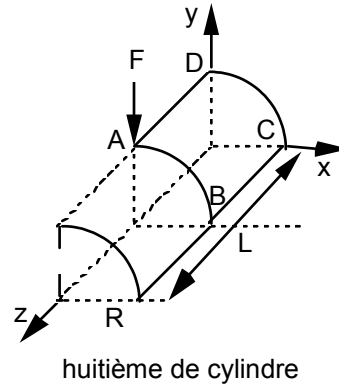
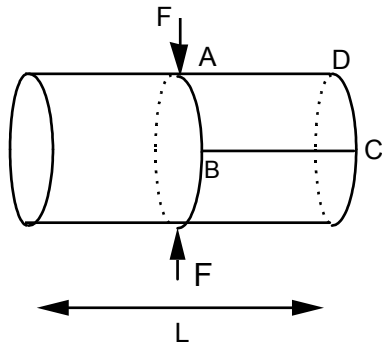

SSLS20 - Cylindrical hull free pinch on board

Summary:

The test from guide VPCS, makes it possible to check the effect of a specific loading on a thin cylindrical hull in linear elasticity. One compares the arrows with the point of application of the loading compared to a modeling of the thin cylindrical hull in elements `DKT` and two modelings `COQUE_3D` (1/8 cylinder is represented).

1 Problem of reference

1.1 Geometry



Longueur $L = 10.35$ m
Rayon $R = 4.953$ m
Epaisseur $t = 0.094$ m

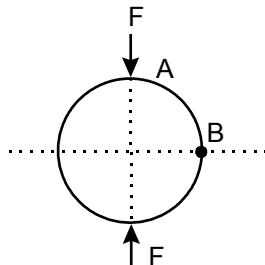
1.2 Material properties

$$E = 10.510^6 \text{ Pa}$$

$$\nu = 0.3125$$

1.3 Boundary conditions and loadings

Specific force: $F = 100. N$



2 Reference solution

2.1 Method of calculating used for the reference solution

The reference solution is that given in card SSLS20/89 of guide VPCS.

It was established by average of results of several software packages of calculation by the finite element method.

2.2 Results of reference

Displacement of the point A according to $y : v = -0.1139$

2.3 Uncertainty on the solution

Less than 2%

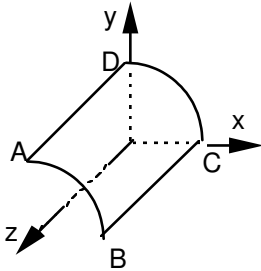
2.4 Bibliographical references

- 1) G. HORRIGMOE, P.G. BERGAN "Not linear analysis of free from shells by flat finite elements" Mathematics Computer in Applied Mechanics and Amsterdam Engineering, North Holland, vol. 16 (1978)

3 Modeling A

3.1 Characteristics of modeling

Element of hull DKT



élanement longitudinal $\frac{L}{30t} = 3.7$

élanement circonférentiel $\frac{0.5 \pi R}{10t} = 8.3$

Modélisation d'un huitième de cylindre

Cutting: 10 on AD and BC 15 on AB and DC : 300 meshes TRIA3

Limiting conditions:

in all the nodes of the arc AB DDL_IMPO: (GROUP_NO: AB DZ: 0. , DRX: 0. , DRY
MARTINI: 0.)
segment) AD) (GROUP_NO: ADsansA DX: 0. , DRY MARTINI:
0. , DRZ: 0.)
segment) BC) (GROUP_NO: BCsansB DY: 0. , DRX: 0. ,
DRZ: 0.)
in A (GROUP_NO: With DX: 0. , DRZ: 0.)
in B (GROUP_NO: B DY: 0. , DRZ: 0.)

Loading:

with the node A FORCE_NODALE: (GROUP_NO: With Fy: - 25.)

