

WTNP129 – Modelization HM of a bar saturated with Summarized compressible

fluid:

One studies here a problem HM saturated with fluid in dimension 2. Considering symmetries of with the dealt problem, the solution is unidimensional. The structure is subjected to a water pressure imposed on its upper part. Its structural mechanics behavior is elastic. The purpose of this test is comparing the resolution by coupling with the resolution by sequence (cf documentation "Note of use of model THM" [U2.04.05])

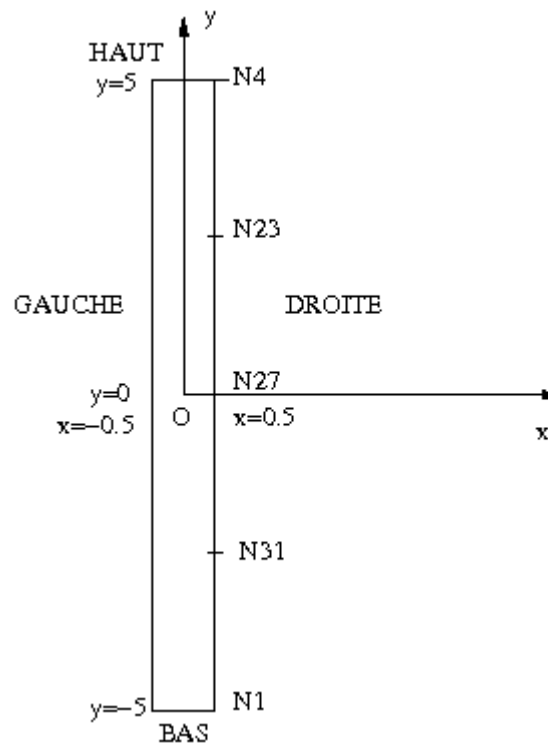
One thus has 3 modelizations in this test:

- Modelization a: one solves the physical problem using the "classical" method, by total coupling
- Modelization b: one C solves the problem using the method by sequence of
- the equations Modelization: This modelization is identical to the modelization A but with the element under-integrated HM_SI
- Modelization D: This modelization identical to the modelization but is B called on constitutive law DRUCK_PRAGER [R7.01.16] only with an aim of validating certain data-processing routines. Materials parameters are identified so that computation remains in the elastic domain and does not have physical meaning.

1 Problem of reference

1.1 Geometry

One considers a rectangular bar directed according to the axis Oy .



The coordinates of the points are given in the following table:

Not	N4	N23	N27	N31	N1
X-coordinate (m)	0.5	0	0	0.5	0.5
Y-coordinate (m)	5	0	0	-2.5	-5

problem is modelled on the time interval $[0; 10s]$.

1.2 Properties of the material

One gives here the parameters of the liquid

bar Water	ρ : density ($kg.m^{-3}$)	1000
	$1/K_{lq}$: opposite of compressibility (Pa^{-1})	0.5E-9
Coefficients material	r : homogenized density ($kg.m^{-3}$)	2800
	E : Young's modulus (Pa)	5.8E9
	ν : Poisson's ratio (--)	0.
	b : coefficient of Biot (--)	1
	K_{int} : intrinsic permeability (m^2)	1.E-8
additional Coefficients material DRUCK_PRAGER for	<i>ECROUISSAGE</i> : form hardening	<i>LINEAIRE</i>
	α : coefficient of dependence in pressure (--)	0.33
	P_{ultm} : ultimate cumulated plastic strain (--)	1.0
	σ_Y : stress of plasticity (Pa)	1.E8
	H : hardening modulus (Pa)	0.0

1.3 Boundary conditions and loadings

On *HAUT* , one imposes the conditions $\sigma \cdot n = 0$ and $p = 3.E6$ Pa.

On *GAUCHE* and *DROITE* , one imposes the conditions $u_x = 0$ and flux of null fluid $M \cdot n = 0$.

On *BAS* , one imposes the conditions $u_x = u_y = 0$ and flux of null fluid $M \cdot n = 0$.

