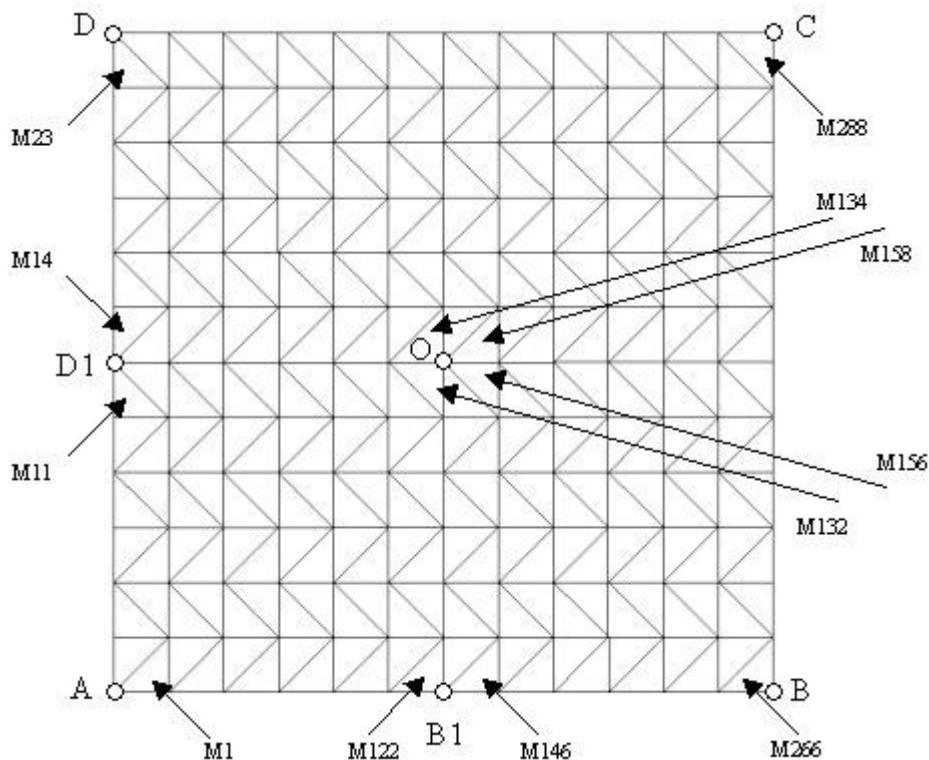
Not D1	(M61) $T_x, T_y$
	(M73) $, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

## 5 Modelization C

### 5.1 Characteristic of the triangular

modelization Shell element DKT.

The reference user is confused with orthotropic reference.



Boundary conditions :

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY:
0. , DRZ: 0.)

FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 5.2 Characteristics of the mesh

Many nodes: 170

Number of meshes and type: 288 TRIA3

### 5.3 Quantities tested and Identification

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

## results

<i>O</i>	
<b>Not forced</b> <i>M134</i>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
<b>Displacement</b>	$w = DZ$
<b>Not B1</b>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not A	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M266)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not C	(M288)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M23)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(M122)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M146)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

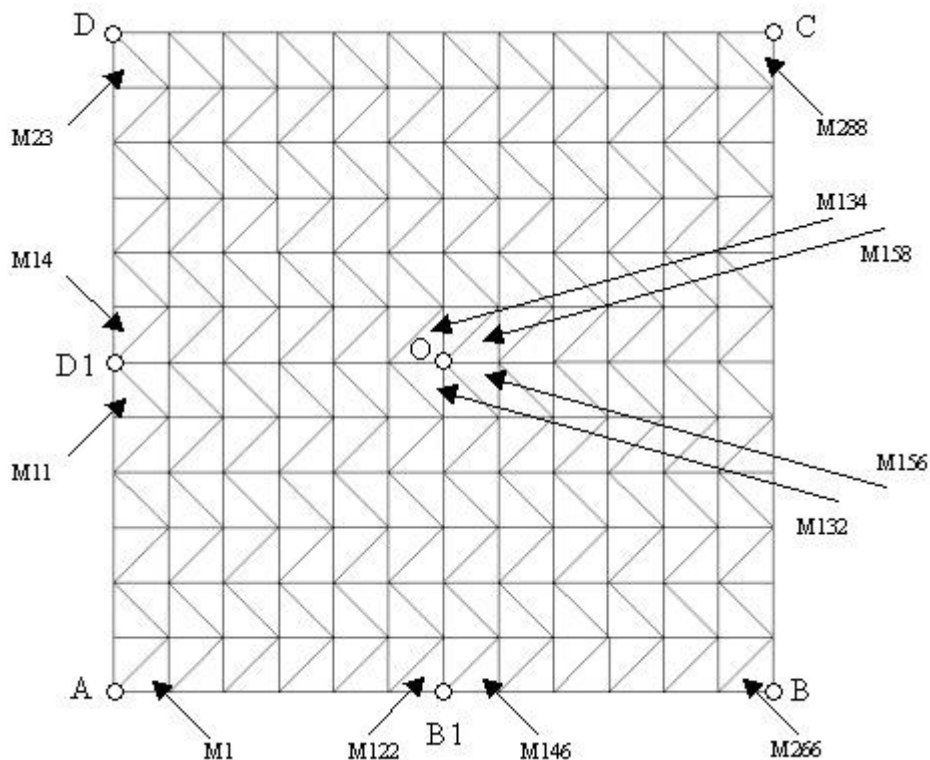
Not D1	(M11)	$T_x, T_y$
	(M14)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

## 6 Modelization D

### 6.1 Characteristic of the triangular

modelization Shell element DST.

The reference user is confused with orthotropic reference.



Boundary conditions:

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,
DRZ: 0.)

FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 6.2 Characteristics of the mesh

Many nodes: 170

Number of meshes and type: 288 TRIA3

### 6.3 Quantities tested and Identification

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

## results

<i>O</i> MI34 Not forced	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
Displacement <i>O</i>	DZ
<i>B1</i> MI22 Not forced	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not O	(MI34)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(MI58)	$T_x, T_y$
	(MI32)	$T_x, T_y$
	(MI56)	$T_x, T_y$

### Identification

Not A	(MI)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M266)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not C	(M288)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M23)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(MI22)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(MI46)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

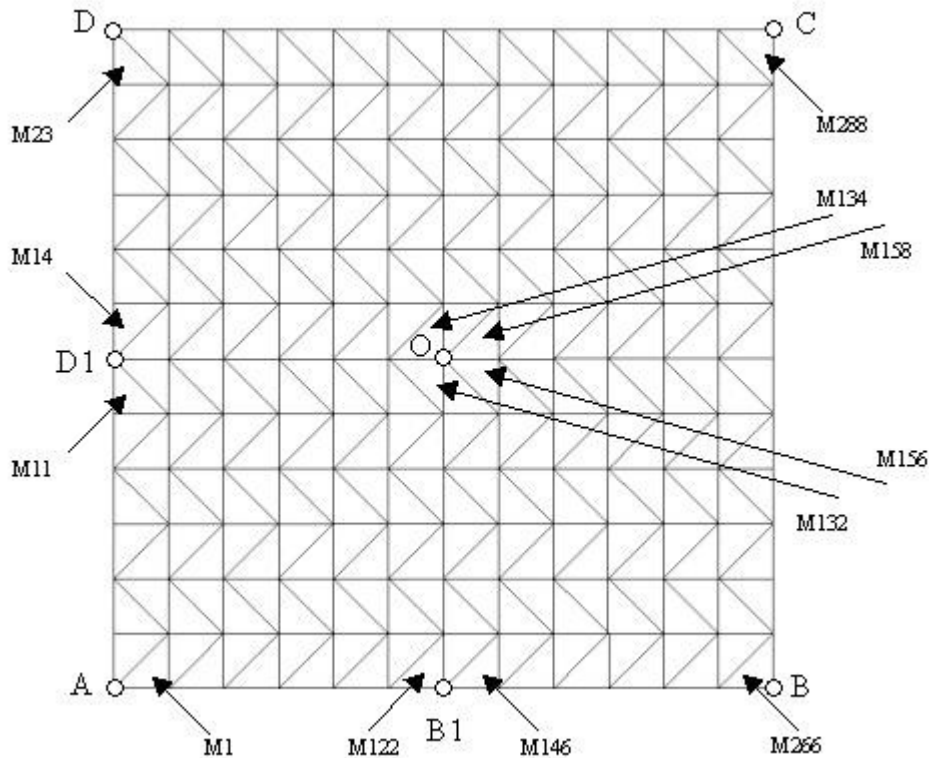
Not D1	(MI1)	$T_x, T_y$
	(MI4)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

## 7 Modelization E

### 7.1 Characteristic of the modelization

Shell element COQUE\_3D triangle.

The reference user is confused with orthotropic reference.



