SSLS04 – Beam with section in Z

Summary:

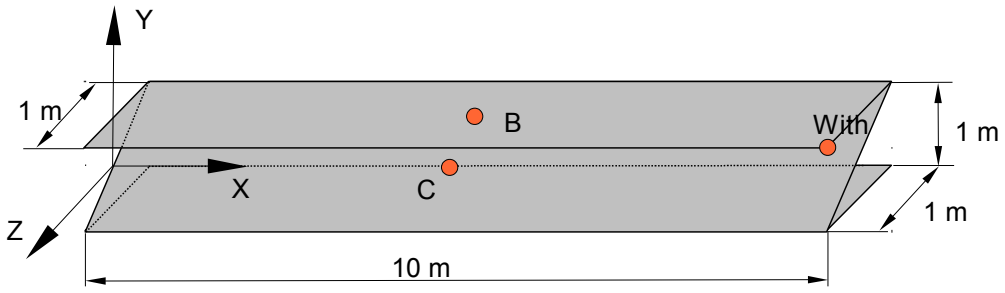
The objective of this test is to validate the calculation of displacements, and the constraints in a beam of section in Z. square plate, subjected has a shearing force.

Modelings :

- Modeling A : DKT with meshs QUAD4/TRIA3
- Modeling B : DST with meshs QUAD4/TRIA3
- Modeling C : Q4G with meshs QUAD4/TRIA3
- Modeling D : COQUE_3D with meshs QUAD4/TRIA3

1 Problem of reference

1.1 Geometry



Points	X	Y	Z
With	10.	0.5	0.5
B	5.	0.5	0.
C	5.	0.	0.

Thickness: $h=0,01\,m$

1.2 Properties of material

The material is elastic isotropic whose properties are:

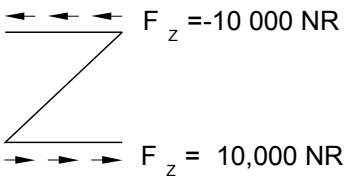
- $E=2,1.\times 10^{11}\,Pa$
- $\nu=0.3$

1.3 Boundary conditions and loadings

The beam is embedded in $x=0$:

- $DX=DY=DZ=DRX=DRY=DRZ=0$

Loading



1.4 Initial conditions

Nothing

2 Reference solution

2.1 Method of calculating

The reference solution is a digital solution [1].

2.2 Sizes and results of reference

- Displacement at the point A

Not	DZ
A	$0.715\times10^{-2}m$

- Constraint at the points B and C

Not	Constraints
B	$\sigma_{xy}=0.186\times10^{7}Pa$
C	$\sigma_{xx}=0.652\times10^{7}Pa$

2.3 Uncertainties on the solution

Digital solution < 5%. This solution was obtained with a quadratic network of 60 meshs.

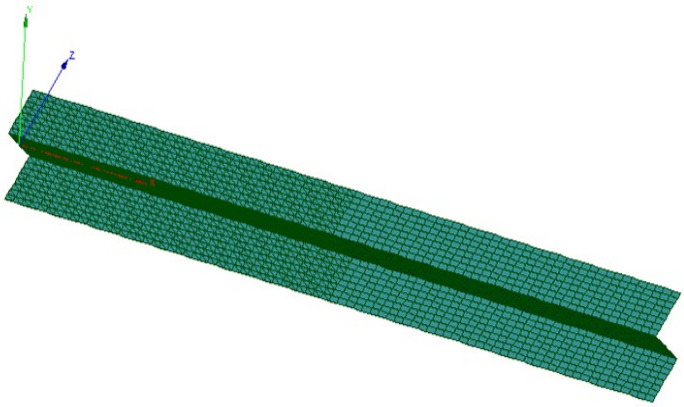
2.4 Bibliographical references

[1] Guide VPCS - Edition 1990.

3 Modeling A

3.1 Characteristics of modeling

A modeling is used DKT .



3.2 Characteristics of the grid

The grid contains 2349 nodes and 3360 meshs of which:

- 2240 meshs of the type TRIA3,
- 1120 meshs of the type QUAD4.

3.3 Sizes tested and results

- Displacement at the point A

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
A	DZ	'AUTRE_ASTER'	$0.715\times10^{-2}m$	17.0

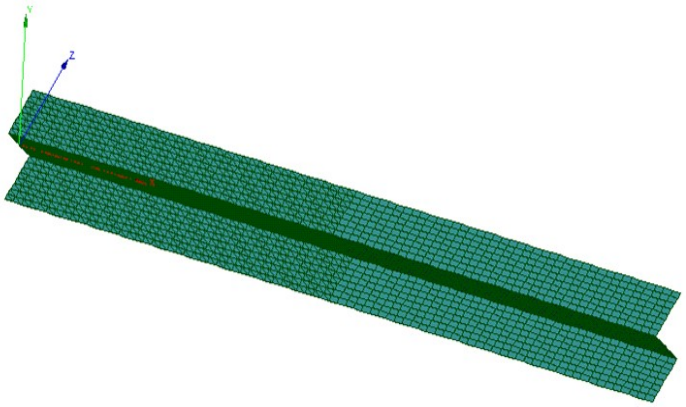
- Constraints at the points B and C

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
B	$SIXY$	'AUTRE_ASTER'	$0.186\times10^{7}Pa$	29.0
C	$SIXX$	'AUTRE_ASTER'	$0.652\times10^{7}Pa$	17.0

4 Modeling B

4.1 Characteristics of modeling

A modeling is used DST.



