

PERF011 – Elastic design of a cylinder

Summary:

The objective of this CAS-test is to measure the performances of an elastic design of a bi-metallic cylinder subjected to a thermal loading.

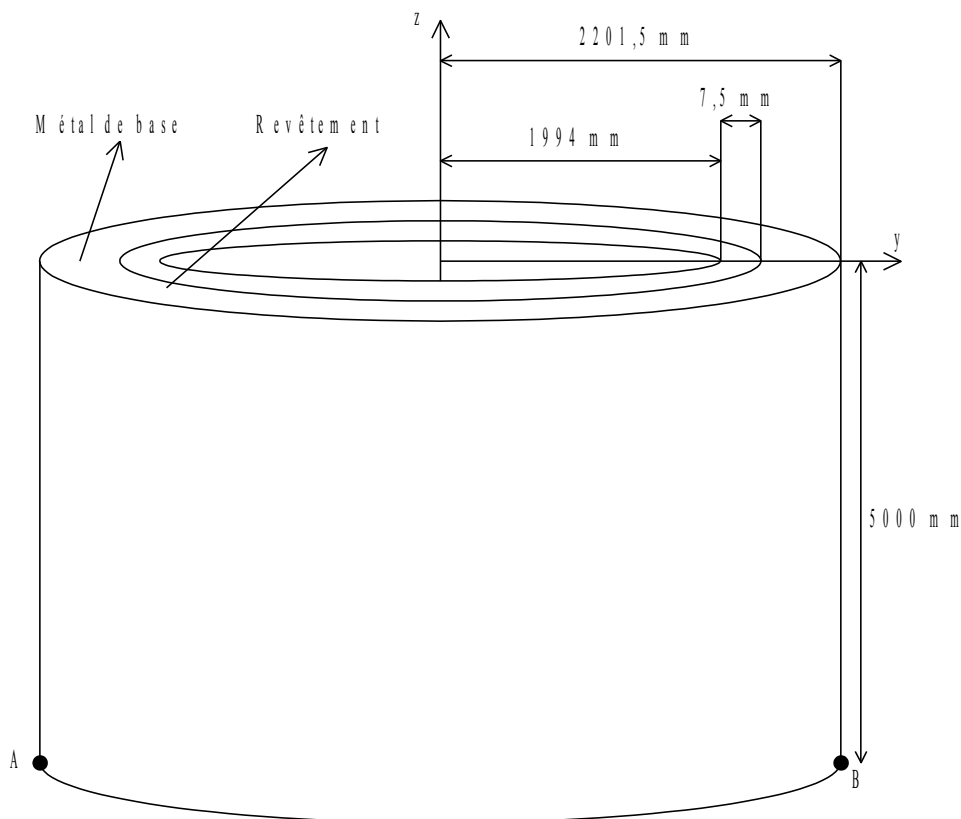
This case test is declined in 2 modelings which are identical. The differences are related to the change of many processors:

- 1) Modeling a: solvor MUMPS on 1 processor,
- 2) Modeling b: solvor MUMPS on 4 processors,

1 Problem of reference

1.1 Geometry

The geometry is the following one:



1.2 Properties of material

Four parameters are indicated, it acts of:

E : Young modulus, expressed in Pa ,
 $\nu = 0.3$: Poisson's ratio,
 With : isotropic thermal dilation coefficient, expressed in $^{\circ}C$,
 $TEMP_DEF_ALPHA = 20$: value of the temperature to which values of the thermal dilation coefficient ALPHA were determined, expressed in $^{\circ}C$.

For the external part:

Temperature ($^{\circ}C$)	E
0	1,9E+11
350	1,7E+11
Temperature ($^{\circ}C$)	ALPHA
20	1,60E-005
450	1,80E-005

For the internal part:

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Temperature (° C)	E
0	2,05E+11
350	1,8E+11

