

SSLS104 - Cylindrical shell pinch with Summarized

diaphragm:

One treats in linear elasticity the case of a cylinder formed by two circular funds at the two ends and gripped with mid-length.

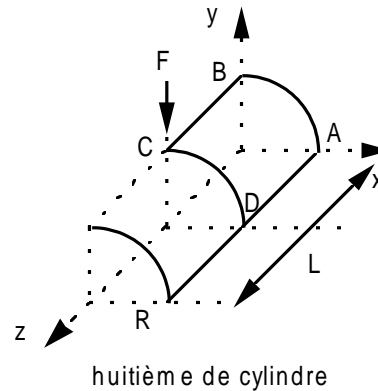
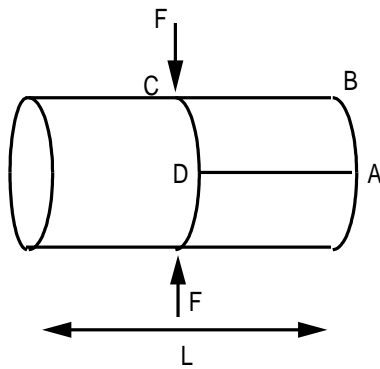
This makes it possible to treat the modes of strain inextensionnels and a membrane behavior complexes due to the diaphragms.

The value tested is the deflection at the point of application of the force.

Three modelizations: DKT, COQUE_3D QUAD9 and COQUE_3D TRIA7.

1 Problem of reference

1.1 Geometry



Longueur $L = 600$
Rayon $R = 300$
Epaisseur $t = 3$

Coordinated of the points:

	A	B	C	D
x	300.	0.	0.	300.
y	0.	300.	300.	0.
z	0.	0.	300.	300.

1.2 Material properties

$E = 3.10^6 Pa$
 $\nu = 0.3$
 $A_{CIS} = 0.8333$

1.3 Boundary conditions and loadings

rigid Diaphragm at each end:

$$u = v = 0, \quad \theta_z = 0$$

Specific Force in C :

$$F = 1. N$$

2 Reference solution

2.1 Method of calculating used for the reference solution

the parameters of the problem treated and the results of reference are explicitly given in the publication quoted below.

2.2 Results of reference

Displacement of the following C point y .

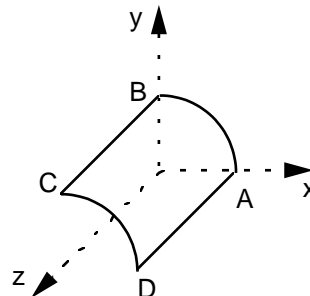
2.3 Bibliographical references

- Thomas J.R HUGHES, Ted BELYTSCHKO. Notes for Recent advances in nonlinear finite element analysis chases. Volume III - p 238 and 239 (1990).

3 Modelization A

3.1 Characteristic of the modelization

Shell element DKT



Modelization of a eighth of plate

Cutting:

10 on AD and BC
16 on AB and DC : 364 meshes limiting

TRIA3 Conditions:

in all the nodes of:

arc (AB)

arc (CD)

segment) BC (

segment) AD (

in C

in D

DDL_IMPO:

(GROUP_NO: AB DX: 0. , DY: 0. , DRZ: 0.)

(GROUP_NO: CD DZ: 0. , DRX: 0. , DRY: 0.)

(GROUP_NO: BCsansBC DX: 0. , DRY: 0. , DRZ: 0.)

(GROUP_NO: ADsansAD DY: 0. , DRX: 0. , DRZ: 0.)

(GROUP_NO: C DX: 0. , DRZ: 0.)

(GROUP_NO: D DY: 0. , DRZ: 0.)

Loading:

with the node is outside (GROUP_NO: C FY: -0.25)
the field of definition
with a right profile of the
EXCLU type node: C

Names of the nodes:

Not A $N04$

Not B $N02$

Not C $N01$

Not D $N03$

3.2 Characteristic of the mesh

Many nodes: 209

Number of meshes and types: 364 TRIA3

3.3 Values tested

Identification

Reference

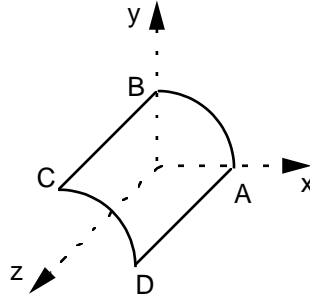
Not C – 1.8248 10-5
displacement v

With 1.366 nodes: $-1.8511 F$ in C .

