

PERF008 – Elastic design of a full elastic twin wheel subjected to a Summarized thermal

loading:

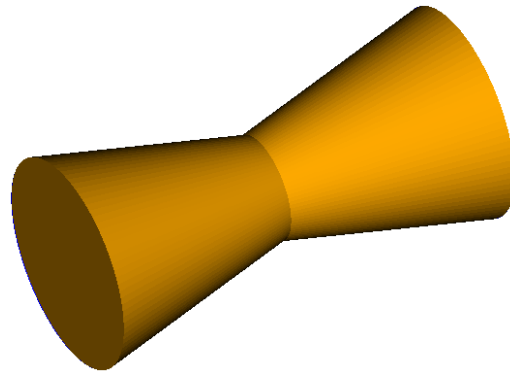
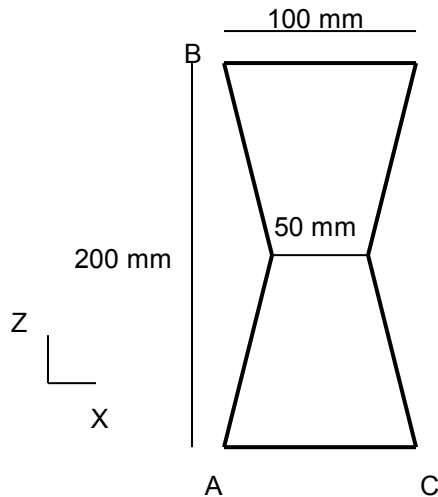
The purpose of this benchmark is to measure the performances of an elastic design of a structure 3D massive subjected to a sinusoidal thermal loading.

The four modelizations carried out are the following ones:

- 1) Modelization a: mesh HEXA8, $4.9 \cdot 10^5$ degrees of freedom
- 2) Modelization b: mesh HEXA20, $4.9 \cdot 10^5$ Modelization
- 3) degrees of freedom C: mesh HEXA8, $1.0 \cdot 10^6$ Modelization
- 4) degrees of freedom D: mesh HEXA8, $1.9 \cdot 10^6$ Problem

1 degrees of freedom of reference

1.1 Geometry



1.2 Properties of the material

- $E = 5.10^{11} Pa$
- $\nu = 0.3$
- $\rho = 9800. kg/m^3$

1.3 Boundary conditions and loadings

imposed Displacements:

A	:	$DX = DY = DZ = 0.$
B	:	$DX = DY = 0.$
C	:	$DY = 0.$

Imposed thermal field:

$$T = \cos(z/\pi)$$

2 Reference solution

2.1 Method of calculating

result of reference (maximum displacement following the axis X and Y) was obtained by making the average of displacements calculated during several computations.

2.2 Uncertainties

numerical Solution

3 Modelization A

3.1 Characteristic of the modelization A

Modelization 3D:

Many nodes	166.397			
Number of meshes	187.680	Are:		
			SEG2	1.376
			QUAD4	25.792
			HEXA8	160.512

3.2 Functionalities tested

Command	Option
AFFE_MODELE	MODELISATION 3D
AFFE_CHAR_MECA	DDL_IMPO
AFFE_MATERIAU	AFFE_VARC NOM_VARC
MECA_STATIQUE	
solver	MULT_FRONT

3.3 Results

Quantity	Reference	Code_Aster	relative Error (%)
DEPL_MAX_DX	5.2E-5	5.19E-5	-0.186
DEPL_MAX_DY	2.6E-5	2.595E-5	-0.186

3.4 Environment of execution

Machine	Version	(Mo) Memory		Number DDL	Time execution (MECA_STATIQUE) (dry)			
		Allocated	Used		USERS	SYSTEM	USERS+SYS	ELAPSED
Linux 64 bits (ia64) "Bulls"	9.4.1	3500	3496.6	499.203	1481.5	103.93	1585.4	1587.6

4 Modelization B

4.1 Characteristic of the modelization B

Modelization 3D:

