ZZZZ298 – Data-processing validation of POST_K1_K2_K3

Summary:

The purpose of this test is to validate in an elementary way the operator POST_K1_K2_K3. This test does not have physical meaning inevitably, it is primarily a data-processing test.

Modeling a:
- Modeling: crack with a grid (FEM)
- Resolution of a linear elastic mechanical problem

Modeling b:
- Modeling: crack not-with a grid (X-FEM)
- Resolution of a linear elastic mechanical problem

Modeling C:
- Modeling: crack with a grid (FEM)
- Resolution of a problem of modal analysis

Although this test is of data-processing nature and that one can be satisfied with a voluntarily brief documentation, certain modelings are more detailed:
- modelings A and B are documented in a complete way,
- modeling C, resulting from CAS-test SDLS114A, is not documented.

1 Problem of reference for modelings A and B

1.1 Geometry

The studied structure is a cube of edge 1 measures comprising a plane crack, being at middle height (see [Figure 1.1-a]). If with the problem is dealt by a classical method (modeling A), the crack is with a grid. On the other hand, if method X-FEM is employed (modeling B), the crack is not with a grid, and the geometry is in fact a healthy cube without crack. The crack will then be introduced by functions of levels (level sets) directly into the file orders using the operator DEFI_FISS_XFEM [U4.82.08].

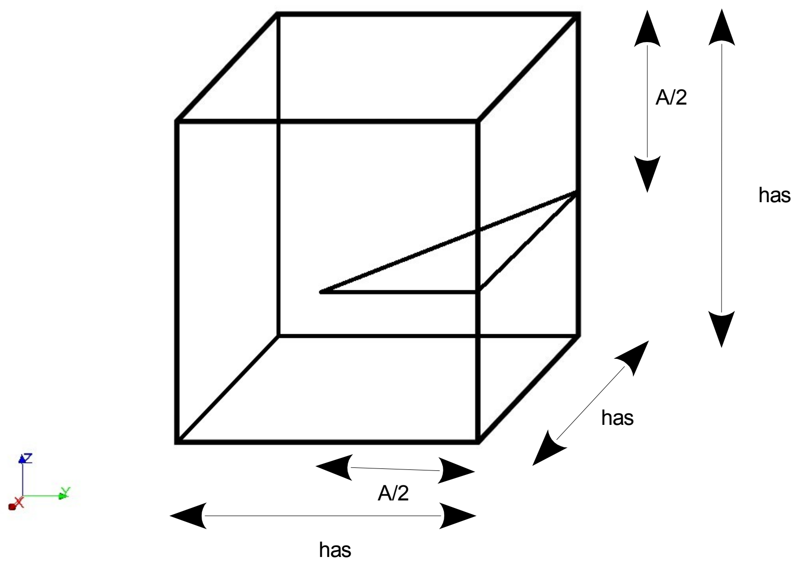

Figure 1.1-a: Geometry of the fissured cube

1.2 Properties materials

The behavior of the structure is elastic and its properties materials are:

Young modulus: $E=205000\,Mpa$
Poisson's ratio: $\nu=0$

1.3 Boundary conditions and loadings

The displacement of the lower face of the structure are blocked whereas a pressure of $1\,MPa$ is applied to the higher face in order to simulate a loading of traction. This makes it possible to request the crack in mode of opening I pure.

2 Modeling a: fissures with a grid

In this modeling, the crack is with a grid, and one uses the standard method of the finite elements to carry out calculation.

2.1 Characteristics of the grid

The structure is modelled by a fissured grid composed of 13874 tetrahedrons (see [Figure 2.1-a]).

