ZZZZ237 – Elementary validation of `LIAISON_UNIL` and `Summarized`

TOLE_APPA:

This test is an analytical test and of NON-regression. The analytical tests are made on displacements only. These tests are supplemented of NON-regression on the values of the nodal forces. The purpose is to validate the following features of operator `DEFI_CONTACT` :

- the exclusion of nodes by `TOLE_APPA` in discrete formulation and continues
- the condition of unilateral connection `LIAISON_UNIL` applied to displacements

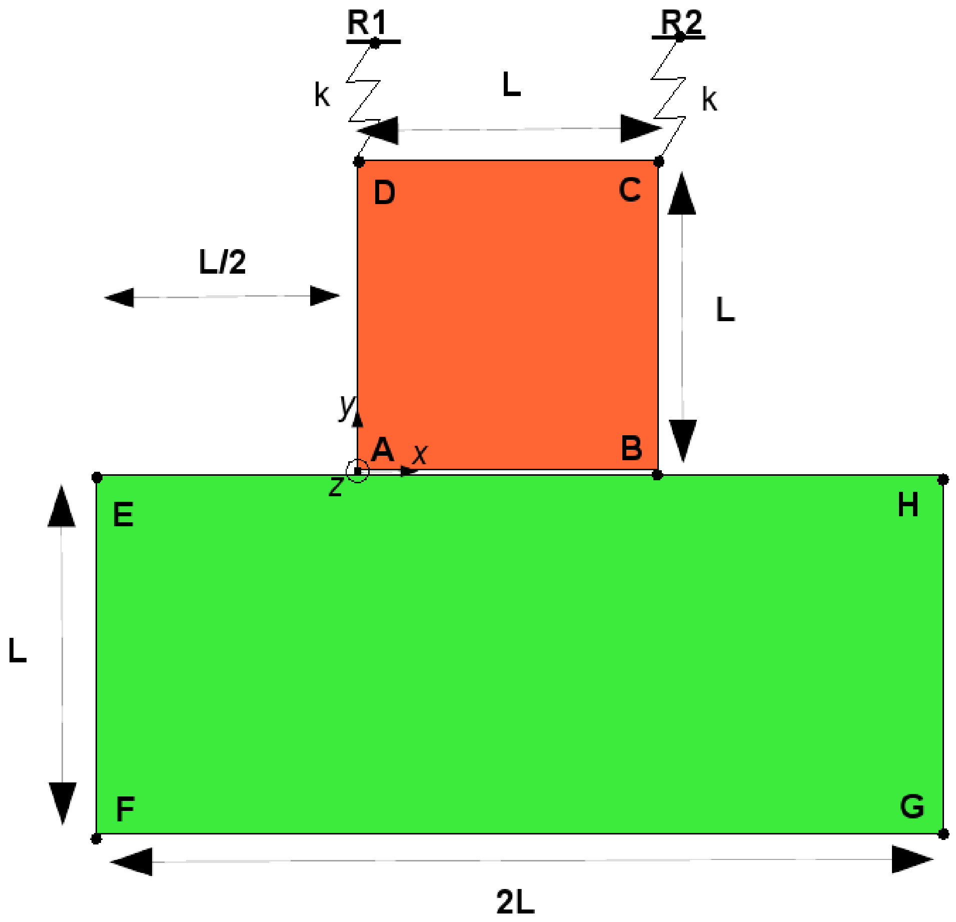
Modelization a:

- Computation of contact of reference of “ `FORCED” method`, validation of `TOLE_APPA`

Modelization b:

- Validation of `LIAISON_UNIL` per comparison with the results of the modelization A

1 Problem of Coordinated



1.1 reference

Geometry:

The geometry is presented above.

The reference is centered coordinated A into cubes $(0,0)$.

$L=50\,m$

Mesh group:

- surfaces $ABCD$, $EFGH$
- segments AB, HE

1.2 Properties of the material

$EFGH$: $E_1=2{,}0.10^{16}\,\text{Pa}$

$ABCD$: $E_2=2{,}0.10^{9}\,\text{Pa}$

$ABCD$ / $EFGH$: $\nu=0{,}3$

Springs: stiffness k in x and y, $k=10\,\text{N.m}^{-1}$

1.3 Boundary conditions and loading

$EFGH$:

- clamped FG side ($DX = DY = 0$)
- side HE condition of contact

$ABCD$:

- displacement imposed on side CD ($DY = -1,0$)
- side AB condition of contact

Springs:

- fixed support of the points $R1$ and $R2$

2 Reference solution

2.1 Variables reference

the reference variables used are displacements DX and DY of the points A and B the nodal forces DY of these same points.

For the nodal forces and the displacements according to DX, in fact the results of the modelization A are used as reference for the modelization B.
This modelization leans on the use of a condition of contact

2.2 Results of reference

With $E^1 \gg E^2$, $EFGH$ can be regarded as rigid and thus displacements following DY of the points A and B are null. This reference is analytical.

The other results tested are:

Displacements with point: A

- $DX = -4.28571\,\mathrm{m}$
- $DY = 0\,\mathrm{m}$

Displacements with point: B

- $DX = +4.28571\,\mathrm{m}$
- $DY = 0\,\mathrm{m}$

Nodal forces at the points A and B :

- $DY = +2.19780\,.\,10^{10}\,N$

3 Modelization A

3.1 Characteristic of the modelization A

Square $ABCD$: Modelization D_PLAN :

Many nodes: 4
Number of meshes: 1

Square $EFGH$: Modelization D_PLAN :

Many nodes: 4
Number of meshes: 1

the rigid body motion of the following $ABCD$ square DX is blocked by the discrete ones.

3.2 Results

Component	Localization	Quantity	Reference
DEPL	A	DY	0.
DEPL	A	DX	-4.28571
DEPL	B	DY	0.
DEPL	B	DX	+4.28571
FORC_NODA	A	DY	2.1978E+10
FORC_NODA	B	DY	2.1978E+10

4 Modelization B

4.1 Characteristic of the modelization B

In this modelization which aims at testing the application of a unilateral condition on displacements, one models only the square $ABCD$: modelization D_PLAN
Many nodes: 4
Number of meshes: 1

the rigid body motion of the following $ABCD$ square DX is blocked by the discrete ones.

4.2 Results

Component	Localization	Quantity	Reference
DEPL	A	DY	0.
DEPL	A	DX	-4.28571
DEPL	B	DY	0.
DEPL	B	DX	+4.28571
FORC_NODA	A	DY	2.1978E+10
FORC_NODA	B	DY	2.1978E+10

5 Summary of the results

This benchmark makes it possible to validate the good taking into account of unilateral conditions on displacements by validation compared to a computation of contact.