SDLS102 - Free vibrations of a paddle of compression

Summary:

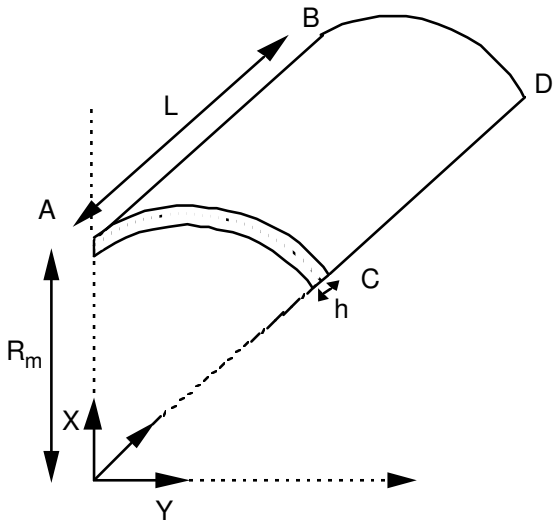
This test makes it possible to validate the calculation of the Eigen frequencies of a paddle of compression by using the order CALC_MODES.

Modelings correspond to the use of the elements COQUE_3D MEC3QU9H (modeling A) and MEC3TR7H (modeling B).

The reference solutions are experimental results. The difference between the digital results and the experimental values does not exceed $4{,}5\%$ for two modelings.

1 Problem of reference

1.1 Geometry



It is about a cylindrical panel:

- Length: $L=0.3048\,m$,
- Average radius: $R_m=0.6096$,
- Length of arc: $0.3042\,m$,
- Thickness: $h=0.003048\,m$.

1.2 Properties of material

The material is homogeneous, isotropic, elastic linear. The elastic coefficients are:

$E=206\,850.\,MPa$
$\nu=0.3$

Density: $\rho=7857{,}2\,kg/m^3$
Coefficient of the deformations of shearing action: $\mathrm{A\_CIS}=0.8333$

1.3 Boundary conditions and loadings

The structure is embedded at the end BD .

2 Reference solution

2.1 Method of calculating used for the reference solution

The reference solution corresponds to the experimental measurements given in [bib1].

2.2 Results of reference

The first six measured Eigen frequencies.

Number of the mode	Experimental values
1	85.6
2	134.5
3	259
4	351
5	395
6	531

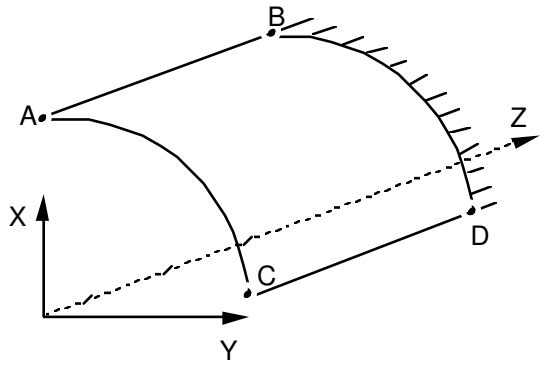
2.3 Bibliographical references

1) J.L. BATOZ, G. DHATT: Modeling of the structures by finite elements - Volume 3 hulls, 1992 HERMES pp 467 to 470.

3 Modeling A

3.1 Characteristics of modeling

Coque 3D MEC3QU9H



3.2 Characteristics of the grid

Many nodes: 169, Many meshs and types: 36 QUAD9

3.3 Features tested

One searches the frequencies in the interval $(80., 570.)$ by using the option 'ADJUST'order CALC_MODES.

3.4 Sizes tested and results

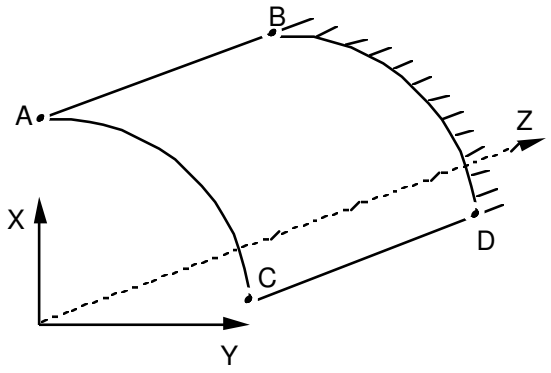
(Frequencies in Hertz)

Identification n° mode	Reference	*Aster*	% difference
1	85.6	85.85	0,302
2	134.5	138.56	3,021
3	259	246.92	– 4,664
4	351	342.71	– 2,361
5	395	386.66	– 2,112
6	531	531.59	0,112

4 Modeling B

4.1 Characteristics of modeling

Coque 3D MEC3TR7H



4.2 Characteristics of the grid

Many nodes: 913, Many meshs and types: 288 TRIA7

4.3 Sizes tested and results

(Frequencies in Hertz)

Identification n° mode	Reference	*Aster*	% difference
1	85.6	86.06	0,534
2	134.5	138.68	3,112
3	259	248	– 4,246
4	351	344.52	– 1,845
5	395	390.62	– 1,108
6	531	533.2	0,415

5 Summary of the results

The results are satisfactory. But grid with elements MEC3TR7H must be fine to have the same level of error as that obtained with elements MEC3QU9H.