1.4 Initial conditions

the initial fluid pressure is taken equalizes to 2 MPa . Initial porosity is taken equalizes with 0.5.

2 Reference solution

One is interested in the values of *DY*, *PRE1* and *SIYY* in 5 nodes (*N4 N23 N27 N31 , N1*) located on flat rim of the bar at two times $t = 1$ dryness and $t = 10$ seconds.

The tests carried out are tests of NON-regression for modelization A.

For the modelizations B, C and D, the tests carried out are tests of dependency to the results of the modelization A (of type *AUTRE_ASTER*).

3 Modelization A

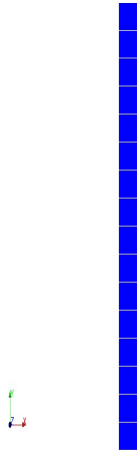
3.1 Characteristic of the modelization

One uses modelization D_PLAN_HMS .

3.2 Characteristics of the mesh

Many nodes: 83

Number of meshes and types: 16 meshes QUAD8



3.3 Quantities tested and results

the following tests of NON-regression are carried out.

Standard	identification of reference	Reference
N23 - PRE1 - t=1	NON_REGRESSION	1.4477057505633E+06
N27 - PRE1 - t=1	NON_REGRESSION	9.8618261792096E+05
N31 - PRE1 - t=1	NON_REGRESSION	6.8416253970115E+05
N1 - PRE1 - t=1	NON_REGRESSION	5.7968660741362E+05
N23 - PRE1 - t=10	NON_REGRESSION	1.9965914222579E+06
N27 - PRE1 - t=10	NON_REGRESSION	1.9937017653319E+06
N31 - PRE1 - t=10	NON_REGRESSION	1.9917709562082E+06
N1 - PRE1 - t=10	NON_REGRESSION	1.991092945817E+06
N4 - DY - t=1	NON_REGRESSION	1.8807606329922E-03
N23 - DY - t=1	NON_REGRESSION	1.139326750168E-03
N27 - DY - t=1	NON_REGRESSION	6.19182033214E-04
N31 - DY - t=1	NON_REGRESSION	2.6539252530741E-04

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

N4 - DY - t=10	NON_REGRESSION	3.4385071565836E-03
N23 - DY - t=10	NON_REGRESSION	2.5771817886894E-03
N27 - DY - t=10	NON_REGRESSION	1.7172304114012E-03
N31 - DY - t=10	NON_REGRESSION	8.5833064233171E-04
N4 - SIYY - t=1	NON_REGRESSION	2.00000E+06
N23 - SIYY - t=1	NON_REGRESSION	1.4477057505633E+06
N27 - SIYY - t=1	NON_REGRESSION	9.8618261792096E+05
N31 - SIYY - t=1	NON_REGRESSION	6.8416253970115E+05
N1 - SIYY - t=1	NON_REGRESSION	5.7968660741362E+05
N4 - SIYY - t=10	NON_REGRESSION	2.00000E+06
N23 - SIYY - t=10	NON_REGRESSION	1.9965914222579E+06
N27 - SIYY - t=10	NON_REGRESSION	1.9937017653319E+06
N31 - SIYY - t=10	NON_REGRESSION	1.9917709562082E+06