Name of the nodes:

Not $A=NO176$ Not $C=NO1$
Not $B=NO11$ Not $D=NO166$

3.2 Characteristics of the grid

Many nodes: 176
Many meshes and types: 300 TRIA3

3.3 Values tested

Not	Size and unit	Reference
A	displacement v (m)	- 0.1139

Code_Aster

Version
default

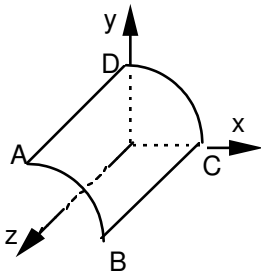
Titre : SSLS20 - Coque cylindrique pincée à bords libre
Responsable : DE SOZA Thomas

Date : 13/12/2011 Page : 5/9
Clé : V3.03.020 Révision :
e65aeebe7efe

4 Modeling B

4.1 Characteristics of modeling

Element of hull COQUE_3D MEC3QU9H



élanement longitudinal $\frac{L}{30t} = 3.7$

élanement circonférentiel $\frac{0.5 \pi R}{10t} = 8.3$

Modélisation d'un huitième de cylindre

Cutting: 4 on AD and BC 4 on AB and DC : 16 meshes QUAD9

Limiting conditions:

in all the nodes of the arc AB DDL_IMPO: (GROUP_NO: AB DZ: 0. , DRX: 0. , DRY MARTINI: 0.)
segment) AD) (GROUP_NO: ADsansA DX: 0. , DRY MARTINI: 0. , DRZ: 0.)
segment) BC) (GROUP_NO: BCsansB DY: 0. , DRX: 0. , DRZ: 0.)
in A (GROUP_NO: With DX: 0. , DRZ: 0.)
in B (GROUP_NO: B DY: 0. , DRZ: 0.)

Loading:

with the node A FORCE_NODALE: (GROUP_NO: With $F_y = -25.$)

Name of the nodes:

Not $A=NO3$ Not $C=NO1$
Not $B=NO4$ Not $D=NO2$

4.2 Characteristics of the grid

Many nodes: 65
Many meshes and types: 16 QUAD9

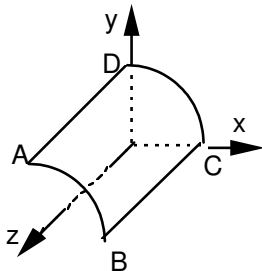
4.3 Values tested

Not	Size and unit	Reference
A	displacement v (m)	-0.1139

5 Modeling C

5.1 Characteristics of modeling

Element of hull COQUE_3D MEC3TR7H



élanement longitudinal $\frac{L}{30t} = 3.7$

élanement circonférentiel $\frac{0.5 \pi R}{10t} = 8.3$

Modélisation d'un huitième de cylindre

Cutting: 5 on AD and BC 12 on AB and DC : 120 meshes TRIA7

Limiting conditions:

in all the nodes of the arc AB DDL_IMPO: (GROUP_NO: AB DZ: 0. , DRX: 0. , DRY
MARTINI: 0.)
segment) AD) (GROUP_NO: ADsansA DX: 0. , DRY MARTINI:
0. , DRZ: 0.)
segment) BC) (GROUP_NO: BCsansB DY: 0. , DRX: 0. ,
DRZ: 0.)
in A (GROUP_NO: With DX: 0. , DRZ: 0.)
in B (GROUP_NO: B DY: 0. , DRZ: 0.)

Loading:

with node A FORCE_NODALE: (GROUP_NO: With Fy: - 25.)

Name of the nodes:

Not $A=NO3$ Not $C=NO1$
Not $B=NO4$ Not $D=NO2$

5.2 Characteristics of the grid

Many nodes: 275

Many meshes and types: 120 TRIA7

5.3 Values tested

Not	Size and unit	Reference	Aster	% difference
A	displacement v (m)	- 0.1139	- 0.1112	- 1.76

6 Summary of the results

With regard to the elements:

- DKT :
 - Suitable solution for a fine network.
 - To supplement later on:
 - by a less fine grid,
 - by an analysis of the constraints,
 - by 4 modelings (DKQ, DST, DSQ, Q4G).
- MEC3QU9H : very good solution obtained with a relatively coarse network.
- MEC3TR7H : to arrive at a suitable solution, that requires a fine grid, compared to that for the element MEC3QU9H. In the same way compared to the element DKT, the total number of nodes is much more important.