

## WTNV125 – capillary Calculation of rebalancing of bi--materials

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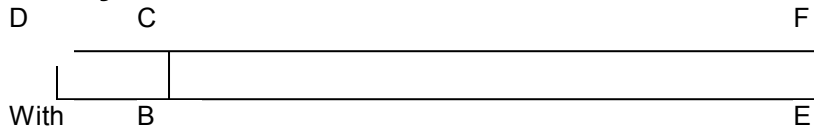
### Summary:

This case test corresponds under investigation hydraulic simplified of a slice of ground in a site of storage. Two materials are considered: a worked barrier ( *BO* ) and a geological barrier ( *BG* ). Initially *BO* is désaturée and *BG* saturated. One studies here the capillary rebalancing of the unit (what corresponds to the resaturation of the barrier worked by the geological barrier).

This CAS-test is similar to the case wtna100 (in axisymmetric version).

## 1 Problem of reference

### 1.1 Geometry



Coordinates of the points (  $m$  ) :

Not	$X$	$Y$
$A$	0.425	-10
$B$	1.1225	-10
$C$	1.1225	0
$D$	0.425	0
$E$	10	-10
$F$	10	0

The part delimited by  $ABCD$  will be called  $BO$  and the part  $BEFC$ ,  $BG$ .  
For the version 3D of the test wtnv125 the geometry is extruded a thickness of  $5,181 m$ .

### 1.2 Properties of material

The properties of material are presented in the table below.

Liquid water	Density ( $kg.m^{-3}$ )	$10^3$
	Heat with constant pressure ( $J.K^{-1}$ )	4180
	Thermal dilation coefficient of the liquid ( $K^{-1}$ )	$10^{-4}$
	Dynamic viscosity of liquid water ( $Pa.s$ )	$10^{-3}$
Gas	Specific heat ( $J.K^{-1}$ )	1000
	Molar mass ( $kg.mol^{-1}$ )	0.02896
		$1.8. 10^{-5}$
Solid ( $BO$ )	Density ( $kg.m^{-3}$ )	2670
	Drained Young modulus $E$ ( $Pa$ )	$1,9.10^{20}$
	Poisson's ratio	0.2
Initial state ( $BO$ )	Porosity	0.35
	Temperature ( $K$ )	293
	Gas pressure ( $Pa$ )	1E5
	Steam pressure ( $Pa$ )	2320
	Initial capillary pressure ( $Pa$ )	$5.10^7$ ( $S=0,57$ )

Homogenized coefficients (BO)	Homogenized density ( $kg.m^{-3}$ ) Saturation Intrinsic permeability ( $m^2$ ) Permeability relating to the liquid Permeability relating to gas Specific heat ( $J.K^{-1}$ ) Biot Conductivities thermics	2670 $S(P_c)=0.99(1-6.10^{-9}P_c)$ $10^{-20}$ $kr_w(S)=S$ $kr_{gz}(S)=1-S$ 482 1 $\lambda_S^T(S)=0.35 \cdot S$ $\lambda_T^T(S)=0.6$ $\lambda_{CT}^T(S)=0.728$
Solid (BG)	Density ( $kg.m^{-3}$ ) Drained Young modulus $E$ ( $Pa$ ) Poisson's ratio	2670 $1,9 \cdot 10^{20}$ 0.2
Initial state (BG)	Porosity Temperature ( $K$ ) Gas pressure ( $Pa$ ) Steam pressure ( $Pa$ ) Initial capillary pressure ( $Pa$ )	0,05 293 1E5 2320 $7 \cdot 10^7$ ( $S=0,81$ )
Homogenized coefficients (BG)	Homogenized density ( $kg.m^{-3}$ ) Saturation Intrinsic permeability ( $m^2$ ) Permeability relating to the liquid Permeability relating to gas Specific heat ( $J.K^{-1}$ ) Biot Thermal conductivity	2670 $S(P_c)=0.99(1-6.10^{-9}P_c)$ $10^{-19}$ $kr_w(S)=S$ $kr_{gz}(S)=1-S$ 706 1 $\lambda_S^T(S)=0.05 \cdot S$ $\lambda_T^T(S)=0.6$ $\lambda_{CT}^T(S)=1.539$

## 1.3 Boundary conditions and loadings

On all the edges: Hydraulic flow no one

The only engine is here the saturation of a medium by another.

## 2 Modeling A

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### 2.1 Characteristics of modeling A

Modeling in axi-symmetry. The worked barrier is with a grid by 15 elements HEXA20 and the geological barrier by 59 elements HEXA20, distributed gradually over the entire length.

It is here about a modeling 3D\_HHD.

### 2.2 Sizes tested and results

N° of node	Coordinate	<i>PREI</i> <i>t = 1,E+06 s</i>	<i>PREI</i> <i>t = 1,E+07 s</i>	<i>PREI</i> <i>t = 1,E+08 s</i>	<i>PREI</i> <i>t = 1,E+09 s</i>
203	1.285	3,76E+007	4,57E+007	4,69E+007	4,51E+007
166	1.118	6,72E+007	5,36E+007	4,75E+007	4,51E+007

## 3 Modeling B

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### 3.1 Characteristics of modeling B

It is the same modeling as for modeling A, but into selective: 3D\_HHS.

### 3.2 Sizes tested and results

N° of node	Coordinate	<i>PREI</i> <i>t = 1,E+06 s</i>	<i>PREI</i> <i>t = 1,E+07 s</i>	<i>PREI</i> <i>t = 1,E+08 s</i>	<i>PREI</i> <i>t = 1,E+09 s</i>
203	1.285	3,76E+007	4,57E+007	4,69E+007	4,51E+007
166	1.118	6,72E+007	5,36E+007	4,75E+007	4,51E+007

## 4 Summary of the results

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The results are in the whole in conformity so that one waits.