Boundary conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,
DRZ: 0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 7.2 Characteristics of the mesh

Many nodes: 626

Number of meshes and type: 288 TRIA6

### 7.3 Quantities tested and Identification

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

## results

o (M134)	
Not forced	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
Displacement	DZ
B (M122)	
Not forced	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not o	(M134)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M158)	$T_x, T_y$
	(M132)	$T_x, T_y, K_{xx}, K_{yy}, K_{xy}$
	(M156)	$T_x, T_y$

### Identification

Not A	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M266)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not C	(M288)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M23)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(M122)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M146)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

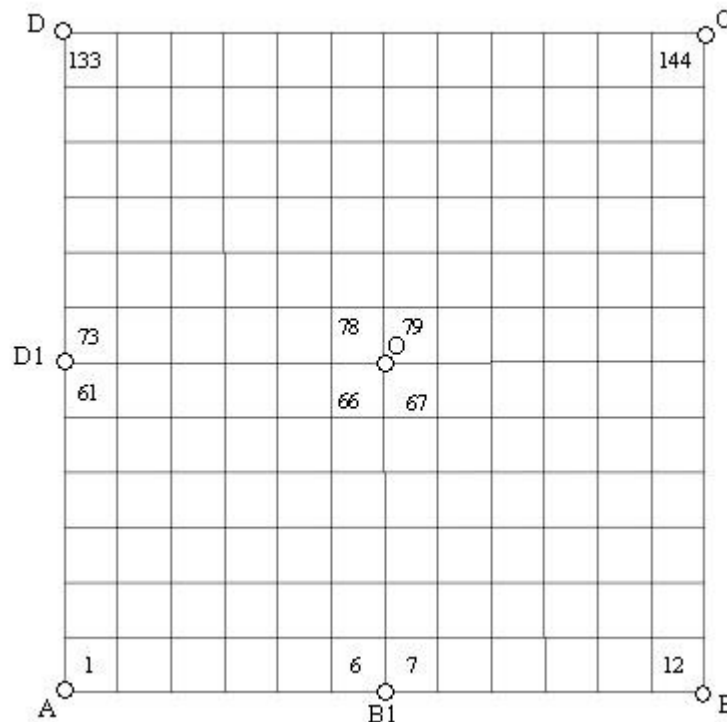
### Identification

Not D1	(M11)	$T_x, T_y$
	(M14)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

## 8 Modelization F

### 8.1 Characteristic of the modelization

Shell element COQUE\_3D quadrangle.  
The reference user is confused with orthotropic reference.



Boundary conditions:

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. , DRZ:
0.)

FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 8.2 Characteristics of the mesh

Many nodes: 482  
Number of meshes and type: 144 QUAD8

### 8.3 Quantities tested and results

#### Identification

Not O

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.



<b>M78</b>	
<b>Forced</b>	$\sigma_{xx} \sigma_{yy} \sigma_{xy} \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
Displacements	$DZ$
<b>Not B1</b>	
<b>M6</b>	
Contraintes	$\sigma_{xx} \sigma_{yy} \sigma_{xy} \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not O	(M78)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x T_y$
	(M79)	$T_x T_y$
	(M66)	$T_x T_y, K_{xx}, K_{yy}, K_{xy}$
	(M67)	$T_x, T_y$

### Identification

Not A	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M12)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not C	(M144)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M133)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(M6)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x T_y$
	(M7)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x, T_y$

### Identification

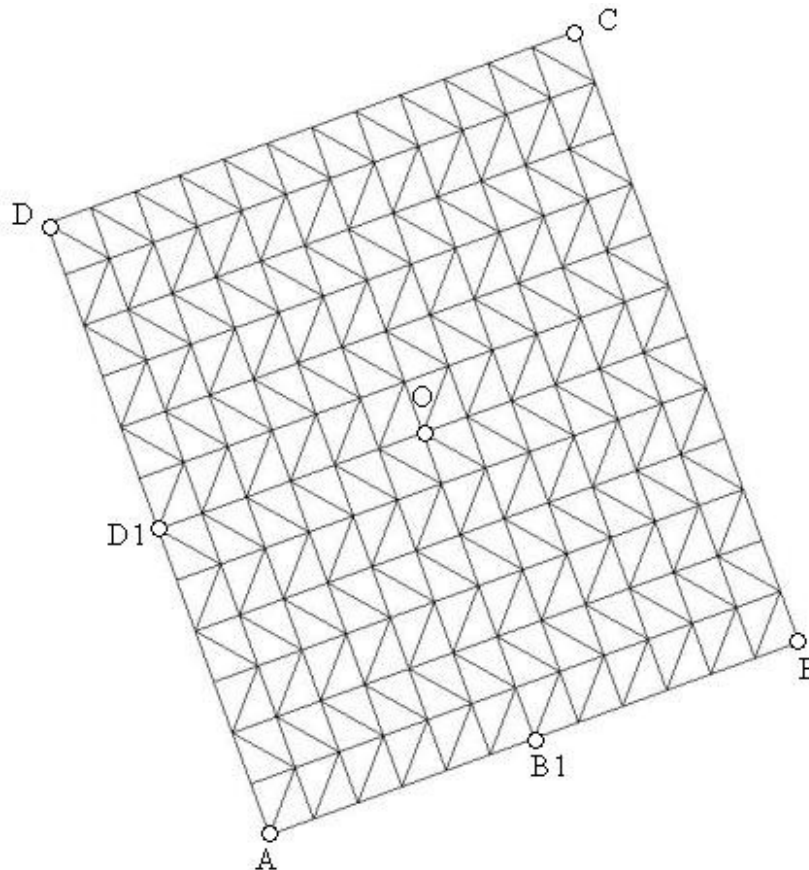
Not D1	(M61)	$T_x T_y$
	(M73)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x, T_y$

## 9 Modelization G

### 9.1 Characteristic of the modelization

triangular Shell element DST.

The model of plate associated with the modelization  $D$  is turned of 20 degrees according to the nautical angle alpha and of 30 degrees according to beta. The classification meshes is identical to that of the modelization  $D$ .



Boundary conditions:

LIAISON\_OBLIQUE

(GROUP\_NO: AB, ANGL\_NAUT= (20. , 30. , 0.), DX: 0. , DZ:  
0. , DRY: 0.)

(GROUP\_NO: BC, ANGL\_NAUT= (20. , 30. , 0.), DY: 0. , DZ:  
0. , DRX: 0.)

(GROUP\_NO: CD, ANGL\_NAUT= (20. , 30. , 0.), DX: 0. , DZ:  
0. , DRY: 0.)

(GROUP\_NO: DA, ANGL\_NAUT= (20. , 30. , 0.), DY: 0. , DZ:  
0. , DRX: 0.)

(GROUP\_NO: O, ANGL\_NAUT= (20. , 30. , 0.), DX: 0. , DY: 0.  
, DRX: 0. , DRY: 0. , DRZ: 0.)

FORCE\_ARETE

(GROUP\_NO: AB MY: 0.)

(GROUP\_NO: BC MX: 0.)

(GROUP\_NO: CD MY: 0.)

(GROUP\_NO: DA MX: 0.)

## 9.2 Characteristics of the mesh

Many nodes: 170  
Number of meshes and type: 288 TRIA3

## 9.3 Quantities tested and Identification

### results

o (M134)	
<b>Not forced</b>	$\sigma_{xx} \sigma_{yy} \sigma_{xy} \sigma_{xz} , \sigma_{yz}$ on averages inferior, medium and higher
Displacement	DZ
B1 (M122)	
Not forced	$\sigma_{xx} , \sigma_{yy} , \sigma_{xy} , \sigma_{xz} , \sigma_{yz}$ on averages inferior, medium and higher

### Identification

	(M134)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x T_y$
Not o	(M158)	$T_x T_y$
	(M132)	$T_x T_y$
	(M156)	$T_x , T_y$
Not A	(M1)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x , T_y$
Not B	(M266)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x , T_y$

### Identification

Not C	(M288)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$
Not D	(M23)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$
Not B1	(M122)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$
	(M146)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$

### Identification

Not D1	(M11)	$T_x T_y$
	(M14)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x , T_y$

## 9.4 Remarks

the value of reference of displacement to the point  $O$  is obtained by projecting the displacement calculated for the modelization D in the turned reference (displacement for the modelization D being vertical, new displacement is function of the projection of the axis  $Z$ ).

