

SSLV153 - Indicators of error – voluminal Meshs and functions

Summary:

This case tests the calculation of the indicators of error by residue and in quantity of interest on a very simple grid: 4 voluminal meshes of each one of the possible types, tetrahedron, pentahedron, hexahedron and pyramid. Compared to the other CAS-tests, this one makes it possible to test to it not regression on two features:

- the taking into account of all the types of edges for meshes 3D,
- the loading expressed by functions.

This case is not a validation of the indicators of error. Nevertheless, it can be used as example with their use.

1 Problem of reference

1.1 Geometry

The studied field is a volume with facets, whose only interest is to be an assembly of different meshes. The starting point is a cube on side 100. The face before this cube is the base of a pyramid; the contiguous side face is the base of a pentahedron. Between the pentahedron and the pyramid, one finds a tetrahedron.

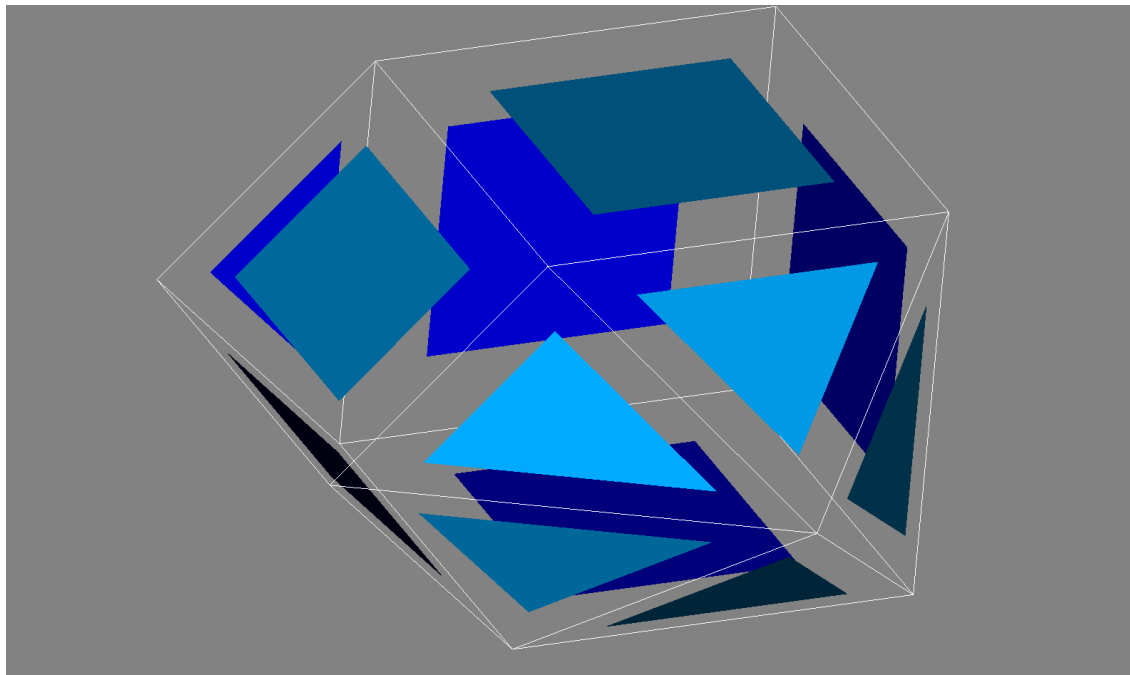


Figure 1.1-1.: Burst sight of the field of calculation

1.2 Properties of material

The material is defined with:

Young modulus = 400 000

Poisson's ratio = 0.3

1.3 Boundary conditions and loadings

The higher face of the block is subjected to a pressure being worth 13,14,15 and 16 respectively, for the higher face of the tetrahedron, the pyramid, the pentahedron and the hexahedron, respectively.

The external triangular face of the pentahedron and the back face of the hexahedron are embedded.

The others external faces are free. One voluntarily imposes a value of worthless normal constraint on it, to ensure a correct calculation of the indicators of error.

2 Reference solution

There does not exist analytical solution.

3 Modeling A

3.1 Characteristics of modeling

Calculation is a resolution in linear mechanics. One calculates then an indicator of error by residue. One then tests the taking into account of the surface terms. The dual calculation which follows is defined to optimize the component DZ field of displacement. For that one modifies the loading by cancelling the external pressures and by adding a voluminal force interns, unit according to Z .

The same calculation is done twice. The first calculation is carried out with loadings expressed in the form of real constants. The second calculation is done with loadings in the form of functions. The results are rigorously identical.

3.2 Characteristics of the grid

The initial grid was created "with the hand", with format MED. It is in degree 1. It placed in degree 2 by the order `MODI_MAILLAGE`.

With each voluminal form a single mesh 3D corresponds. The hexahedron is in contact on one of its faces with the pentahedron and on a close face with the pyramid. The tetrahedron is between the pentahedron and the pyramid. Thus, each voluminal mesh is in contact with two other meshes of the different type, on the one hand, and with outside, on the other hand. The only contact not represented is that between the pentahedron and the pyramid. The meshes 2D bordering the field all are created.

Many nodes:	11
Many TRIA6:	6
Many QUAD8:	6
Many TETRA10:	1
Many PENTA15:	1
Many PYRAM13:	1
Many HEXA20:	1

The groups are defined to be able to apply material and the loadings and to carry out the final test.

<i>MESURE</i>	The node common to all the meshes 3D.
<i>VOLUME</i>	4 voluminal meshes.
<i>CHARHEXA</i>	The higher face of the hexahedron.
<i>CHARPENT</i>	The higher face of the pentahedron.
<i>CHARPYRA</i>	The higher face of the pyramid.
<i>CHARTETR</i>	The higher face of the tetrahedron.
<i>MURHEXA</i>	The face postpones hexahedron.
<i>MURPENT</i>	The face postpones pentahedron.
<i>LIBRE2</i>	The face of the hexahedron opposed to the pentahedron.
<i>LIBRE</i>	5 others faces of edge.

3.3 Sizes tested and results

Nonthe regression is tested on the top common to all the meshes.

Field	Component	Value
DEPL	DZ	-0.0186729786
Primal ERME_NOEU	ERREST	9358.16222031
Dual ERME_NOEU	ERREST	39919.0267977
QIRE_NOEU	ERREST	-4623.29451753

Table 3.3-1.: Values of reference

4 Summary of the results

It was checked that the results were the same ones as the loadings are defined by real constants or functions.