

SSNA01 - infinite Cylinder under pressure: viscoelasticity of Summarized

Lemaître:

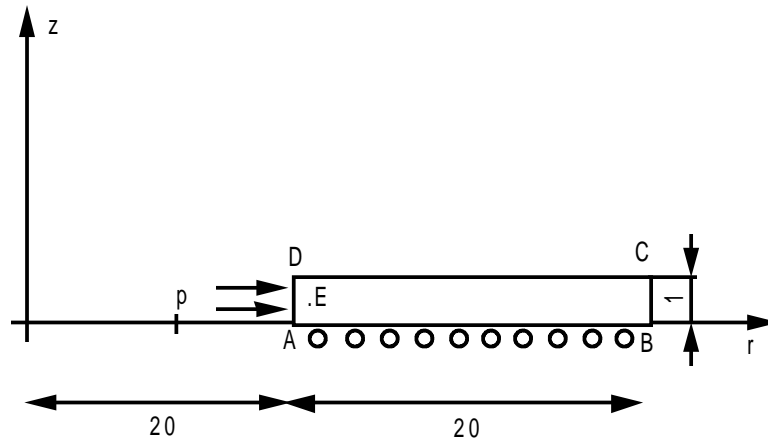
This test of nonlinear quasi-static mechanics consists in modelling an infinite cylinder subjected to an internal pressure depending on time. One thus validates the nonlinear behavior model of viscoelasticity of Lemaître into axisymmetric, and on a complete mesh. This test is drawn from guide VPCS of the SFM.

The cylinder is modelled by axisymmetric 2D elements (QUAD8).

The results got by *Code_Aster* are very close to the reference solution.

1 Problem of reference

1.1 Geometry



1.2 Material properties

$$E = 210\,000 \text{ MPa}$$

$$\nu = 0.3$$

viscoelastic Behavior model of Lemaître

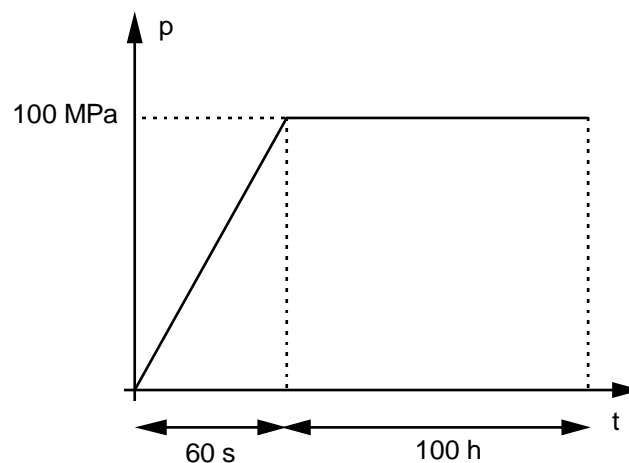
$$N = 11 \quad \frac{1}{K} = 3.284 \cdot 10^{-4} \quad (K = 3045) \quad \frac{1}{m} = 0.17857 \quad (m = 5.6)$$

1.3 Boundary conditions and loadings

On AB : $u_z = 0$

On CD : u_z uniform

Loading below: uniform pressure p following along AD .



2 Reference solution

2.1 Method of calculating used for the reference solution

Computation carried out with various codes of finite elements using various explicit algorithms, semi - implicit or implicit.

2.2 Results of reference

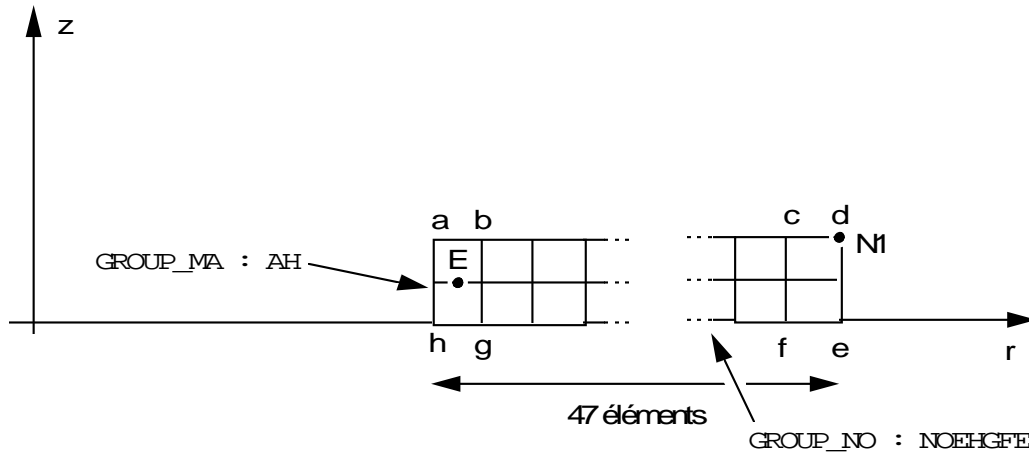
$\varepsilon_{v_{rr}}$ and $\varepsilon_{v_{zz}}$ at time $60s$ with the point E located at a distance $d = \frac{3 - \sqrt{3}}{6}$ from the interior surface of the cylinder.

2.3 Bibliographical references

Card-indexes SSNA01/89 of Commission VPCS.

3 Modelization A

3.1 Characteristic of the modelization



the loading and the boundary conditions are modelled by:

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DDL_IMPO: (GROUP_NO: NOEHGFE, DY: 0.)
LIAISON_DDL: (THE NODE IS OUTSIDE THE FIELD OF DEFINITION WITH A RIGHT
PROFILE OF THE EXCLU TYPE NODE: (N1 NXXX), DDL: ("DY", "DY"), COEF_MULT: (1,
-1), COEF_IMPO: 0.)
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for all the nodes belonging to edge AD (u_z uniform on ad)

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PRES_REP: (GROUP_MA: AH, NEAR: p (T))
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where $p(t)$ is the higher definite positive function [§1.3].

3.2 Characteristics of the mesh

Many nodes: 381
Number of meshes and types: 94 elements QUAD8

3.3 Quantities tested and results

One tests the parameters of the data structure results:

Identification	Reference	Test	Tolerance
INST for NUME_ORDRE= 7	60 , 0	ANALYTIQUE	0,10%
ITER_GLOB for NUME_ORDRE=7	3	NON_REGRESSION	0.00%

Identification	Reference	Test	Tolerance
$\varepsilon_{v_{rr}}$ to the point E with $t=60s$	-1,08E-4	NON_DEFINI	0,5%
$\varepsilon_{v_{zz}}$ at the point E with $t=60s$	-1,84E-5	NON_DEFINI	0,5%

3.4 Remarks

One stopped with $t=60s$ not to have time too long computation.

4 Summary of the results

the accuracy necessary for this test was fixed at 0.5% instead of 0.1% not lengthening the computing time too much. However, it is checked that by refining the discretization in time, the mistake made compared to the reference solution tends towards zero.