ZZZZ358 – Validation of the keyword `MODELE_THER` of the operator `MODI_MODELE_XFEM`

Summary

This test does not have any physical meaning, it acts of a data-processing test. The keyword there is validated `MODELE_THER` of the operator `MODI_MODELE_XFEM` [U4.41.11]. This keyword makes it possible to build a mechanical model enriched “by copy” by an enriched thermal model. It is an alternative to the keyword `CRACK` of the operator `MODI_MODELE_XFEM`, useful only within the framework of thermomechanical calculations chained with X-FEM, which make it possible to ensure that cutting (in subelements and facets) remains strictly identical between the enriched thermal model, and mechanical nouveau riche.

One validates this functionality on 4 possible modelings in mechanics X-FEM:

- modeling a: ‘3D’
- modeling b: ‘C_PLAN’
- modeling C: ‘D_PLAN’
- modeling D: ‘AXIS’
1 Principle of the test

The principle of this test consists in defining, starting from the same grid:

- a thermal model enriched with \texttt{MODI\_MODELE\_XFEM/Crack};
- a mechanical model enriched with \texttt{MODI\_MODELE\_XFEM/Crack}, with the same geometry fissured as for \texttt{modthx};
- a mechanical model enriched with \texttt{MODI\_MODELE\_XFEM/MODELE\_THER}, in "copying" \texttt{modthx}.

Once these 3 models created, one carries out several checks which require the use of python, and the carrying out of the test in \texttt{PAR\_LOT = 'NOT'}. These checks are the following ones.

1. By using the procedure \texttt{IMPR\_CO/NIVEAU=-1 [U4.91.11]}, one makes sure that these 3 models nouveau riches contain all the same number of objects.

2. One makes sure then that the description of each object \texttt{'.CELV' cham_elem contents} in the 3 \texttt{sd\_modele\_xfem} remain identical of a model to the other. This description corresponds to \texttt{NIVEAU=-1 in IMPR\_CO}.
2 Modeling A

It is modeling ‘3D’, in thermics and mechanics.

2.1 Characteristics of the grid

The grid contains all the linear types of meshes being able to support finite elements X-FEM of modeling ‘3D’. The cracks are laid out of such kind that all elements X-FEM of modeling are tested. The grid, as well as the two cracks considered (a circular crack and an interface) are represented with the figure below.

![Figure 2.1-1: grid A and localizations of the cracks](image)

The characteristics of the grid are recapitulated in the table below.

<table>
<thead>
<tr>
<th>SEG2</th>
<th>TRIA3</th>
<th>QUAD4</th>
<th>TETRA4</th>
<th>PENTA6</th>
<th>PYRAM5</th>
<th>HEXA8</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>228</td>
<td>540</td>
<td>1988</td>
<td>918</td>
<td>1000</td>
<td>1700</td>
</tr>
</tbody>
</table>

The grid also contains two orphan nodes, from which two meshes of the type are built POI1 to affect two elements of the type to it MECA_DIS_TR_N.
3  Modeling B

It is modeling ‘C_PLAN’ in mechanics, and modeling ‘PLAN’ in thermics.

3.1  Characteristics of the grid

The grid contains all the linear types of meshes being able to support finite elements X-FEM of modeling ‘C_PLAN’ in mechanics, and modeling ‘PLAN’ in thermics. The cracks are laid out of such kind that all elements X-FEM of modeling are tested. Grid, as well as the 3 cracks considered are represented with the figure below.

![Figure 3.1-1: grid B and localizations of the cracks](image)

The characteristics of the grid are recapitulated in the table below.

<table>
<thead>
<tr>
<th>SEG2</th>
<th>TRIA3</th>
<th>QUAD4</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>324</td>
<td>162</td>
</tr>
</tbody>
</table>

The grid also contains two orphan nodes, from which two meshes of the type are built POI1 to affect two elements of the type to it MECA_2D_DIS_T_N.
4 Modeling C

It is modeling ‘D_PLAN’ in mechanics, and modeling ‘PLAN’ in thermics. One uses here the grid of modeling B.
5 Modeling D

It is modeling ‘AXIS’, in thermics and mechanics. One uses here the grid of modeling B.