SSLV153 - Error indicators – Meshes voluminal and functions

Summarized:

This case tests the computation of the error indicators by residue and in quantity of interest on a very simple mesh: 4 meshes voluminal of each one of the possible types, tetrahedron, pentahedron, hexahedron and pyramid. Compared to the other benchmarks, this one makes it possible to test the non regression one 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 error indicators. 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 meshes different. 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.

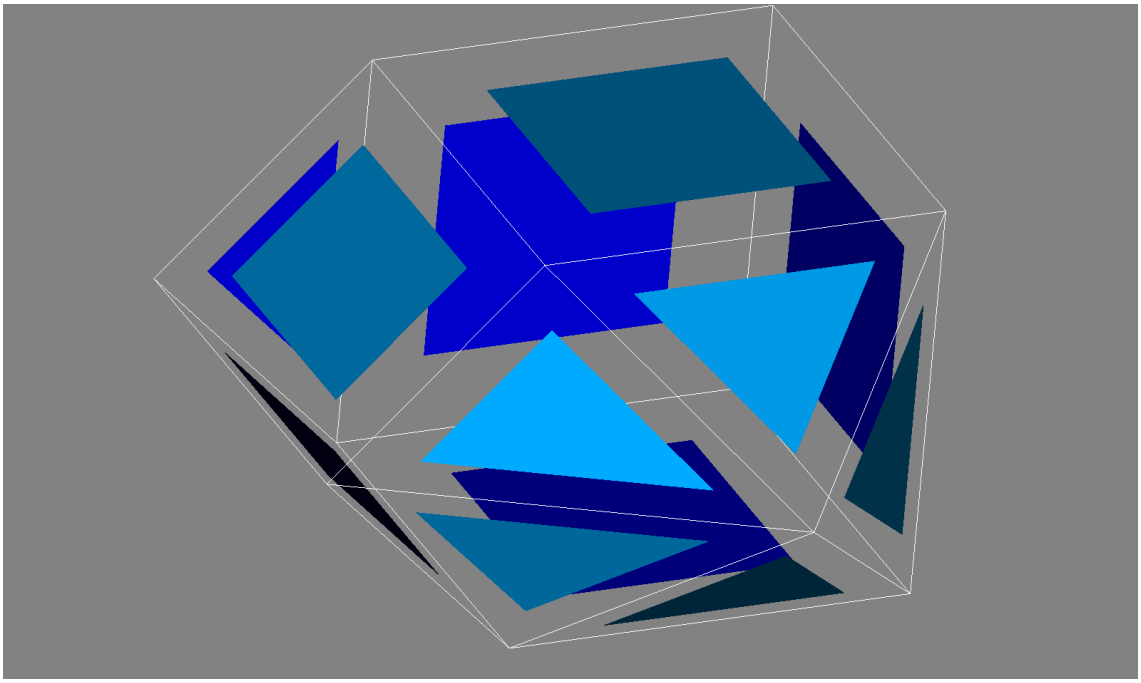

Figure 1.1-1.: Burst sight of the field of computation

1.2 Properties of the material

the material is defined with:

Young's modulus $=400\,000$
Poisson's ratio $=0.3$

1.3 Boundary conditions and loadings

the upper face of the block is subjected to a pressure being worth 13,14,15 and 16 respectively, for the upper 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 clamped.

The other external sides are free. One voluntarily imposes a value of normal stress on it null, to ensure a correct computation of the error indicators.

2 Reference solution

It does not exist of solution analytical.

3 Modelization A

3.1 Characteristic of the modelization

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

The same calculation is done twice. The first computation 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 mesh

The mesh initial was created “with the hand”, with med format. It is in degree 1. It passed in degree 2 by the command MODI_MAILLAGE.

A each voluminal form corresponds a single mesh 3D. The hexahedron is in contact on one of its sides 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 others meshes of 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. 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 the material and the loadings and to carry out the final test.

MESURE	The node common to all meshes 3D.
VOLUME	4 the meshes voluminal ones.
CHARHEXA	The upper face of the hexahedron.
CHARPENT	The upper face of the pentahedron.
CHARPYRA	The upper face of the pyramid.
CHARTETR	The upper face of the tetrahedron.
MURHEXA	The face postpones hexahedron.
MURPENT	The face postpones pentahedron.
LIBRE2	The face of the hexahedron opposed to the pentahedron.
LIBRE	5 other edge sides.

3.3 Quantities tested and results

the non regression one is tested on the top common to all meshes.

Dual	field	Component
Value	DEPL	DZ
-0,0186729786 ERME_NOEU	primal	ERREST
9358,16222031 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.