In the local coordinate system, the projection of the axis  $Z$  is the following one:

$$\begin{pmatrix} \sin \beta \cos \alpha \\ \sin \beta \sin \alpha \\ \cos \beta \end{pmatrix}, \text{ with } \alpha = 20. \quad \beta = 30.$$

In addition, the statement of the sinusoidal pressure in the turned reference becomes:

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

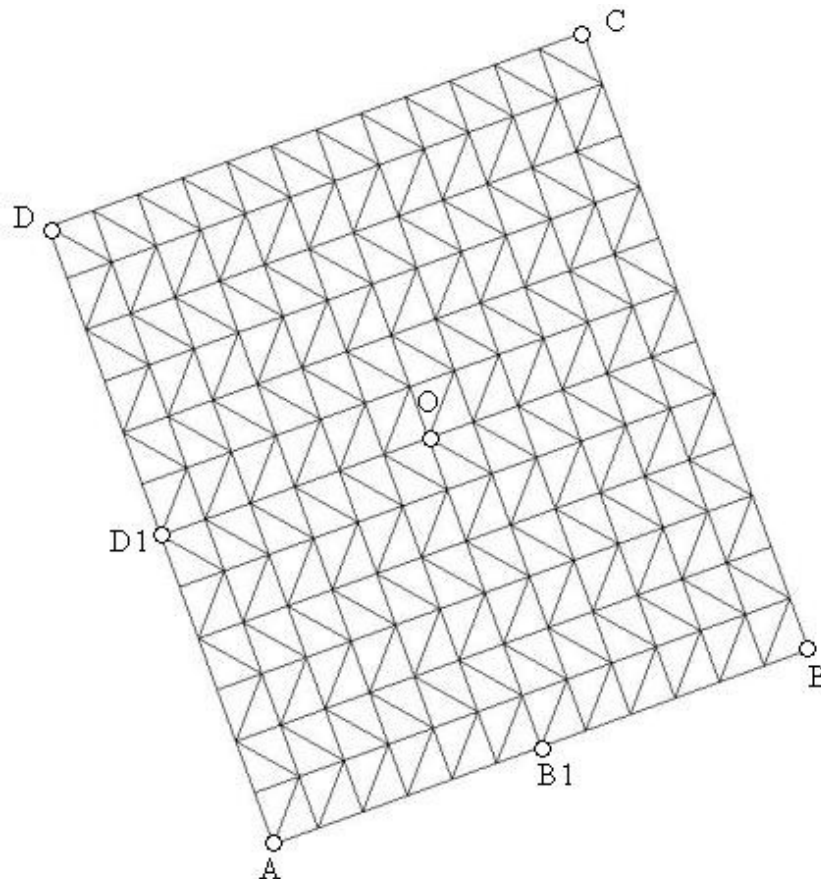
$$P = f_0 \sin \pi \frac{\cos \alpha \cos \beta x + \sin \alpha \cos \beta y - \sin \beta z}{a} \sin \pi \frac{\cos \alpha y - \sin \alpha x}{a}$$

## 10 Modelization H

### 10.1 Characteristic of the triangular

modelization Shell element COQUE\_3D.

The model of plate associated with the modelization  $E$  is turned of 20 degrees according to the nautical angle alpha and of 30 degrees according to beta. The classification meshes is identical to that of the modelization  $E$ .



Boundary conditions:

LIAISON\_OBLIQUE

(GROUP\_NO: AB, ANGL\_NAUT= (20. , 30. , 0.), DX: 0. , DZ: 0. ,  
DRY: 0.)

(GROUP\_NO: BC, ANGL\_NAUT= (20. , 30. , 0.), DY: 0. , DZ: 0. ,  
DRX: 0.)

(GROUP\_NO: CD, ANGL\_NAUT= (20. , 30. , 0.), DX: 0. , DZ: 0. ,  
DRY: 0.)

(GROUP\_NO: DA, ANGL\_NAUT= (20. , 30. , 0.), DY: 0. , DZ: 0. ,  
DRX: 0.)

(GROUP\_NO: O, ANGL\_NAUT= (20. , 30. , 0.), DX: 0. , DY: 0. , DRX:  
0. , DRY: 0. , DRZ: 0.)

FORCE\_ARETE

(GROUP\_NO: AB MY: 0.)

(GROUP\_NO: BC MX: 0.)

(GROUP\_NO: CD MY: 0.)

(GROUP\_NO: DA MX: 0.)

## 10.2 Characteristics of the mesh

Many nodes: 626  
Number of meshes and type: 288 TRIA6

## 10.3 Quantities tested and Identification

### results

o (M134)	
<b>Not forced</b>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
Displacement	DZ
B1 (M122)	
Not forced	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

	(M134)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not o	(M158)	$T_x, T_y$
	(M132)	$T_x, T_y$
	(M156)	$T_x, T_y$
Not A	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M266)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not C	(M288)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M23)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(M122)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M146)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not D1	(M11)	$T_x, T_y$
	(M14)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

## 10.4 Remarks

the value of reference of displacement to the point  $O$  is obtained by projecting the displacement calculated for the modelization E in the reference turned (displacement for the modelization E being vertical, new displacement is function of the projection of the axis  $Z$ ).

In the local coordinate system, the projection of the axis  $Z$  is the following one:

$$\begin{pmatrix} \sin \beta \cos \alpha \\ \sin \beta \sin \alpha \\ \cos \beta \end{pmatrix}, \text{ with } \alpha = 20. \quad \beta = 30.$$

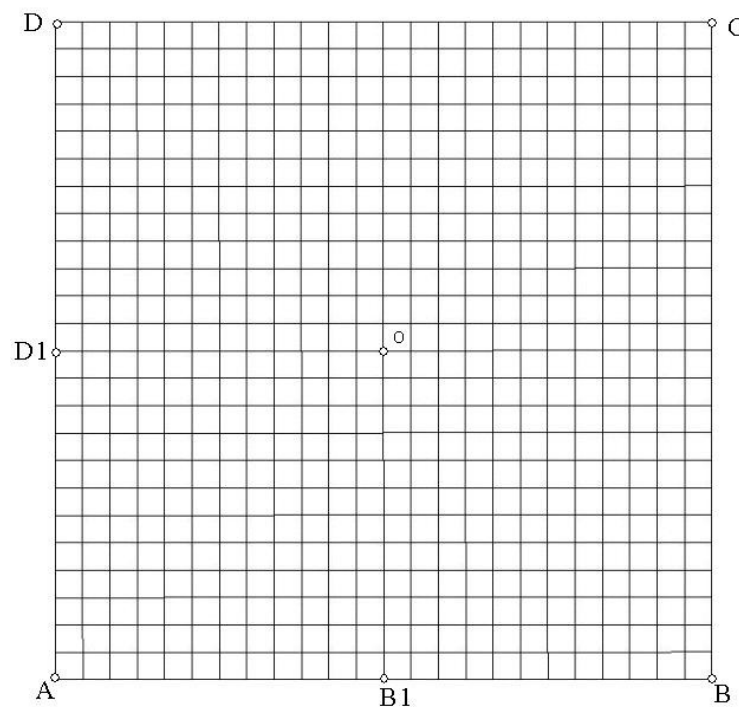
In addition, the statement of the sinusoidal pressure in the turned reference becomes:

$$P = f_0 \sin \pi \frac{\cos \alpha \cos \beta x + \sin \alpha \cos \beta y - \sin \beta z}{a} \sin \pi \frac{\cos \alpha y - \sin \alpha x}{a}$$

## 11 Modelization I

### 11.1 Characteristic of the quadrangular

modelization Shell element DSQ. The plate is modelled with a mesh  $24 \times 24$ .  
The reference user is confused with orthotropic reference.



Boundary conditions:

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,
DRZ: 0.)

FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 11.2 Characteristics of the mesh

Many nodes: 626  
Number of meshes and type: 576 QUAD4

### 11.3 Quantities tested and Identification

results

o (M300)



<b>Not forced</b>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
Displacement	DZ
<b>B1 (M12)</b>	
Not forced	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not O	(M300)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M301)	$T_x, T_y$
	(M276)	$T_x, T_y$
	(M277)	$T_x, T_y$

### Identification

Not A	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M24)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not C	(M576)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M576)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(M12)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M13)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

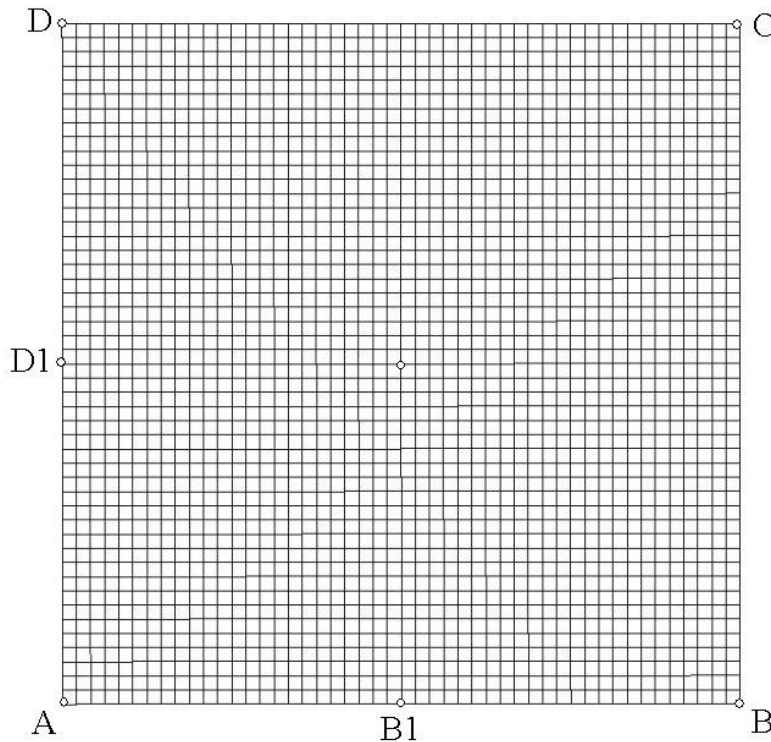
### Identification

Not D1	(M265)	$T_x, T_y$
	(M289)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

## 12 Modelization J

### 12.1 Characteristic of the quadrangular

modelization Shell element `DSQ`. The plate is modelled with a mesh  $48 \times 48$ .  
The reference user is confused with orthotropic reference.



