

PERF002 - Thermoelastic computation of a hollow ring subjected to a Summarized thermal

loading:

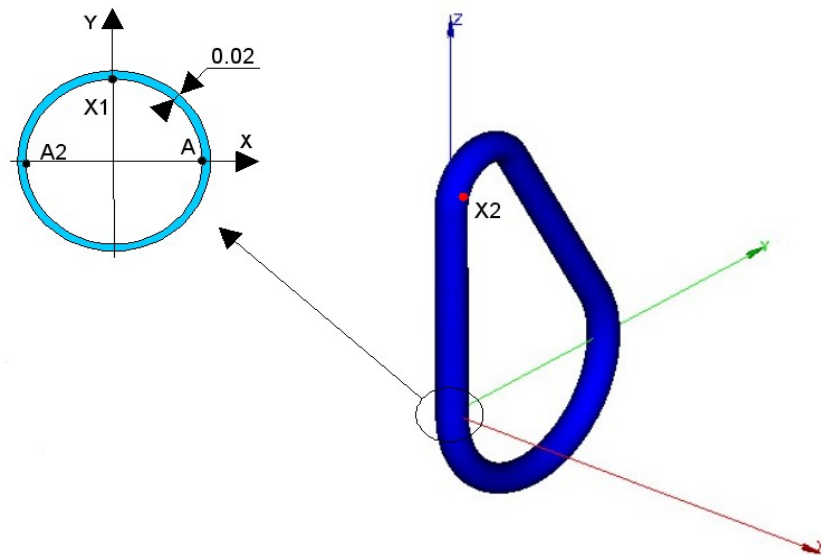
The purpose of this benchmark is to 3D measure the performances of a thermoelastic computation with several time step.

The three modelizations carried out are the following ones:

- Modelization a: mesh HEXA8, $2.5 E5$ degrees of freedom, MECA_STATIQUE ("MULT_FRONT")
- Modelization b: mesh HEXA8, $5.0 E5$ degrees of freedom, MECA_STATIQUE ("MULT_FRONT")
- Modelization C: mesh HEXA8, $1.0 E6$ degrees of freedom, MECA_STATIQUE ("MULT_FRONT")

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

- $E = 5.0 \text{ E11 Pa}$
- $\nu = 0.3$
- $\rho = 9800 \text{ kg.m}^{-3}$
- $\alpha = 2.0 \text{ E-5 } ^\circ\text{C}^{-1}$

1.3 Boundary conditions and loadings

- imposed Displacements:
 - A : $DX = DY = DZ = 0.$
 - $A2$: $DY = DZ = 0.$
 - $X1$: $DZ = 0.$

- Thermal loading:

The loading thermal transient evolves according to the axis Z , on the interval $[0. 10.]$ in the following way:

- $t = 0.s$: the temperature is constant with 20°C for $Z = -20m$ with $Z = 30m$
- $t = 10.s$: the temperature varies from 20°C for $Z = -20m$ with 220°C for $Z = 30m$

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 displacements calculated during the modelizations A and B with time $t=9.s$.

2.2 Results of reference

Displacement to point: $X2$ $DZ=3.57 E-2$ m with $t=9.s$.

2.3 Uncertainties

numerical Solution.

3 Modelization A

3.1 Characteristic of the modelization A

Modelization 3D:

Many nodes	83 760		
Number of meshes	112 928	Are:	
		SEG2	3 320
		QUAD4	46 788
		HEXA8	62 820

3.2 Results

Points	Quantity	Reference (<i>m</i>)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	$3.57 E-2$	1.000E-5

4 Modelization B

4.1 Characteristic of the modelization B

Modelization 3D:

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

4.2 Results

Points	Quantity	Reference (<i>m</i>)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	$3.57 E-2$	1.000E-5

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 (<i>m</i>)	Tolerance (%)
<i>X2</i>	<i>DZ</i>	$3.57 E-2$	1.000E-5

6 Summary of the results

Machine	Aster	MOD.	Nb DDL	Memory (Mo)		Time execution (MECA_STATIQUE) (dry)			
				Allocated	Used	USERS	SYSTEM	USERS+SYS	ELAPSED
Linux 64 bits (ia64) "Bull"	10.1	A	251.292.387		292	207.05	53.72	260.77	263.36
		B	504.012.807		578	413.38	72.54	485.92	489.48
		C	1.008.012	1796	1263	1284.55	235.61	1520.16	1525.72