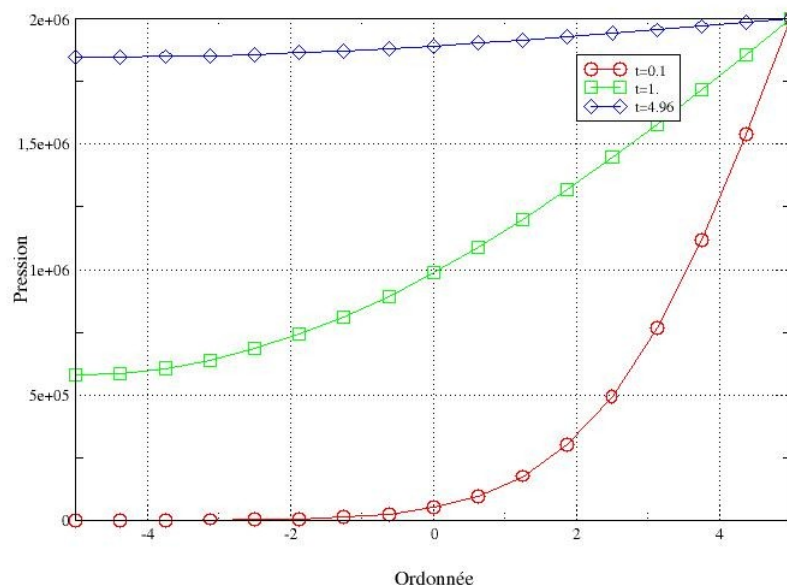


Illustration 1: Pressure on flat rim at 3 times

N1 - SIYY - t=10	NON_REGRESSION	1.991092945817E+06
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4 Modelization B

4.1 Characteristic of the modelization

One uses modelizations D_PLAN_HS for the hydraulics and D_PLAN_SI for the mechanics.

4.2 Characteristics of the mesh

The mesh is identical to that of modelization A.

Nombre of nodes: 83

Number of meshes and types: 16 meshes QUAD8

the meshes mechanical and hydraulic are identical.

4.3 Quantities tested and Standard

Identification	results of reference	Reference	Error
N23 - PRE1 - t=1	AUTRE_ASTER	1.4477057505633E+06	0.0495%
N27 - PRE1 - t=1	AUTRE_ASTER	9.8618261792096E+05	0.294%
N31 - PRE1 - t=1	AUTRE_ASTER	6.8416253970115E+05	0.850%
N1 - PRE1 - t=1	AUTRE_ASTER	5.7968660741362E+05	1.24%
N4 - DY - t=1	AUTRE_ASTER	1.8807606329922E-03	0.299%
N23 - DY - t=1	AUTRE_ASTER	1.139326750168E-03	0.483%
N27 - DY - t=1	AUTRE_ASTER	6.19182033214E-04	0.772%
N31 - DY - t=1	AUTRE_ASTER	2.6539252530741E-04	1.09%
N4 - SIYY - t=1	AUTRE_ASTER	2.00000E+06	1.0E-08%
N23 - SIYY - t=1	AUTRE_ASTER	1.4477057505633E+06	0.0495%
N27 - SIYY - t=1	AUTRE_ASTER	9.8618261792096E+05	0.294%
N31 - SIYY - t=1	AUTRE_ASTER	6.8416253970115E+05	0.850%
N1 - SIYY - t=1	AUTRE_ASTER	5.7968660741362E+05	1.24%
N23 - PRE1 - t=10	AUTRE_ASTER	1.9965914222579E+06	0.0202%
N27 - PRE1 - t=10	AUTRE_ASTER	1.9937017653319E+06	0.0373%
N31 - PRE1 - t=10	AUTRE_ASTER	1.9917709562082E+06	0.0488%
N1 - PRE1 - t=10	AUTRE_ASTER	1.991092945817E+06	0.0528%
N4 - DY - t=10	AUTRE_ASTER	3.4385071565836E-03	0.0335%
N23 - DY - t=10	AUTRE_ASTER	2.5771817886894E-03	0.0414%
N27 - DY - t=10	AUTRE_ASTER	1.7172304114012E-03	0.0475%
N31 - DY - t=10	AUTRE_ASTER	8.5833064233171E-04	0.0514%
N4 - SIYY - t=10	AUTRE_ASTER	2.00000E+06	9.31E-14%
N23 - SIYY - t=10	AUTRE_ASTER	1.9965914222579E+06	0.0202%

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

N27 - SIYY - t=10	AUTRE_ASTER	1.9937017653319E+06	0.0373%
N31 - SIYY - t=10	AUTRE_ASTER	1.9917709562082E+06	0.0488%
N1 - SIYY - t=10	AUTRE_ASTER	1.991092945817E+06	0.0528%