Boundary conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
DRZ: 0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)  
(GROUP_NO: BC MX: 0.)  
(GROUP_NO: CD MY: 0.)  
(GROUP_NO: DA MX: 0.)
```

### 12.2 Characteristics of the mesh

Many nodes: 2402

Number of meshes and type: 2304 QUAD4

### 12.3 Quantities tested and Identification

results

O M1176

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

<b>Not forced</b>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
Displacement	DZ
<b>B1 (M24)</b>	
Not forced	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not O	(M1176)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M1177)	$T_x, T_y$
	(M1128)	$T_x, T_y$
	(M1129)	$T_x, T_y$

### Identification

Not A	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not B	(M48)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not C	(M2304)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
Not D	(M2257)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

### Identification

Not B1	(M24)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$
	(M25)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

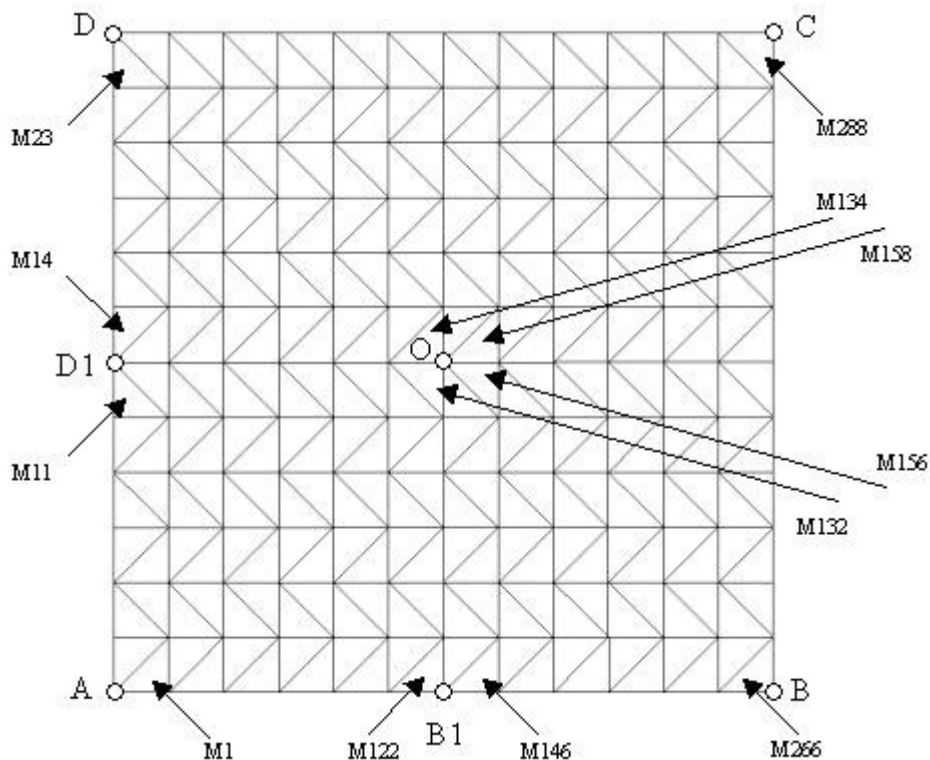
### Identification

Not D1	(M1105)	$T_x, T_y$
	(M1153)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$

## 13 Modelization K

### 13.1 Characteristic of the modelization

Plate multi-layer isotropic (5 layers in the thickness). Triangular shell element DST.  
The reference user is confused with orthotropic reference.



Boundary conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,
DRZ: 0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 13.2 Characteristics of the mesh

Many nodes: 170

Number of meshes and type: 288 TRIA3

### 13.3 Quantities tested and Identification

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

## results

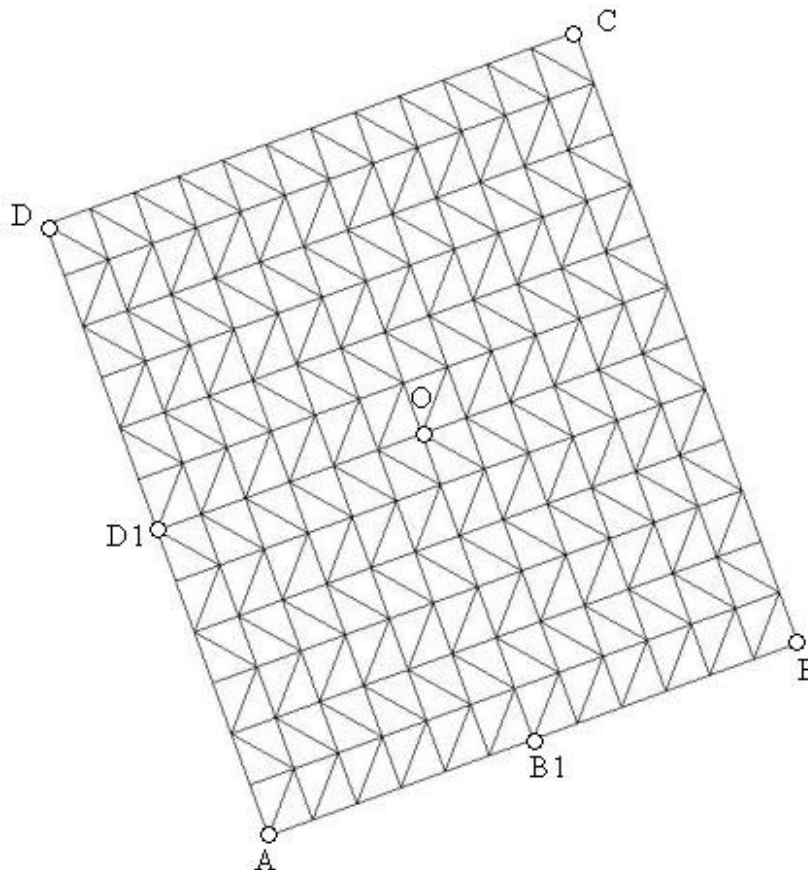
<b>Not</b> <i>O MI34</i>	
<b>Layer 1</b>	$\sigma_{xx}$ $\sigma_{yy}$ $\sigma_{xy}$ $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average higher
Displacement	<i>DZ</i>
<b>Not</b> <i>B1 MI22</i>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on higher average

## 14 Modelization L

### 14.1 Characteristic of the modelization

Plates multi-layer isotropic (5 layers in the thickness). Triangular shell element `DST`.

The model of plate associated with the modelization `K` is turned of 20 degrees according to the nautical angle  $\alpha$  and of 30 degrees according to  $\beta$ . The classification meshes is identical to that of the modelization `K`.



Boundary conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
DRZ: 0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)  
(GROUP_NO: BC MX: 0.)  
(GROUP_NO: CD MY: 0.)  
(GROUP_NO: DA MX: 0.)
```

### 14.2 Characteristics of the mesh

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

Many nodes: 170  
Number of meshes and type: 288 TRIA3

## 14.3 Quantities tested and Identification

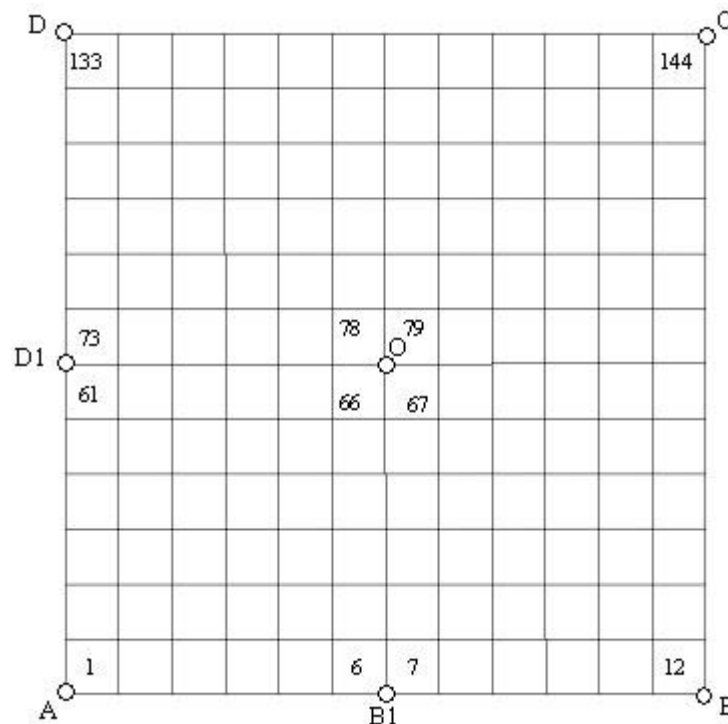
### results

<b>Not O MI34</b>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\bar{0}_{xz}$ , $\bar{0}_{yz}$ on average higher
Displacement	$DZ$
<b>Not BI MI22</b>	
<b>Layer 1</b>	$\bar{0}_{xx}$ , $\bar{0}_{yy}$ , $\bar{0}_{xy}$ , $\bar{0}_{xz}$ , $\bar{0}_{yz}$ on lower average
<b>Lay down 3</b>	$\bar{0}_{xx}$ , $\bar{0}_{yy}$ , $\bar{0}_{xy}$ , $\bar{0}_{xz}$ , $\bar{0}_{yz}$ on average medium
<b>Lay down 5</b>	$\bar{0}_{xx}$ , $\bar{0}_{yy}$ , $\bar{0}_{xy}$ , $\bar{0}_{xz}$ , $\bar{0}_{yz}$ on higher average

## 15 Modelization M

### 15.1 Characteristic of the modelization

Plates multi-layer isotropic (5 layers in the thickness). Quadrangular shell element DSQ.  
The reference user is confused with orthotropic reference.



