ZZZZ127 - Validation of key word LIAISON_MAIL

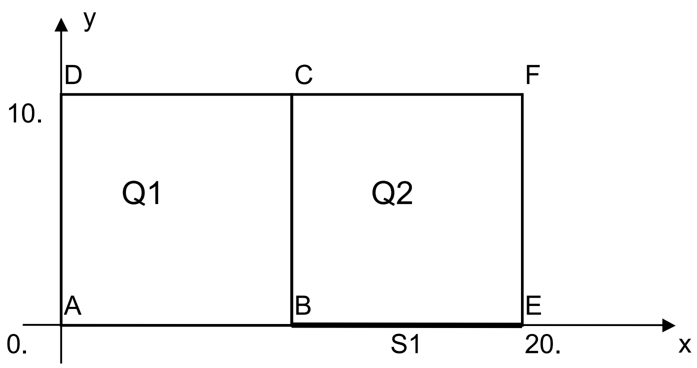
Summarized:

This test validates key word LIAISON_MAIL of commands AFFE_CHAR_MECA and AFFE_CHAR_THER. This key word generates the linear relations between the degrees of freedom of the nodes of 2 edges which one puts in opposite. The programming is validated in 2D and 3D by intercomparison with a similar Aster computation where the relations between degrees of freedom directly entered by key word LIAISON_DDL. One also validates the geometrical transformation (rotation/translation) applied to the one of edges.

1 Problem of reference

1.1 Geometry

with the dealt problem is plane. The studied structure is 1 rectangle cut out in 2 squares $ABCD$ and $BEFC$.
The solution is established with a network using 2 QUAD4 corresponding to the 2 squares.



1.2 Properties of the elastic

material material:

$E=10.0$ units S.I
$\nu=0.0$

formula $\nu=0.0$ so that one can 3D deal with this plane problem with a layer of elements by having the plane solution.

1.3 Boundary conditions and loadings

1) One applies a specific force to point: F $FY=4.0$ u.s.i. 2) Blockings

: point:
point: A $DX=DY=0.$
3 D) linear $DX=0.$

Relations between degrees of freedom: loading case

: cas1 loading case
$1.0\,DX(E)-0.5\,DY(D)-0.5\,DY(C)=0.0$
$1.0\,DY(E)+0.5\,DX(D)+0.5\,DX(C)=0.0$

: cas2
$1.0\,DY(E)+0.5\,DY(D)+0.5\,DY(C)=0.0$
$1.0\,DY(B)+0.5\,DY(C)+0.5\,DY(F)=0.0$

the initial conditions are of no importance here. Reference solution

2 Méthodede calcul

2.1 used for the reference solution In

each case, one carries out a preliminary computation with key word LIAISON_DDL to introduce the linear relations between degrees of freedom. This computation is used as reference to computation with the key word LIAISON_MAIL `which` generates these linear relations.

To obtain the desired linear relations with LIAISON_MAIL , `one` writes: Cas1

: LIAISON_MAIL

```
: (NOEUD_2    : E MAILLE_1         : Q1 CENTER
                  : BANGL_NAUT            : 90.TRAN:    (-5. 0.)   ) What
```

wants to say that one eliminates the 2 degrees of freedom from the node according to E the degrees of freedom of the point obtained E' when one subjects to E a rotation of 90 degrees around then B a translation of vector (– 5,0). is E' thus in the middle of. CD The vector displacement of E is identified (after rotation of 90 degrees) with that of. E' The 2 equations are thus obtained: DX (E

```
) = DY (E   ") = 0.5  DY (C) + 0.5 DY (D) DY (E
) = - DX (E") = -0.5 DX (C) - 0.5 DX (D) Cas2
```

: LIAISON_MAIL

```
: (MAILLE_2   : S1 MAILLE_1        : (Q1, Q2) DDL_2
                  : "DNOR" DDL_1       : "DNOR" CENTER
                  : BANGL_NAUT            : 180.TRAN:   (+5. +10.   )) What
```

wants to say that one eliminates normal displacement from the nodes and B (nodes E of the segment) according to $S1$ the degrees of freedom from the points and B' obtained E' when one subjects to and B E a rotation from 180 degrees around then B a translation from vector. is $(+5,+10)$ B' thus in the middle of and CF in the middle of E' . DC The normal displacement of B is identified (after rotation of 180 degrees) with that of. One B' makes in the same way for. B' The 2 equations then are obtained: Results

$$DY(E)=-DY(E')=-0.5\,DY(C)-0.5\,DY(D)$$
$$DY(B)=-DY(B')=-0.5\,DY(C)-0.5\,DY(F)$$

2.2 of reference One observes

the displacement of point: DY case F 1

: cas2 $DY(F)=1.4153582447720\mathrm{D}+00$
: These $DY(F)=1.0561898652983\mathrm{D}+00$

displacements are obtained with linear relations enter degrees of freedom introduced by key word LIAISON_DDL . `Uncertainties`

2.3 on the solution No

uncertainty. Modelization

3 A Characteristic

3.1 of the modelization the problem

is solved with modelization D_PLAN . `Characteristics`

3.2 of the mesh The mesh

is made of: 2 QUAD4

: = and $Q1$ $ABCD$ = 1 $Q2$ SEG2 $BEFC$
: = Quantities $S1$ BE

3.3 tested and results Identification

Reference	cas1
: 1.4153582447720 $DY(F)$	D+00 cas2
: 1.0561898652983 $DY(F)$	D+00 Modelization

4 B Characteristic

4.1 of the modelization the problem

is solved with the modelization 3D. `Characteristics`

4.2 of the mesh The mesh

is made of: 2 HEXA

8: and $Q1$ 1 QUAD4 $Q2$
: Functionalities $S1$

4.3 tested

the same ones as for the modelization A but in 3D. Quantities

4.4 tested and results Identification

Reference	cas1
: 1.4153582447720 $DY(F)$	D+00 cas2
: 1.0561898652983 $DY(F)$	D+00 Summary

5 of the results

the numerical results, displacement in a point, are rigorously identical between two Aster computations *, with* key word LIAISON_MAIL , or key word LIAISON_DDL .