4 Modelization B

4.1 Characteristic of the modelization

Shell element 3D MEC3QU9H



Modelization of a eighth of plate

Cutting:

4 on AD and BC
8 on AB and DC : 32 meshes limiting

QUAD9 Conditions:

in all the nodes of:

arc (AB)

arc (CD)

segment) BC (

segment) AD (

in C

in D

DDL_IMPO:

(GROUP_NO: AB DX: 0. , DY: 0. , DRZ: 0.)

(GROUP_NO: CD DZ: 0. , DRX: 0. , DRY: 0.)

(GROUP_NO: BCsansBC DX: 0. , DRY: 0. , DRZ: 0.)

(GROUP_NO: ADsansAD DY: 0. , DRX: 0. , DRZ: 0.)

(GROUP_NO: C DX: 0. , DRZ: 0.)

(GROUP_NO: D DY: 0. , DRZ: 0.)

Loading:

with the node is outside (GROUP_NO: C FY: -0.25)
the field of definition
with a right profile of the
EXCLU type node: C

Names of the nodes:

Not A $N01$

Not B $N02$

Not C $N03$

Not D $N04$

4.2 Characteristic of the mesh

Many nodes: 121

Number of meshes and types: 32 QUAD9

4.3 Values tested

Identification	Reference
Not C displacement v	- 1.8248 10-5

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.

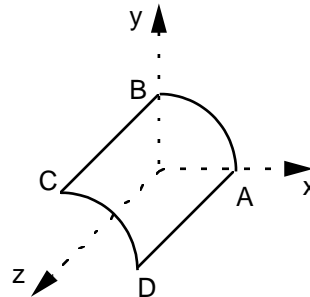
4.4 Remarks

For a mesh of 60 meshes QUAD9 and 213 nodes (corresponding to cutting 6 on AD and BC 10 on AB and DC), displacement v at the point C is worth $-1.8011 \cdot 10^{-5}$.

5 Modelization C

5.1 Characteristic of the modelization

Shell element MEC3TR7H



Modelization of a eighth of plate

Cutting:

10 on AD and BC
18 on AB and DC : 360 meshes limiting

TRIA7 Conditions:

in all the nodes of:

arc (AB)

arc (CD)

segment) BC (

segment) AD (

in C

in D

DDL_IMPO:

(GROUP_NO: AB DX: 0. , DY: 0. , DRZ: 0.)

(GROUP_NO: CD DZ: 0. , DRX: 0. , DRY: 0.)

(GROUP_NO: BCsansBC DX: 0. , DRY: 0. , DRZ: 0.)

(GROUP_NO: ADsansAD DY: 0. , DRX: 0. , DRZ: 0.)

(GROUP_NO: C DX: 0. , DRZ: 0.)

(GROUP_NO: D DY: 0. , DRZ: 0.)

Loading:

with the node is outside (GROUP_NO: C FY: -0.25)
the field of definition
with a right profile of the
EXCLU type node: C

Names of the nodes:

Not A $N01$

Not B $N02$

Not C $N03$

Not D $N04$

5.2 Characteristic of the mesh

Many nodes: 777

Number of meshes and types: 360 TRIA7

5.3 Values tested

Identification	Reference
Not C displacement v	- 1.8248 10-5

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.

5.4 Remarks

For a mesh with 500 meshes TRIA7 and 1071 nodes (cutting 10 on AD and BC , 25 on AB and DC), one obtains a displacement v at the point C of $-1.7723 \cdot 10^{-5}$. The relative error on displacement v in C is then of 2.88%. The results with this element for light meshes is thus not very good and improves relatively little with an increase amongst meshes.

6 Summary of the results

With regard to the elements:

DKT:

Result is better with a finer mesh (1366 nodes) which leads to an error < 1.5 %.

MEC3QU9H:

Result is acceptable with relatively few elements (compared with DKT). By increasing appreciably the number of elements (60 instead of 32), the error is < 1.3%.

MEC3TR7H:

Result little satisfying even with a fine mesh leading to a great total number of nodes for MEC3TR7H (777 for MEC3TR7H to be compared with 209 for DKT and 121 for MEC3QU9H). To arrive at an error lower than 2.9%, that requires one very a large number of nodes (1071). It seems recognized that this element is less good than MEC3QU9H.