Limiting conditions:

DDL\_IMPO

(GROUP\_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP\_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP\_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP\_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP\_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
DRZ: 0.)

FORCE\_ARETE

(GROUP\_NO: AB MY: 0.)  
(GROUP\_NO: BC MX: 0.)  
(GROUP\_NO: CD MY: 0.)  
(GROUP\_NO: DA MX: 0.)

### 15.2 Characteristics of the mesh

Many nodes: 171

Number of meshes and type: 144 QUAD4

### 15.3 Quantities tested and Identification

results

Not O MI34



# Code Aster

Version  
default

Titre : SSLS118 - Plaque carrée posée soumise à une pressi[...]  
Responsable : Thomas DE SOZA

Date : 02/04/2013 Page : 33/54  
Clé : V3.03.118 Révision : 10777

<b>Layer 1</b>	$\sigma_{xx}$ $\sigma_{yy}$ $\sigma_{xy}$ $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average higher
Displacement	DZ
<b>Not B1 M122</b>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on higher average

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

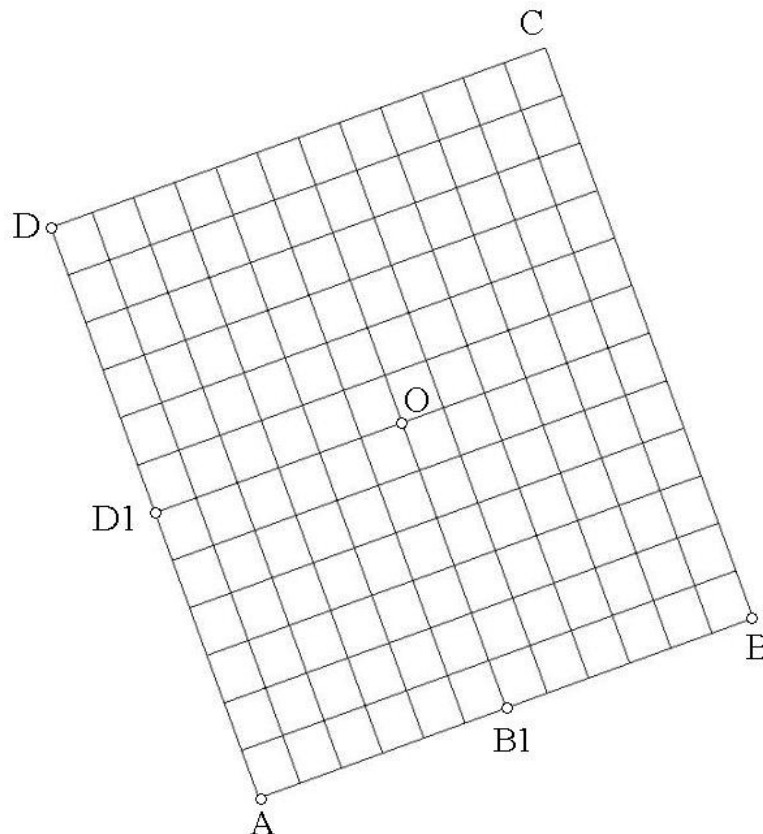
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## 16 Modelization N

### 16.1 Characteristic of the modelization

Plates multi-layer isotropic (5 layers in the thickness). Quadrangular shell element `DSQ`.

The model of plate associated with the modelization M is turned of 20 degrees according to the nautical angle  $\alpha$  and of 30 degrees according to  $\beta$ . The classification meshes is identical to that of the modelization Mr.



Boundary conditions:

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,
DRZ: 0.)
```

```
FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 16.2 Characteristics of the mesh

Many nodes: 171

Number of meshes and type: 144 QUAD4

## 16.3 Quantities tested and Identification

results

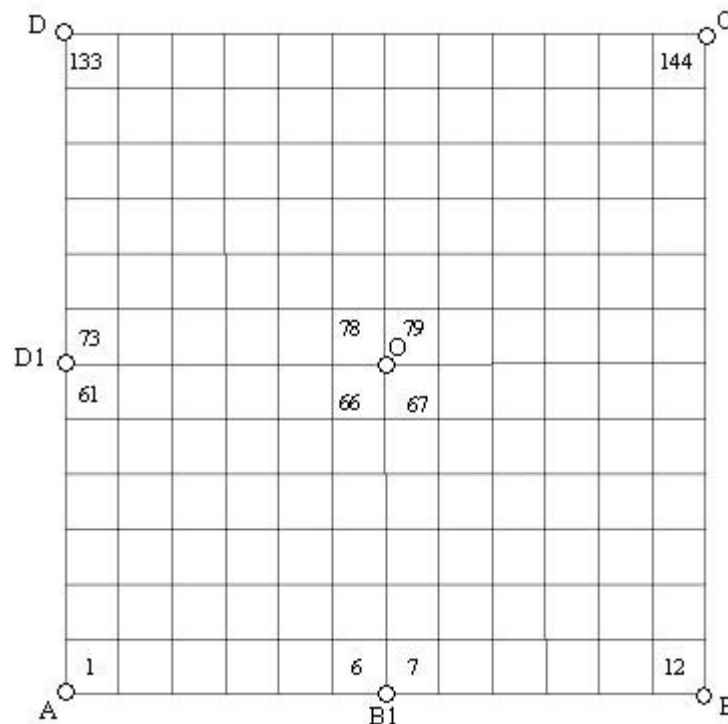
<b>Not</b> <i>O MI34</i>	
<b>Layer 1</b>	$\sigma_{xx}$ $\sigma_{yy}$ $\sigma_{xy}$ $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ $\sigma_{yy}$ $\sigma_{xy}$ $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average higher
Displacement	<i>DZ</i>
<b>Not</b> <i>B1 MI22</i>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on higher average

## 17 Modelization O

### 17.1 Characteristic of the quadrangular

modelization Shell element Q4G.

The reference user is confused with orthotropic reference.



Boundary conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,
DRZ: 0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 17.2 Characteristics of the mesh

Many nodes: 171

Number of meshes and type: 144 QUAD4

### 17.3 Quantities tested and Identification

## results

<i>O</i> M78	
<b>Not forced</b>	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher
Displacement	DZ
<b>Not BI</b> M6	
	$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}, \sigma_{xz}, \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not O	(M78)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
	(M79)	$T_x$	$T_y$						
	(M66)	$T_x$	$T_y$						
	(M67)	$T_x, T_y$							

### Identification

Not C	(M144)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x, T_y$
Not D	(M133)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x, T_y$

### Identification

Not D1	(M61)	$T_x, T_y$						
	(M73)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$						

### Identification

Not A	(M1)	$N_{xx}, N_{yy}, N_{xy}, M_{xx}, M_{yy}, M_{xy}, T_x, T_y$						
-------	------	--	--	--	--	--	--	--

### Identification

Not B	(M12)	$N_{xx}$ formula	$N_{yy}$ formula	$N_{xy}$ formula	$M_{xx}$ formula	$M_{yy}$ formula	$M_{xy}$ formula	$T_x$ formula	$T_y$ formula
-------	-------	------------------	------------------	------------------	------------------	------------------	------------------	---------------	---------------