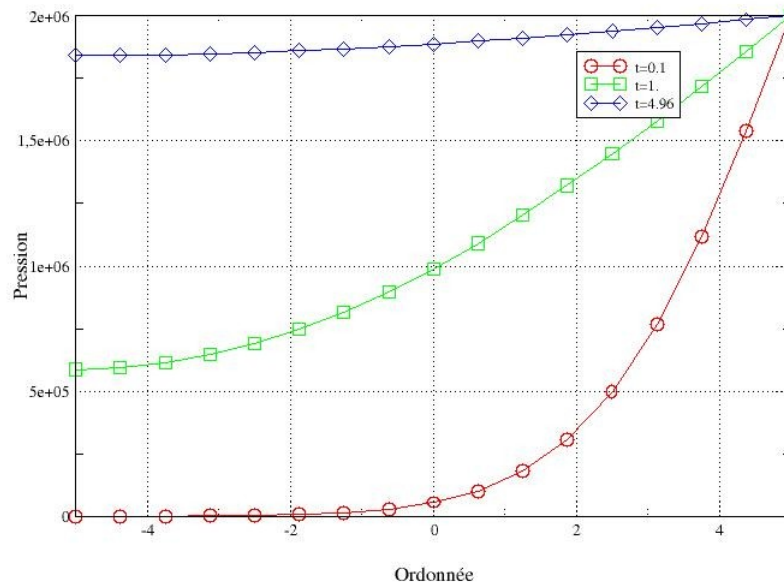


Illustration 2: Pressure on flat rim at 3 times

5 Modelization C

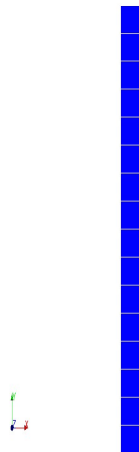
5.1 Characteristic of the modelization

One uses modelization D_PLAN_HM_SI .

5.2 Characteristics of the mesh

Many nodes: 83

Number of meshes and types: 16 meshes QUAD8



5.3 Quantities tested and results

the tests of NON-regression are carried out in version 11.0.25.

Standard	identification of reference	Reference	Error
N23 - PRE1 - t=1	AUTRE_ASTER	1.4477057505633E+06	0.0044%
N27 - PRE1 - t=1	AUTRE_ASTER	9.8618261792096E+05	0.0462%
N31 - PRE1 - t=1	AUTRE_ASTER	6.8416253970115E+05	0.151%
N1 - PRE1 - t=1	AUTRE_ASTER	5.7968660741362E+05	0.226%
N4 - DY - t=1	AUTRE_ASTER	1.8807606329922E-03	0.0506%
N23 - DY - t=1	AUTRE_ASTER	1.139326750168E-03	0.0829%
N27 - DY - t=1	AUTRE_ASTER	6.19182033214E-04	0.136%
N31 - DY - t=1	AUTRE_ASTER	2.6539252530741E-04	0.197%
N4 SIYY - t=1	AUTRE_ASTER	2.00000E+06	1.0E-13%
N23 - SIYY - t=1	AUTRE_ASTER	1.4477057505633E+06	0.0044%
N27 - SIYY - t=1	AUTRE_ASTER	9.8618261792096E+05	0.0462%
N31 - SIYY - t=1	AUTRE_ASTER	6.8416253970115E+05	0.151%
N1 - SIYY - t=1	AUTRE_ASTER	5.7968660741362E+05	0.226%

