

PERF001 - Elastic design of a hollow ring subjected to an internal pressure

Summary:

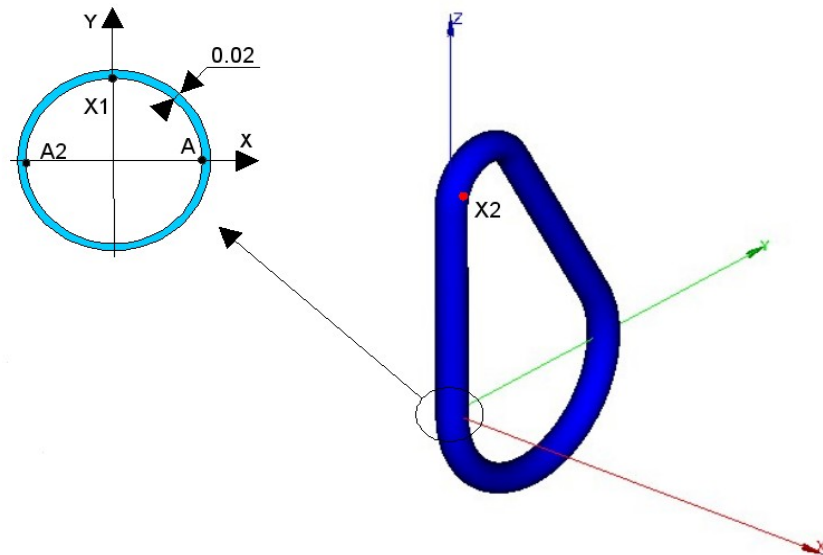
The objective of this CAS-test is to measure the performances of an elastic design 3D.

Five modelings carried out are the following ones:

- Modeling a: grid HEXA8, $5.0 E5$ degrees of freedom, MECA_STATIQUE ('MULT_FRONT')
- Modeling b: grid HEXA20, $5.2 E5$ degrees of freedom, MECA_STATIQUE ('MULT_FRONT')
- Modeling C: grid HEXA8, $1.0 E6$ degrees of freedom, MECA_STATIQUE ('MULT_FRONT')
- Modeling D: grid HEXA8, $2.0 E6$ degrees of freedom, MECA_STATIQUE ('MULT_FRONT')
- Modeling E: grid HEXA8, $5.0 E5$ degrees of freedom, MECA_STATIQUE ('MUMPS')

1 Problem of reference

1.1 Geometry



Coordinates of the points (m) :

$A : (1., 0., 0.)$
 $A2 : (-1., 0., 0.)$
 $X1 : (0., 1., 0.)$
 $X2 : (1., 0., 15.)$

Group of meshes: *PI* internal surface

1.2 Properties of material

- $E = 5.0 E11 Pa$
- $\nu = 0.3$
- $\rho = 9800 kg.m^{-3}$

1.3 Boundary conditions and loadings

- Imposed displacements:
 - A : $DX = DY = DZ = 0.$
 - $A2$: $DY = DZ = 0.$
 - $X1$: $DZ = 0.$
- Internal pressure:
 - $p = 2.0 E6 Pa$

2 Reference solution

2.1 Method of calculating

The result of reference (displacement following the axis Z point $X2$) was obtained by making the average of the displacements calculated at the time as of modelings A , B and C .

2.2 Results of reference

Displacement at the point $X2$: $DZ = 5.87E - 4 m$

2.3 Uncertainties

Digital solution.

3 Modeling A

3.1 Characteristics of modeling A

Modeling 3D:

Many nodes	168 000	
Many meshes	225 248	That is to say:
		SEG2 6 128
		QUAD4 93 120
		HEXA8 126000

3.2 Results

Points	Size	Reference (<i>m</i>)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	5.870E-4	3.000E-3

4 Modeling B

4.1 Characteristics of modeling B

Modeling 3D:

Many nodes	172 800	
Many meshes	62 408	That is to say:
		SEG3 2352
		QUAD8 26 496
		HEXA20 34 560

4.2 Results

Points	Size	Reference (m)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	5.870E-4	3.000E-3

5 Modeling C

5.1 Characteristics of modeling C

Modeling 3D:

Many nodes	336 000		
Many meshes	405 472	That is to say:	
		SEG2	6 192
		QUAD4	105 280
		HEXA8	294 000

5.2 Results

Points	Size	Reference (m)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	5.870E-4	3.000E-3

6 Modeling D

6.1 Characteristics of modeling D

Modeling 3D:

Many nodes	672000		
Many meshes	785 632	That is to say:	
		SEG2	6 672
		QUAD4	190 960
		HEXA8	588 000

6.2 Results

Points	Size	Reference (m)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	5.870E-4	3.000E-3

7 Modeling E

7.1 Characteristics of modeling E

Modeling 3D:

Many nodes	168000		
Many meshes	225248	That is to say:	
		SEG2	6128
		QUAD4	93120
		HEXA8	126000

7.2 Results

Points	Size	Reference (<i>m</i>)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	5.870E-4	3.000E-3

8 Summary of the results

Machine	Aster	MOD.	Nb DDL	Memory (Mo)		Time execution (MECA_STATIQUE) (dryness)			
				Allocat ed	Used	USERS	SYSTEM	USERS+SYS	ELAPSED
Linux 64 bits (ia64) "Bull"	10.1	With	504,012	763	758	138.22	18.73	156.37	157.49
		B	518,412	1,348	1,221	406.03	50.93	456.96	462.52
		C	1 008,012	1,690	1,263	707.14	97.74	804.88	807.53
		D	2 016,012	3,961	2,486	2256.55	225.42	2481.97	2633.52
		E	504,012	624	570	132.98	35.57	168.55	169.16