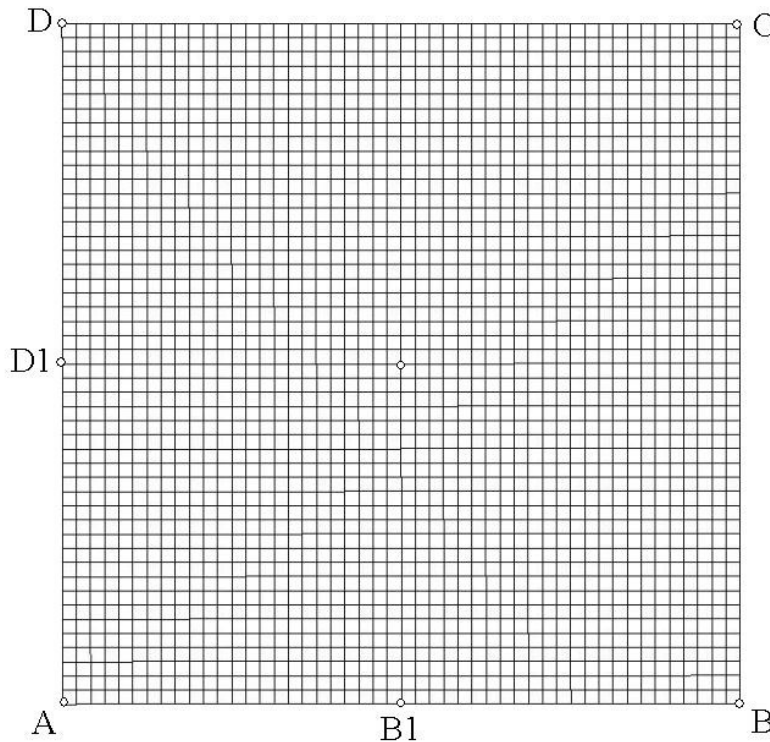
### formula

Identification Not	(M6)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
	(M7)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x, T_y$	

## 18 Modelization P

### 18.1 Characteristic of the quadrangular

modelization Shell element Q4G. The plate is modelled with a mesh  $48 \times 48$  .  
The reference user is confused with orthotropic reference.



Limiting conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. , DRZ:  
0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)  
(GROUP_NO: BC MX: 0.)  
(GROUP_NO: CD MY: 0.)  
(GROUP_NO: DA MX: 0.)
```

### 18.2 Characteristics of the mesh

Many nodes: 2402  
Number of meshes and type: 2304 QUAD4

### 18.3 Quantities tested and Identification

results

O M1176

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

<b>Not forced</b>	$\sigma_{xx} \sigma_{yy} \sigma_{xy} \sigma_{xz} , \sigma_{yz}$ on averages inferior, medium and higher
Displacement	DZ
B1 M24	
Not forced	$\sigma_{xx} , \sigma_{yy} , \sigma_{xy} , \sigma_{xz} , \sigma_{yz}$ on averages inferior, medium and higher

### Identification

Not O	(M1176)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x T_y$
	(M1177)	$T_x T_y$
	(M1128)	$T_x T_y$
	(M1129)	$T_x , T_y$

### Identification

Not A	(M1)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$
Not B	(M48)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$
Not C	(M2304)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$
Not D	(M2257)	$N_{xx} , N_{yy} , N_{xy} , M_{xx} , M_{yy} , M_{xy} , T_x , T_y$

### Identification

Not B1	(M24)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x T_y$
	(M25)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x , T_y$

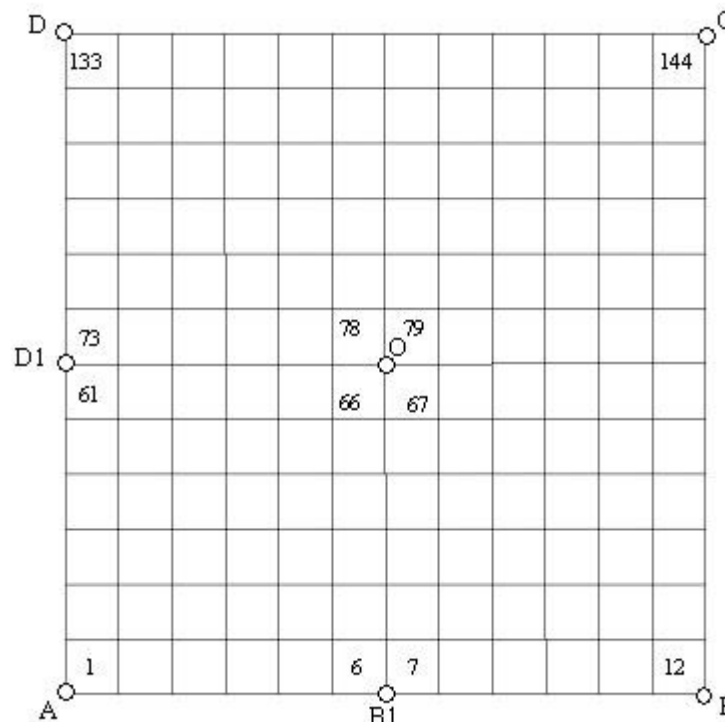
### Identification

Not D1	(M1105)	$T_x T_y$
	(M1153)	$N_{xx} N_{yy} N_{xy} M_{xx} M_{yy} M_{xy} T_x , T_y$

## 19 Modelization Q

### 19.1 Characteristic of the modelization

Plates multi-layer isotropic (5 layers in the thickness). Quadrangular shell element Q4G.  
The reference user is confused with orthotropic reference.



Limiting conditions:

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY:
0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX:
0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY:
0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX:
0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX:
0. , DRY: 0. , DRZ: 0.)

FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 19.2 Characteristics of the mesh

Many nodes: 171  
Number of meshes and type: 144 QUAD4

### 19.3 Quantities tested and Identification

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*



## results

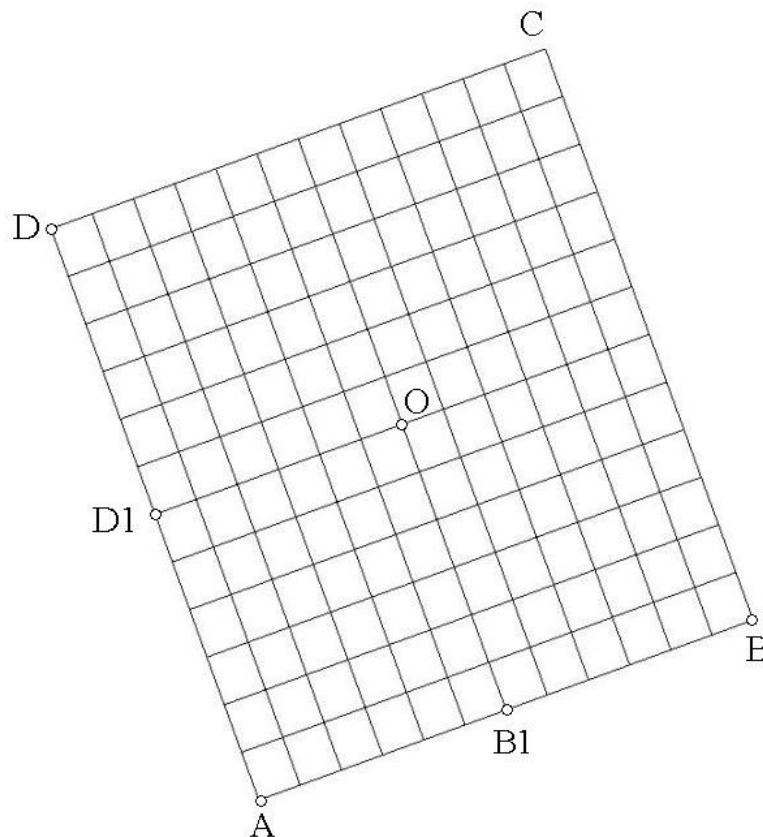
<b>Not O MI34</b>	
<b>Layer 1</b>	$\sigma_{xx}$ $\sigma_{yy}$ $\sigma_{xy}$ $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average higher
vertical	Deflection Displacement $w = DZ$
<b>BI MI22</b>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on higher average

## 20 Modelization R

### 20.1 Characteristic of the modelization

Plates multi-layer isotropic (5 layers in the thickness). Quadrangular shell element Q4G.

The model of plate associated with the modelization  $Q$  is turned of 20 degrees according to the nautical angle alpha and of 30 degrees according to beta. The classification meshes is identical to that of the modelization  $Q$ .



Boundary conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
DRZ: 0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)  
(GROUP_NO: BC MX: 0.)  
(GROUP_NO: CD MY: 0.)  
(GROUP_NO: DA MX: 0.)
```

### 20.2 Characteristics of the mesh

Many nodes: 171

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

Number of meshes and type: 144 QUAD4

## 20.3 Quantities tested and Identification

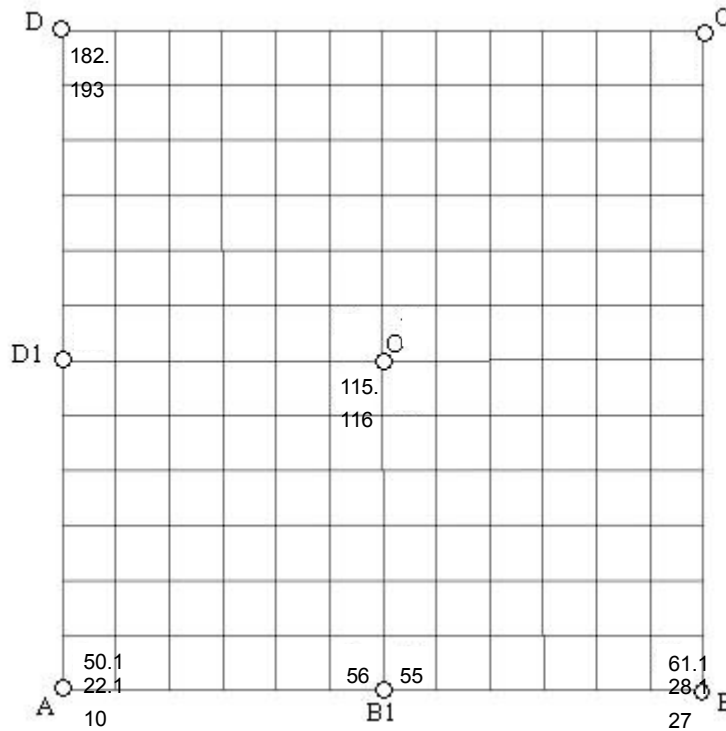
results

<b>Not O M78</b>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average higher
vertical	Deflection Displacement $w = DZ$
<b>BI M6</b>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on higher average

## 21 Modelization S

### 21.1 Characteristic of the quadrangular

modelization Shell element Q4GG.