Many nodes	165.021				
Number of meshes	50.348	Are:			
			SEG3	836	
			QUAD8	9.768	
			HEXA20	39.744	

4.2 Functionalities tested

Command	Option
AFFE_MODELE	MODELISATION 3D
AFFE_CHAR_MECA	DDL_IMPO
AFFE_MATERIAU	AFFE_VARC NOM_VARC
MECA_STATIQUE	
solver	MULT_FRONT

4.3 Results

Quantity	Reference	Code_Aster	relative Error (%)
DEPL MAX DX	6.5E-5	6.44E-5	-0.009
DEPL MAX DY	3.25E-5	3.249E-5	-0.009

4.4 Environment of execution

Machine	Version	(Mo) Memory		Number DDL	Time execution (MECA_STATIQUE) (dry)			
		Allocated	Used		USERS	SYSTEM	USERS +SYS	ELAPSED
Linux 64 bits (ia64) "Bulls"	9.4.1	6500	6440.9	495.075	2912.9	129.17	3042.08	3357.3

5 Modelization C

5.1 Characteristic of the modelization C

Modelization 3D:

Many nodes	333.805			
Number of meshes	367.480	Are:		
			SEG2	1.736
			QUAD4	40.944
			HEXA8	324.800

5.2 Functionalities tested

Command	Option
AFFE MODELE	MODELISATION 3D
AFFE CHAR MECA	DDL IMPO
AFFE MATERIAU	AFFE VARC NOM VARC
MECA STATIQUE	
solver	MULT_FRONT

5.3 Results

Quantity	Reference	Code_Aster	relative Error (%)
DEPL MAX DX	5.8E-5	5.813E-5	-0.229
DEPL MAX DY	2.9E-5	2.906E-5	-0.229

5.4 Environment of execution

Machine	Version	(Mo) Memory		Number DDL	Time execution (MECA_STATIQUE) (dry)			
		Allocated	Used		USERS	SYSTEM	USER S +SYS	ELAPSED
Linux 64 bits (ia64) "Bulls"	9.4.1	8500	8346.8	1.001.427	5891.1	229.11	6120.26	6166.6

6 Modelization D

6.1 Characteristic of the modelization D

Modelization 3D:

Many nodes	664.323			
Number of meshes	716.976	Are:		
			SEG2	2.176
			QUAD4	64.784
			HEXA8	650.016

6.2 Functionalities tested

Command	Option
AFFE_MODELE	MODELISATION 3D
AFFE_CHAR_MECA	DDL_IMPO
AFFE_MATERIAU	AFFE_VARC NOM_VARC
MECA_STATIQUE	
solver	PCG

6.3 Results

Quantity	Reference	Code_Aster	relative Error (%)
DEPL_MAX_DX	6.1E-5	6.1011E-5	0.18
DEPL_MAX_DY	3.05E-5	3.0505E-5	0.18

6.4 Environment of execution

Machine	Version	(Mo) Memory		Number DDL	Time execution (MECA_STATIQUE) (dry)			
		Allocated	Used		USERS	SYSTEM	USERS+SYS	ELAPSED
Linux 64 bits (ia64) "Bulls"	9.4.1	3000	2998.6	1.992.981	3492.4	34.98	3527.37	3531.9

7 Summary of the results

Machine	Aster	MO D.	Nb DDL	Memory (Mo)		Time execution (MECA_STATIQUE) (dry)			
				Allocat ed	Used	USERS	SYSTEM	USERS +SYS	ELAPSED
Linux 64 bits (ia64) "Bull"	9.4.1	A	499.203	3500	3496.6	1481.5	103.93	1585.4	1587.67
		B	495.075	6500	6440.9	2912.9	129.17	3042.08	3357.33
		C	1.001.427	8500	8346.8	5891.1	229.11	6120.26	6166.59
		D	1.992.981	3000	2998.6	3492.4	34.98	3527.37	3531.93