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N23 - PRE1 - t=10	AUTRE_ASTER	1.9965914222579E+06	0.0012%
N27 - PRE1 - t=10	AUTRE_ASTER	1.9937017653319E+06	0.0023%
N31 - PRE1 - t=10	AUTRE_ASTER	1.9917709562082E+06	0.003%
N1 - PRE1 - t=10	AUTRE_ASTER	1.991092945817E+06	0.0032%
N4 - DY - t=10	AUTRE_ASTER	3.4385071565836E-03	0.002%
N23 - DY - t=10	AUTRE_ASTER	2.5771817886894E-03	0.0025%
N27 - DY - t=10	AUTRE_ASTER	1.7172304114012E-03	0.0029%
N31 - DY - t=10	AUTRE_ASTER	8.5833064233171E-04	0.0031%
N4 - SIYY - t=10	AUTRE_ASTER	2.00000E+06	1E-13%
N23 SIYY - t=10	AUTRE_ASTER	1.9965914222579E+06	0.0012%
N27 - SIYY - t=10	AUTRE_ASTER	1.9937017653319E+06	0.0023%
N31 - SIYY - t=10	AUTRE_ASTER	1.9917709562082E+06	0.003%
N1 - SIYY - t=10	AUTRE_ASTER	1.991092945817E+06	0.0032%

6 Modelization D

6.1 Characteristic of the modelization

One uses modelizations D_PLAN_HS for the hydraulics and D_PLAN_SI for the mechanics.

6.2 Characteristics of the mesh

The mesh is identical to that of modelization A.

Nombre of nodes: 83

Number of meshes and types: 16 meshes QUAD8

the meshes mechanical and hydraulic are identical.

6.3 Quantities tested and results

the quantities tested are identical to those of the modelization B.

Standard	Identification of reference	Reference	Error
N23 - PRE1 - t=1	AUTRE_ASTER	1.4477057505633E+06	0.0495%
N27 - PRE1 - t=1	AUTRE_ASTER	9.8618261792096E+05	0.294%
N31 - PRE1 - t=1	AUTRE_ASTER	6.8416253970115E+05	0.850%
N1 - PRE1 - t=1	AUTRE_ASTER	5.7968660741362E+05	1.24%
N4 - DY - t=1	AUTRE_ASTER	1.8807606329922E-03	0.299%
N23 - DY - t=1	AUTRE_ASTER	1.139326750168E-03	0.483%
N27 - DY - t=1	AUTRE_ASTER	6.19182033214E-04	0.772%
N31 - DY - t=1	AUTRE_ASTER	2.6539252530741E-04	1.09%
N4 SIYY - t=1	AUTRE_ASTER	2.00000E+06	1.0E-08%
N23 - SIYY - t=1	AUTRE_ASTER	1.4477057505633E+06	0.0495%
N27 - SIYY - t=1	AUTRE_ASTER	9.8618261792096E+05	0.294%
N31 - SIYY - t=1	AUTRE_ASTER	6.8416253970115E+05	0.850%
N1 - SIYY - t=1	AUTRE_ASTER	5.7968660741362E+05	1.24%
N23 - PRE1 - t=10	AUTRE_ASTER	1.9965914222579E+06	0.0202%
N27 - PRE1 - t=10	AUTRE_ASTER	1.9937017653319E+06	0.0373%
N31 - PRE1 - t=10	AUTRE_ASTER	1.9917709562082E+06	0.0488%
N1 - PRE1 - t=10	AUTRE_ASTER	1.991092945817E+06	0.0528%
N4 - DY - t=10	AUTRE_ASTER	3.4385071565836E-03	0.0335%
N23 - DY - t=10	AUTRE_ASTER	2.5771817886894E-03	0.0414%
N27 - DY - t=10	AUTRE_ASTER	1.7172304114012E-03	0.0475%
N31 - DY - t=10	AUTRE_ASTER	8.5833064233171E-04	0.0514%
N4 - SIYY - t=10	AUTRE_ASTER	2.00000E+06	9.31E-14%
N23 SIYY - t=10	AUTRE_ASTER	1.9965914222579E+06	0.0202%

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N27 - SIYY - $t=10$	AUTRE_ASTER	1.9937017653319E+06	0.0373%
N3I - SIYY - $t=10$	AUTRE_ASTER	1.9917709562082E+06	0.0488%
NI - SIYY - $t=10$	AUTRE_ASTER	1.991092945817E+06	0.0528%

7 Summary of the results

the values provided by *Code_Aster* are in perfect agreement with values of reference.