Boundary conditions:

DDL\_IMPO

(GROUP\_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
 (GROUP\_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
 (GROUP\_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
 (GROUP\_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
 (GROUP\_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
 DRZ: 0.)

FORCE\_ARETE

(GROUP\_NO: AB MY: 0.)  
 (GROUP\_NO: BC MX: 0.)  
 (GROUP\_NO: CD MY: 0.)  
 (GROUP\_NO: DA MX: 0.)

### 21.2 Characteristics of the mesh

Many nodes: 171

Number of meshes and type: 144 QUAD4

### 21.3 Quantities tested and results

		Identification							
Not o	(M115)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
	(M128)	$T_x$	$T_y$						
	(M116)	$T_x$	$T_y$						

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

?) ,  $T_y$

### Identification

Not A (M50)  $N_{xx}$  ,  $N_{yy}$  ,  $N_{xy}$  ,  $M_{xx}$  ,  $M_{yy}$  ,  $M_{xy}$  ,  $T_x$  ,  $T_y$

Not B (M61)  $N_{xx}$  ,  $N_{yy}$  ,  $N_{xy}$  ,  $M_{xx}$  ,  $M_{yy}$  ,  $M_{xy}$  ,  $T_x$  ,  $T_y$

### Identification

Not C (M193)  $N_{xx}$   $N_{yy}$   $N_{xy}$   $M_{xx}$   $M_{yy}$   $M_{xy}$   $T_x$  ,  $T_y$

Not D (M182)  $N_{xx}$   $N_{yy}$   $N_{xy}$   $M_{xx}$   $M_{yy}$   $M_{xy}$   $T_x$  ,  $T_y$

### Identification

Not B1 (M55)  $N_{xx}$   $N_{yy}$   $N_{xy}$   $M_{xx}$   $M_{yy}$   $M_{xy}$   $T_x$   $T_y$

(M56)  $N_{xx}$   $N_{yy}$   $N_{xy}$   $M_{xx}$   $M_{yy}$   $M_{xy}$   $T_x$  ,  $T_y$

### Identification

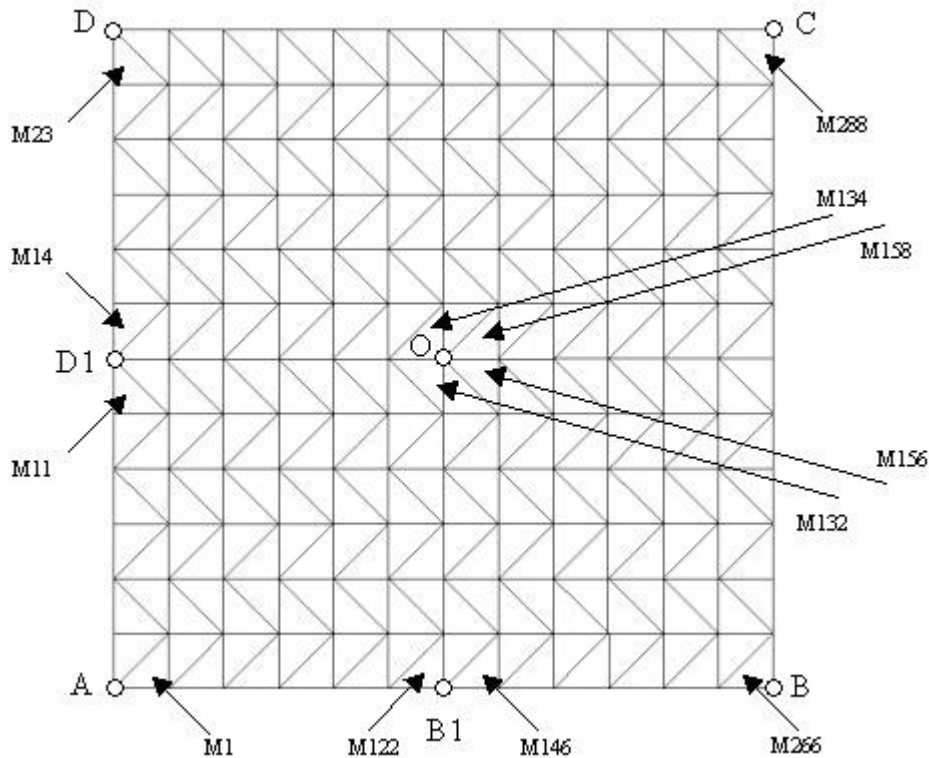
Not D1 (M122)  $T_x$  formulates  $T_y$

(M110)  $N_{xx}$  formula  $N_{yy}$   $N_{xy}$   $M_{xx}$   $M_{yy}$   $M_{xy}$   $T_x$   $T_y$

## 22 , Modelization

### 22.1 Characteristic of the triangular

modelization Shell element Q4GG.



Boundary conditions:

```
DDL_IMPO
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,
DRZ: 0.)

FORCE_ARETE
(GROUP_NO: AB MY: 0.)
(GROUP_NO: BC MX: 0.)
(GROUP_NO: CD MY: 0.)
(GROUP_NO: DA MX: 0.)
```

### 22.2 Characteristics of the mesh

Many nodes: 170

Number of meshes and type: 288 TRIA3

### 22.3 Quantities tested and results

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

## Identification

Not O	(M134)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
	(M158)	$T_x$	$T_y$						
	(M132)	$T_x$	$T_y$						
	(M156)	$T_x$	$T_y$						
		DZ							

## Identification

Not A	(M1)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
Not B	(M266)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
Not C	(M288)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
Not D	(M23)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$

## Identification

Not B1	(M122)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
	(M146)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$

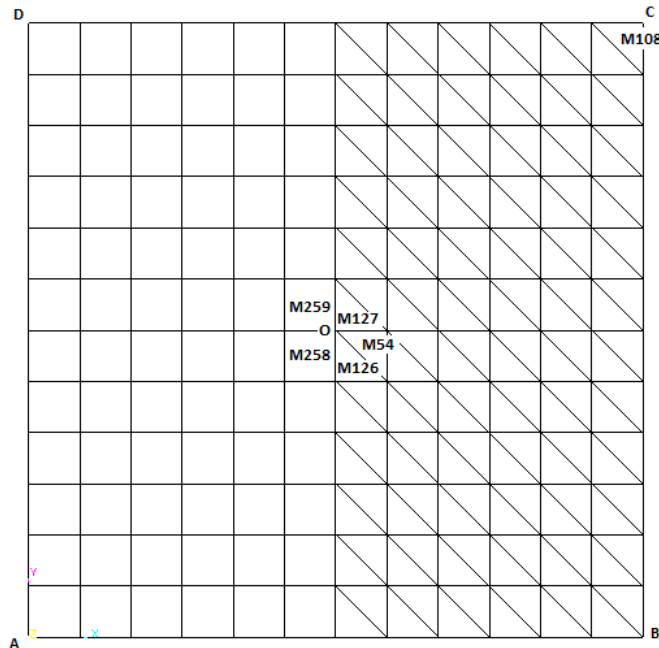
## Identification

Not D1	(M11)	$T_x$	$T_y$						
	(M14)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$

## 23 Modelization U

### 23.1 Characteristics of the quadrangular

modelization Shell element and triangular Q4GG.



Limiting conditions:

DDL\_IMPO

(GROUP\_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP\_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP\_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP\_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP\_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
DRZ: 0.)

FORCE\_ARETE

(GROUP\_NO: AB MY: 0.)  
(GROUP\_NO: BC MX: 0.)  
(GROUP\_NO: CD MY: 0.)  
(GROUP\_NO: DA MX: 0.)