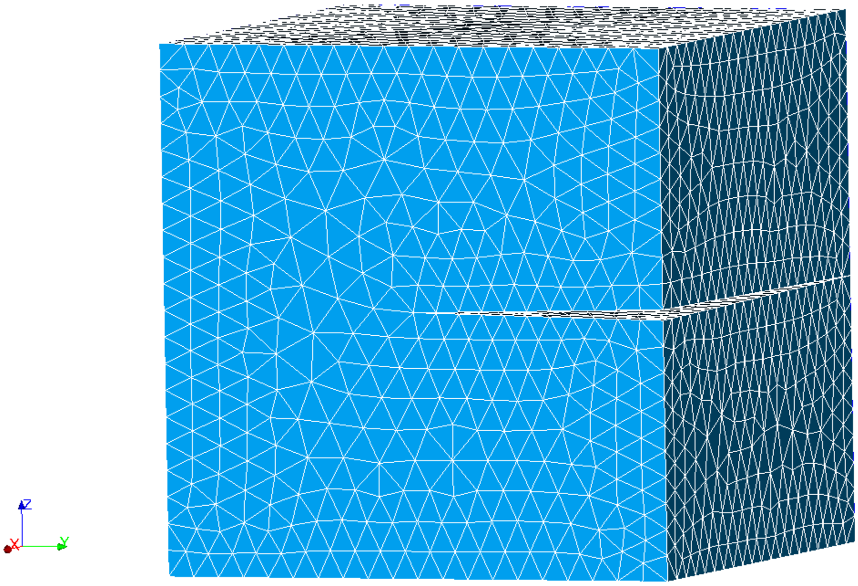

Figure 2.1-a: Fissured grid

2.2 Sizes tested and results

One tests the values of $K1$ on the first two nodes and the three last of the bottom of crack. Indeed, the orientation of the crack implies that $K1$ could not be calculated on certain nodes. We test the nodes concerned to check that Code_Aster their attribute the value of the close node nearest or calculation to $K1$ with been able to be carried out.

Identification	Type of reference	Value of reference
Node 1	'NON_REGRESSION'	7.7933E+05
Node 2	'NON_REGRESSION'	7.7933E+05
Node 22	'NON_REGRESSION'	3.81219E+05
Node 23	'NON_REGRESSION'	3.81219E+05
Node 24	'NON_REGRESSION'	3.81219E+05

3 Modeling b: fissures X-FEM

In this modeling, the crack is not with a grid any more, but it is represented by level sets: $LSN=z-1/2$ and $LST=-y-x/2+1$.

3.1 Characteristics of the grid

The structure is modelled by a grid made up of 15872 tetrahedrons (see [Figure 2.1-a]).

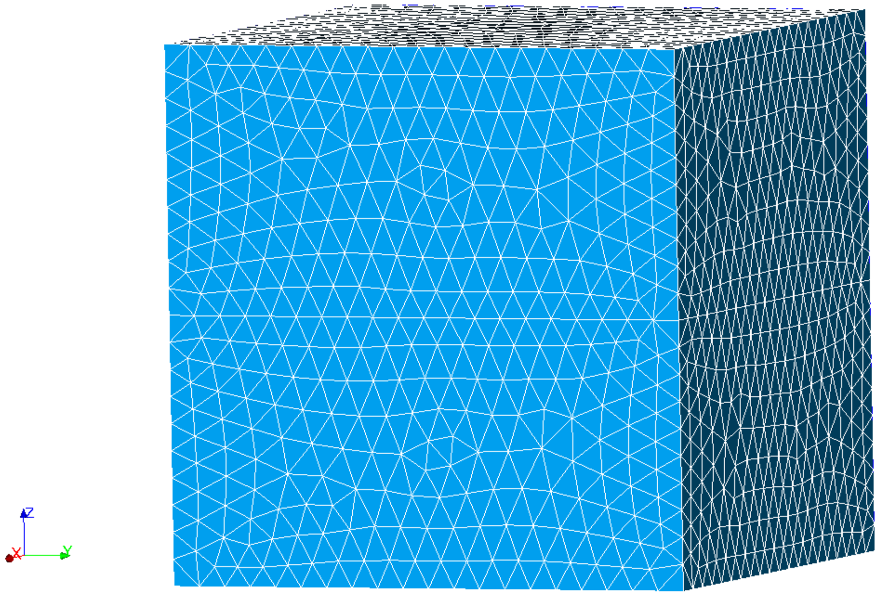

Figure 2.1-a: Healthy grid

3.2 Sizes tested and results

One tests the values of $K1$ on the first three nodes and the two last of the bottom of crack. Indeed, the orientation of the crack implies that $K1$ could not be calculated on certain nodes. We test the nodes concerned to check that *Code_Aster* their attribute the value of the close node nearest or calculation to $K1$ with been able to be carried out.

Identification	Type of reference	Value of reference
Node 1	'NON_REGRESSION'	8.96954e5
Node 2	'NON_REGRESSION'	8.96954e5
Node 3	'NON_REGRESSION'	8.96954e5
Node 23	'NON_REGRESSION'	1.47784e6
Node 24	'NON_REGRESSION'	1.47784e6