

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

Abstract:

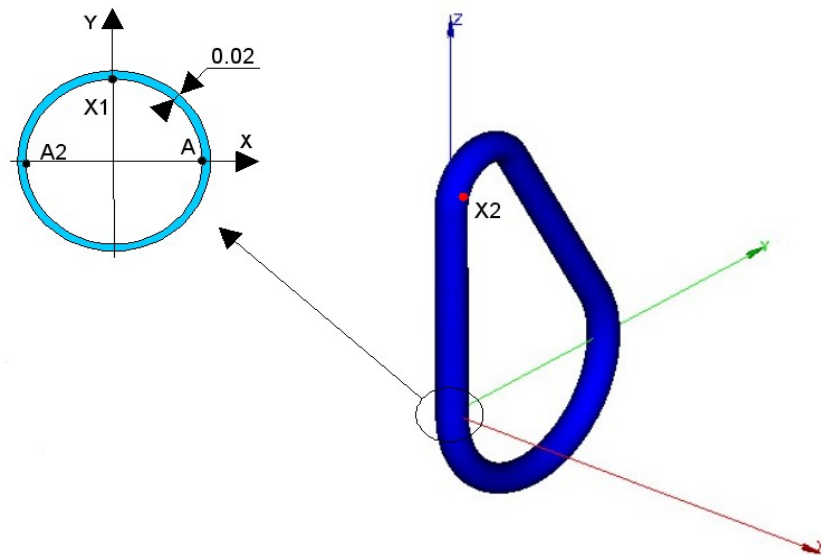
The purpose of this benchmark is to measure the performances of an elastic design 3D.

The five modelizations carried out are the following ones:

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

1 Problem of reference

1.1 Geometry



Coordinated of the points (m) :

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

Mesh group: PI surface intern

1.2 Properties of the 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

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

2.2 Results of reference

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

2.3 Uncertainties

numerical Solution.

3 Modelization A

3.1 Characteristic of the modelization A

Modelization 3D:

Many nodes	168 000		
Number of meshes	225 248	Are:	
		SEG2	6 128
		QUAD4	93 120
		HEXA8	126000

3.2 Results

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

4 Modelization B

4.1 Characteristic of the modelization B

Modelization 3D:

Many nodes	172 800		
Number of meshes	62 408	Are:	
		SEG3	2 352
		QUAD8	26 496
		HEXA20	34 560

4.2 Results

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

5 Modelization C

5.1 Characteristic of the modelization C

Modelization 3D:

Many nodes	336 000		
Number of meshes	405 472	Are:	
		SEG2	6 192
		QUAD4	105 280
		HEXA8	294 000

5.2 Results

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

6 Modelization D

6.1 Characteristic of the modelization D

Modelization 3D:

Many nodes	672000		
Number of meshes	785 632	Are:	
		SEG2	6 672
		QUAD4	190 960
		HEXA8	588 000

6.2 Results

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

7 Modelization E

7.1 Characteristic of the modelization E

Modelization 3D:

Many nodes	168 000		
Number of meshes	225248	Are:	
		SEG2	6128
		QUAD4	93120
		HEXA8	126000

7.2 Results

Points	Quantity	Reference (m)	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) (dry)			
				Allocat ed	Used	USERS	SYSTEM	USERS+SYS	ELAPSED
Linux 64 bits (ia64) "Bull"	10.1	A	504.012.76 3		758	138.22	18.73	156.37	157.49
		B	518.412	1.348	1.221	406.03	50.93	456.96	462.52
		C1	008.012	1.690	1.263	707.14	97.74	804.88	807.53
		D2	016.012	3.961	2.486	2256.55	225.42	2481.97	2633.52
		E	504.012.62 4		570	132.98	35.57	168.55	169.16