### 23.2 Characteristics of the mesh

Many nodes: 171

Number of meshes and type: 72 QUAD4 , 144 TRIA3



## 23.3 Quantities tested and results

		Identification							
Not O	(M258)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$
	(M54)	$T_x$	$T_y$						
	(M126)	$T_x, T_y$							
		DZ							

		Identification							
Not C	(M108)	$N_{xx}$	$N_{yy}$	$N_{xy}$	$M_{xx}$	$M_{yy}$	$M_{xy}$	$T_x$	$T_y$

		Identification		
(M126)	Point 1	$M_{xx}$		
(M259)	Point 3	$M_{yy}$		

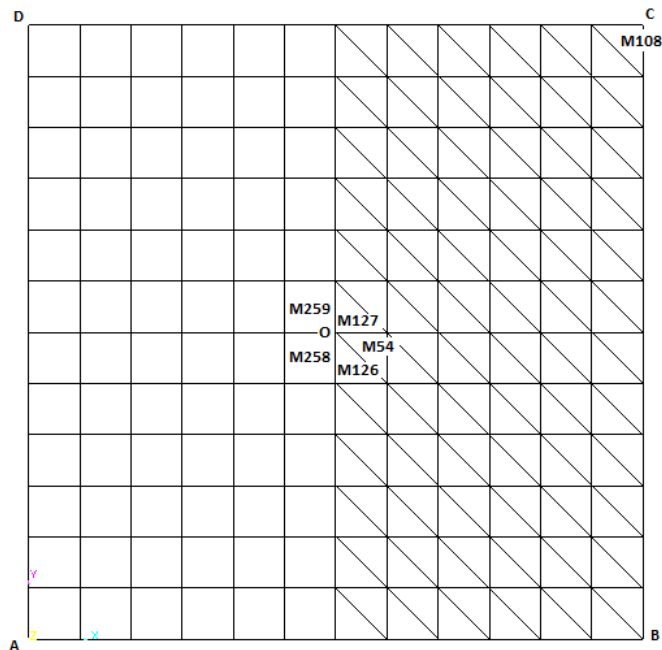
## 23.4 Remarks

In this modelization one checks that it is possible to calculate the generalized stresses (  $N$   $M$  ,  $T$  ) from fields of displacements coming from Europlexus.

## 24 Modelization V

### 24.1 Characteristic of the quadrangular

modelization Shell element and triangular DKTG.



Limiting conditions:

DDL\_IMPO

(GROUP\_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP\_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP\_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP\_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP\_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
DRZ: 0.)

FORCE\_ARETE

(GROUP\_NO: AB MY: 0.)  
(GROUP\_NO: BC MX: 0.)  
(GROUP\_NO: CD MY: 0.)  
(GROUP\_NO: DA MX: 0.)

### 24.2 Characteristics of the mesh

Many nodes: 171

Number of meshes and type: 72 QUAD4 , 144 TRIA3

## 24.3 Quantities tested and Identification

		results	
Not O	(M258)	$N_{xx}$ $N_{yy}$ $N_{xy}$ $M_{xx}$ $M_{yy}$ $M_{xy}$ $T_x$ , $T_y$	
	Elastic strain energy: <i>TOTALE MEMBRANE FLEXION</i>		
	(M54)	$T_x$ , $T_y$	
	(M126)	$T_x$ , $T_y$	
		DZ	

		Identification	
Not C	(M108)	$N_{xx}$ , $N_{yy}$ , $N_{xy}$ , $M_{xx}$ , $M_{yy}$ , $M_{xy}$ , $T_x$ , $T_y$	

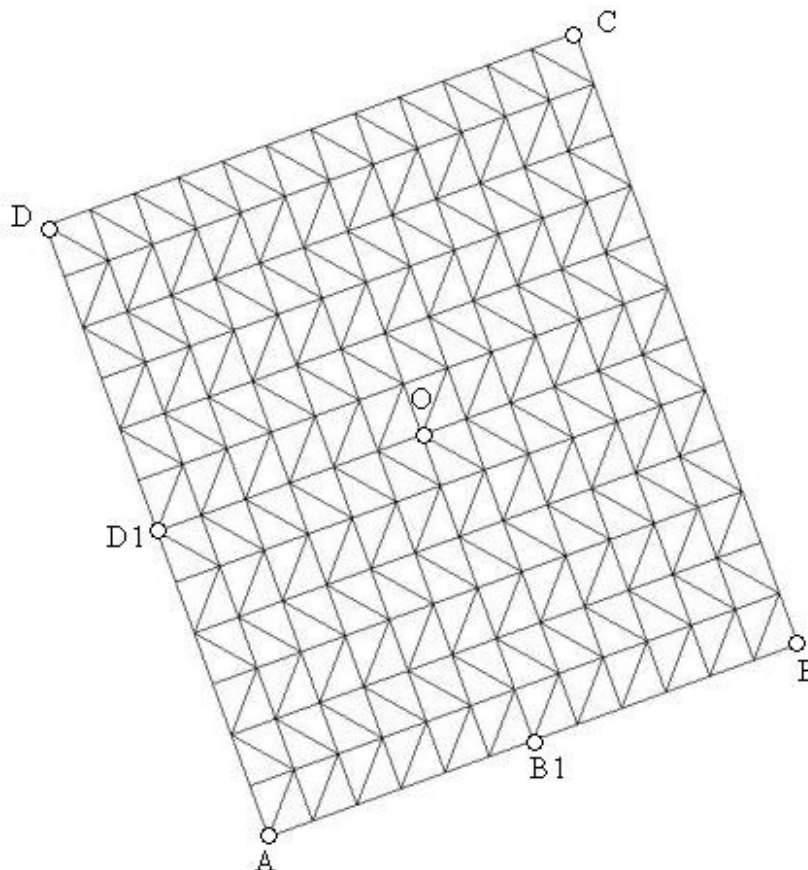
		Identification	
(M126)	Point 1	$M_{xx}$	
(M259)	Point 3	$M_{yy}$	

## 25 formula Modelization

### 25.1 Characteristic of the modelization

Plates multi-layer isotropic (5 layers in the thickness). Triangular shell element T3G.

The model of plate associated with the modelization  $K$  is turned of 20 degrees according to the nautical angle alpha and of 30 degrees according to beta. The classification meshes is identical to that of the modelization  $K$ .



Boundary conditions:

DDL\_IMPO

```
(GROUP_NO: AB, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: BC, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: CD, DX: 0. , DZ: 0. , DRY: 0.)  
(GROUP_NO: DA, DY: 0. , DZ: 0. , DRX: 0.)  
(GROUP_NO: O, DX: 0. , DY: 0. , DRX: 0. , DRY: 0. ,  
DRZ: 0.)
```

FORCE\_ARETE

```
(GROUP_NO: AB MY: 0.)  
(GROUP_NO: BC MX: 0.)  
(GROUP_NO: CD MY: 0.)  
(GROUP_NO: DA MX: 0.)
```

### 25.2 Characteristics of the mesh

Many nodes: 170

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

Number of meshes and type: 288 TRIA3

## 25.3 Quantities tested and Identification

### results

<b>Not O M134</b>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average higher
Displacement	<i>DZ</i>
<b>B1 M122</b>	
<b>Layer 1</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on lower average
<b>Lay down 3</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on average medium
<b>Lay down 5</b>	$\sigma_{xx}$ , $\sigma_{yy}$ , $\sigma_{xy}$ , $\sigma_{xz}$ , $\sigma_{yz}$ on higher average

## 26 Summary of the results

---

the got results show than:

- modelization `DSQ` provides a more precise estimate of the stresses and shears (<5%) that modelization `DKQ` (=20%). The estimate of the moments is equivalent for the two modelizations,
- with mesh of equivalent, modelization `DSQ` gets results more precise than modelization `Q4G` (comparison of the modelizations `B` and `O`). The 2 models converge towards the same results (comparison of the modelizations `J` and `P`). That is explained by the order of approximation of rotations which is quadratic for `DSQ` and bilinear for `Q4G`,
- the estimate of the stresses is more precise with modelization `DKT` (<2%) compared to modelization `DST` (<3,5%). The shears are estimated on the other hand better by `DST` (<10% for `DST` and <20% for `DKT`),
- for configurations `COQUE_3D` triangle or quadrangle, the estimate of the transverse shearing stress is constant in the thickness of the plate, in accordance with the assumptions of modelization,
- the results expressed in the reference user for configurations `DST` and `COQUE_3D` are identical to those expressed in the total reference,
- the refinement of the mesh for configuration `DSQ` improves the estimate of the stresses, the shears and the moments; the tendency is reversed with regard to displacement,
- the multi-layer configuration makes it possible to visualize the distribution of the plane stresses and transverse shears in the thickness of the plate, and to confirm the theory, namely a linear distribution for the plane stresses and parabolic for the shearing stresses; in addition, the rotation of the reference does not influence the values of the stresses,
- in a general way, with the nodes where one expects stresses or forces analytically null, the got numerical results are not correct owing to the fact that the estimates are made mesh by mesh then extrapolated with the nodes. Even the values realised with the nodes in question are not inevitably null.