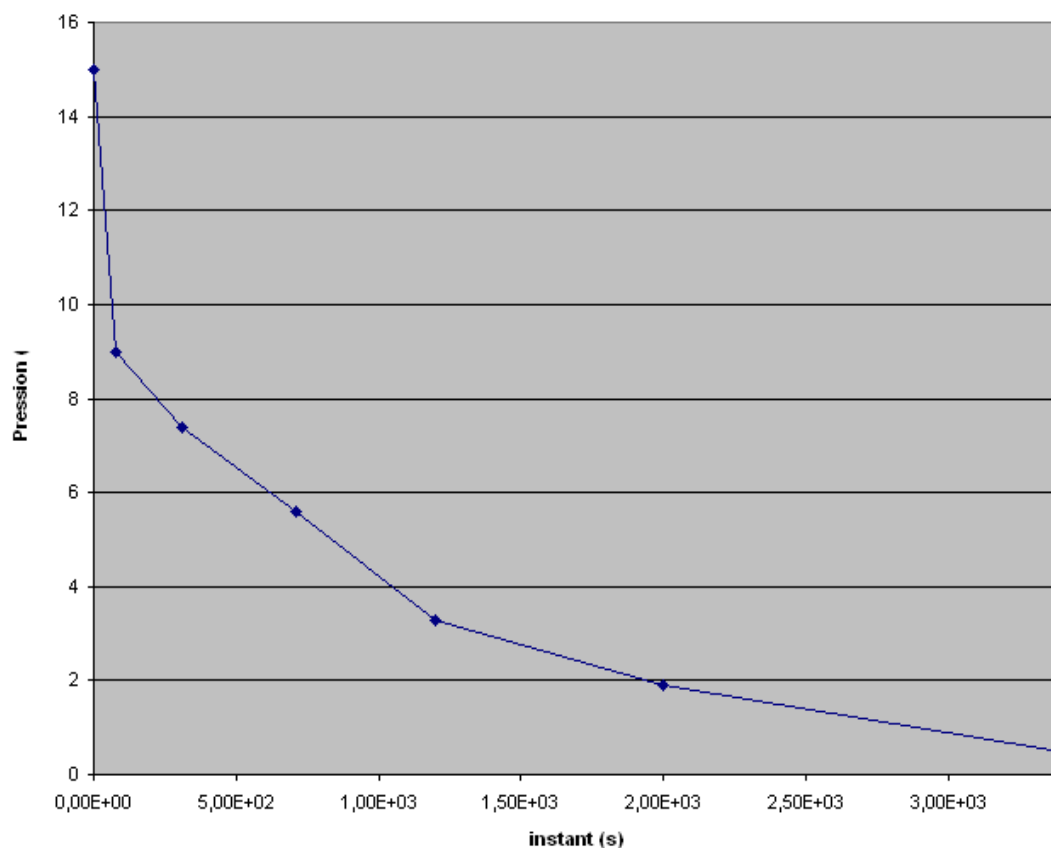
Temperature (° C)	ALPHA
20	1,10E-005
450	1,40E-005

1.3 Boundary conditions and loadings

Imposed displacement:

- Lower face : $DZ = 0$
- Not A : $DX = DY = 0$
- Not B : $DX = 0$
- Higher face : Equality of displacements along the axis Z

Interior pressure and on the faces higher and lower imposed variable according to time:



2 Reference solution

2.1 Method of calculating

The results of reference were got in version 10.2.5 of *Code_Aster*. The values tested are displacements along the axes X and Y on two nodes whose coordinates are:

Node C : $X = -1,775388$; $Y = +1,301768$; $Z = -3.100000$

Node D : $X = +1.614099$; $Y = -1.183506$; $Z = -5.054278$

2.2 Uncertainties

Digital solution (not-regression).

3 Modeling A

3.1 Characteristics of modeling A

Number of processor: 1

Modeling 3D :

Many nodes	284,544	That is to say:	POI1	10,944
Many meshes	158,400		SEG3	67,392
			QUAD8	14,400
			HEXA20	65,664

3.2 Results

Size	Reference	Tolerance (%)
DEPL DX Point C	-7,59E-004	1.e-3
DEPL DY Not C	1.531257E-03	1.e-3
DEPL DX Point D	4.0006E-04	1.e-3
DEPL DY Not D	4.0006E-04	1.e-3

3.3 Environment of execution

Machine	Version	Memory (Mo)		Number DDL	Time execution (MECA_STATIQUE) (dryness)			
		Allocat ed	Used		TO USE	SYSTEM	TO USE +SYS	ELAPSED
Linux 64 bits (ia64) "Bull"	10.2.23	6,500	5 822.6	864,574	2 863.8	67.5	2 931.4	2 969.0

4 Modeling B

4.1 Characteristics of modeling B

Number of processor: 4

Modeling 3D :

Many nodes	284,544	That is to say:	POI1	10,944
Many meshes	158,400		SEG3	67,392
			QUAD8	14,400
			HEXA20	65,664

4.2 Results

Size	Reference	Tolerance (%)
DEPL DX Point C	-7,59E-004	1.e-3
DEPL DY Not C	1.531257E-03	1.e-3
DEPL DX Point D	4.0006E-04	1.e-3
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Linux 64 bits (ia64) "Bull"	10.2.23	6,500	5 125.7	864,574	906.4	26.7	933.2	1 060.5

5 Summary of the results

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Linux 64 bits (ia64) "Bull"	10.2.23	6,500	5 822.6	864,574	2 863.8	67.5	2 931.4	2 969.0
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