PERF004 - Computation elastoplastic of a hollow ring subjected to an internal pressure

Abstract:

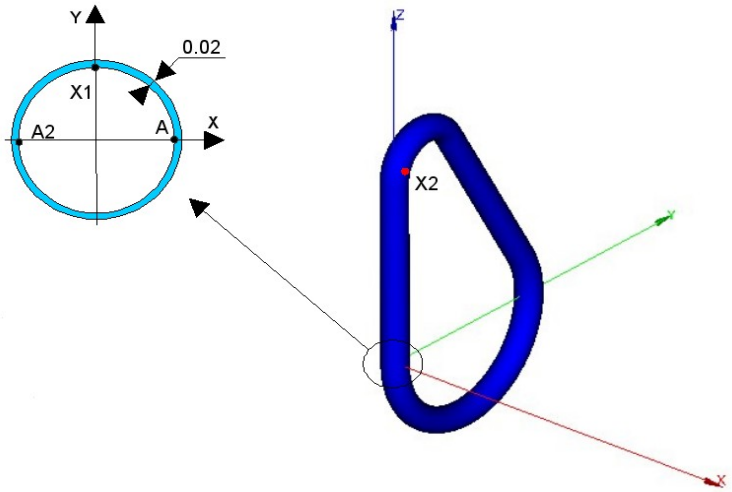
The purpose of this benchmark is to measure the performances of an elastoplastic computation 3D.

The five modelizations carried out are the following ones:

- Modelization a: mesh HEXA8, $5.3\,E4$ degrees of freedom, STAT_NON_LINE ("MULT_FRONT")
- Modelization b: mesh HEXA8, $1.0\,E5$ degrees of freedom, STAT_NON_LINE ("MULT_FRONT")
- Modelization C: mesh HEXA8, $2.5\,E5$ degrees of freedom, STAT_NON_LINE ("MULT_FRONT")
- Modelization D: mesh HEXA8, $5.0\,E5$ degrees of freedom, STAT_NON_LINE ("MULT_FRONT")
- Modelization E: mesh HEXA8, $5.0\,E5$ degrees of freedom, STAT_NON_LINE ("NEWTON_KRYLOV" + "PCG")

1 Problem of reference

1.1 Geometry



Coordinated of the points (m) :

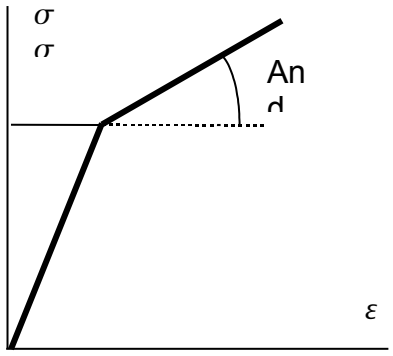
$A:(1.,0.,0.)$
$A2:(-1.,0.,0.)$
$X1:(0.,1.,0.)$
$X2:(1.,0.,15.)$

Mesh group: $P1$ surface intern

1.2 Properties of the material

- $E=5.0\ E11\ \ Pa$
- $\nu=0.3$
- $\rho=9800\ \ kg.m^{-3}$
- $\sigma_y=1.0E9\ Pa$
- $E_T=1.0E4\ Pa$

there



1.3 Boundary conditions and loadings

•imposed Displacements:

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

•Internal pressure:

- $P=2.0E6\ Pa$

2 Reference solution

2.1 Method of calculating

result of reference (displacement DZ of the point $X2$) is obtained by making the average of the displacements calculated for the four modelizations A B , C and D .

2.2 Results of reference

Displacement to point: $X2$ $DZ=5.5\mathrm{E}-3\,m$ at time $t=9.5\,s$, corresponding to a pressure interns $2.\mathrm{E}6\,Pa$.

2.3 Uncertainties

numerical Solution

3 Modelization A

3.1 Characteristic of the modelization A

Modelization 3D:

Many nodes 17920
Number of meshes 25888 Are:

SEG2	1424
QUAD4	11024
HEXA8	13440

3.2 Results

Time	Points	Quantity	Reference (m)	Tolerance (%)
9.5	*X2*	*DZ*	$5.5\mathrm{E}-3$	0.02

4 Modelization B

4.1 Characteristic of the modelization B

Modelization 3D:

Many nodes	33 200			
Number of meshes	44 848	Are:		
			SEG2	1 712
			QUAD4	16 576
			HEXA8	26 560

4.2 Results

Time	Points	Quantity	Reference (m)	Tolerance (%)
9.5	*X2*	*DZ*	5.5E−3	0.02

5 Modelization C

5.1 Characteristic of the modelization C

Modelization 3D:

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

5.2 Results

Time	Points	Quantity	Reference (m)	Tolerance (%)
9.5	*X2*	*DZ*	5.5E−3	0.02

6 Modelization D

6.1 Characteristic of the modelization D

Modelization 3D:

Many nodes 168 000
Number of meshes 225 248 Are:

SEG2	6 128
QUAD4	93 120
HEXA8	126 000

6.2 Results

Time	Points	Quantity	Reference (m)	Tolerance (%)
9.5	*X2*	*DZ*	5.5E−3	0.02

7 Modelization E

7.1 Characteristic of the modelization E

Modelization 3D:

Many nodes 168 000
formula 225 248 Are:

SEG2	6 128
QUAD4	93 120
HEXA8	126 000

7.2 Results

Urgent	Points	Quantity	Référenceformule (m)	Tolerance (%)
9.5	*X2*	*DZ*	5.5E−3	0.02