4.2 Characteristics of the grid

The grid contains 2349 nodes and 3360 meshs of which:

- 2240 meshs of the type TRIA3,
- 1120 meshs of the type QUAD4.

4.3 Sizes tested and results

- Displacement at the point A

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
A	DZ	'AUTRE_ASTER'	$0.715\times10^{-2}m$	17.0

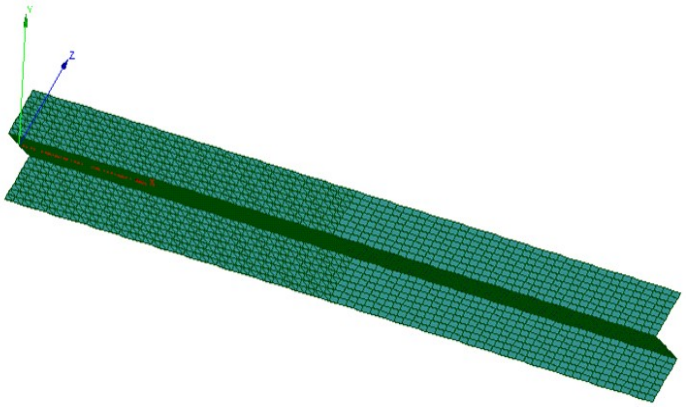
- Constraints at the points B and C

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
B	$SIXY$	'AUTRE_ASTER'	$0.186\times10^{7}Pa$	29.0
C	$SIXX$	'AUTRE_ASTER'	$0.652\times10^{7}Pa$	17.0

5 Modeling C

5.1 Characteristics of modeling

A modeling is used Q4G.



5.2 Characteristics of the grid

The grid contains 2349 nodes and 3360 meshs of which:

- 2240 meshs of the type TRIA3,
- 1120 meshs of the type QUAD4.

5.3 Sizes tested and results

- Displacement at the point A

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
A	DZ	'AUTRE_ASTER'	$0.715\times10^{-2}m$	17.0

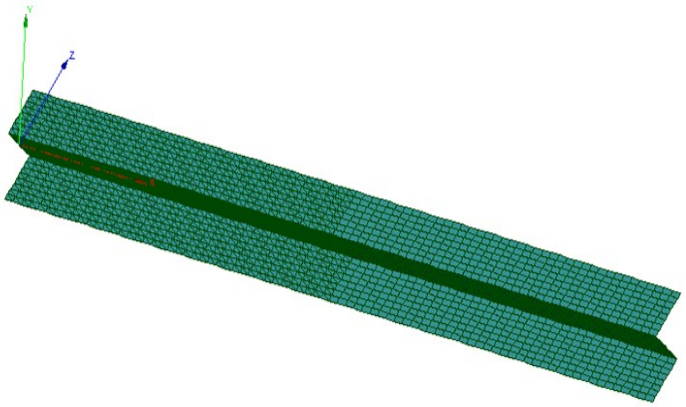
- Constraints at the points B and C

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
B	$SIXY$	'AUTRE_ASTER'	$0.186\times10^{7}Pa$	29.0
C	$SIXX$	'AUTRE_ASTER'	$0.652\times10^{7}Pa$	17.0

6 Modeling D

6.1 Characteristics of modeling

A modeling is used COQUE_3D.



6.2 Characteristics of the grid

The grid contains 2349 nodes and 3360 meshs of which:

- 2240 meshs of the type TRIA7,
- 1120 meshs of the type QUAD9.

6.3 Sizes tested and results

- Displacement at the point A

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
A	DZ	'AUTRE_ASTER'	$0.715\times10^{-2}m$	19.5

- Constraints at the points B and C

Identification		Type of reference	Value of reference	Tolerance (%)
Not	Size			
B	$SIXY$	'AUTRE_ASTER'	$0.186\times10^{7}Pa$	30.5
C	$SIXX$	'AUTRE_ASTER'	$0.652\times10^{7}Pa$	18.5

7 Summary of the results

Displacements : some is the type of mesh used (TRIA3, QUAD4) , and modeling selected the got results are far away from the reference solution, one observes a maximum change of 19%. On the other hand it is noted that 4 modelings (DKT, DST, Q4G and COQUE_3D) give the same results.

Constraints : some is modeling, the got results are far away from the reference solution. One observes a maximum change of 30.5% for the constraint SIXY and of 18.5% for the constraints SIXX. As for displacements 4 modelings give the same results appreciably.