ZZZZ237 – Elementary validation of LIAISON_UNIL and TOLE_APPA

Summary:

This test is an analytical test and of not-regression. The analytical tests are made on displacements only. These tests are supplemented of not-regression on the values of the nodal forces. The objective is to validate the following features of the operator DEFI_CONTACT :

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

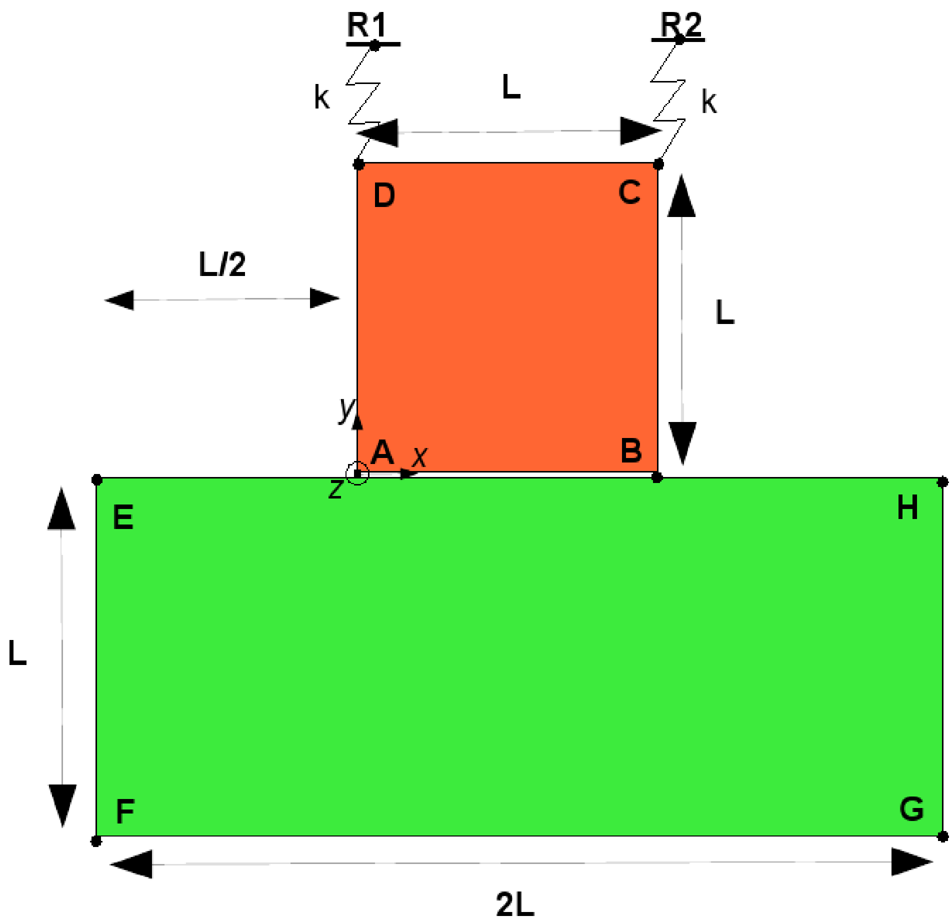
Modeling a:

- Calculation of contact of reference of method 'FORCED', validation of TOLE_APPA

Modeling b:

- Validation of LIAISON_UNIL by comparison with the results of modeling A

1 Problem of reference



1.1 Geometry

Coordinates:

The geometry is presented above.

The reference mark is centered in A coordinates $(0,0)$.

$L=50\,m$

Group of meshs:

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

1.2 Properties of material

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

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

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

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

1.3 Boundary conditions and loading

$EFGH$:

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

$ABCD$:

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

Springs:

- embedding of the points $R1$ and $R2$

2 Reference solution

2.1 Reference variables

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

For the nodal forces and displacements according to DX, in fact the results of modeling A are used as reference for modeling B.
This modeling is based 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 according to DY points A and B are worthless. This reference is analytical.

The other results tested are:

Displacements at the point A :

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

Displacements at the 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 Modeling A

3.1 Characteristics of modeling A

Square $ABCD$: Modeling D_PLAN :

Many nodes: 4
Many meshs: 1

Square $EFGH$: Modeling D_PLAN :

Many nodes: 4
Many meshs: 1

The rigid movement of body of the square $ABCD$ according to DX is blocked by the discrete ones.

3.2 Results

Quantity	Localization	Component	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 Modeling B

4.1 Characteristics of modeling B

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

The rigid movement of body of the square $ABCD$ according to DX is blocked by the discrete ones.

4.2 Results

Quantity	Localization	Component	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 CAS-test makes it possible to validate the good taking into account of unilateral conditions on displacements by validation compared to a calculation of contact.