Comparison of tetrahedral and hexahedral GMSH mesh in Abaqus

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August 14, 2020

1 Mesh configuration

For the comparison of different meshes, two meshes have been created, one with tetrahedrons and one with hexahedrons. Both should roughly have the same amount of elements. The geometry is a squared block with length $l = 1000\ mm$ with a spherical inclusion with radius $r = 300\ mm$ on the origin. The following options has been used to generate the tetrahedral and hexahedral mesh:

option	tetrahedral	hexahedral
mesh algo.	Delaunay	frontal-Delaunay for Quads
mesh algo. 3D	Delaunay	Delaunay
subdivisoin algo.	none	all hexahedra
recombination algo.	blossom	blossom

2 Simulation configuration

The simulation case is fixing one surface completely and the opposite surface in two directions, the load, is configured by displacing the opposite surface by 100 mm downwards.
The following configuration has been choosen:

- $-x-$Surface is fixed in all directions and motions.
- $+x-$Surface is fixed in $x-$ and $z-$direction
- $+x-$Surface is displaced in negative $y-$direction with a value of 100 mm

Apart from that, the materials in the box as well as in the inclusion are the same.

3 Results

The loadcase results in the following deformation (see figure 1). In figures 2, 3 and 4 the stress results are compared:

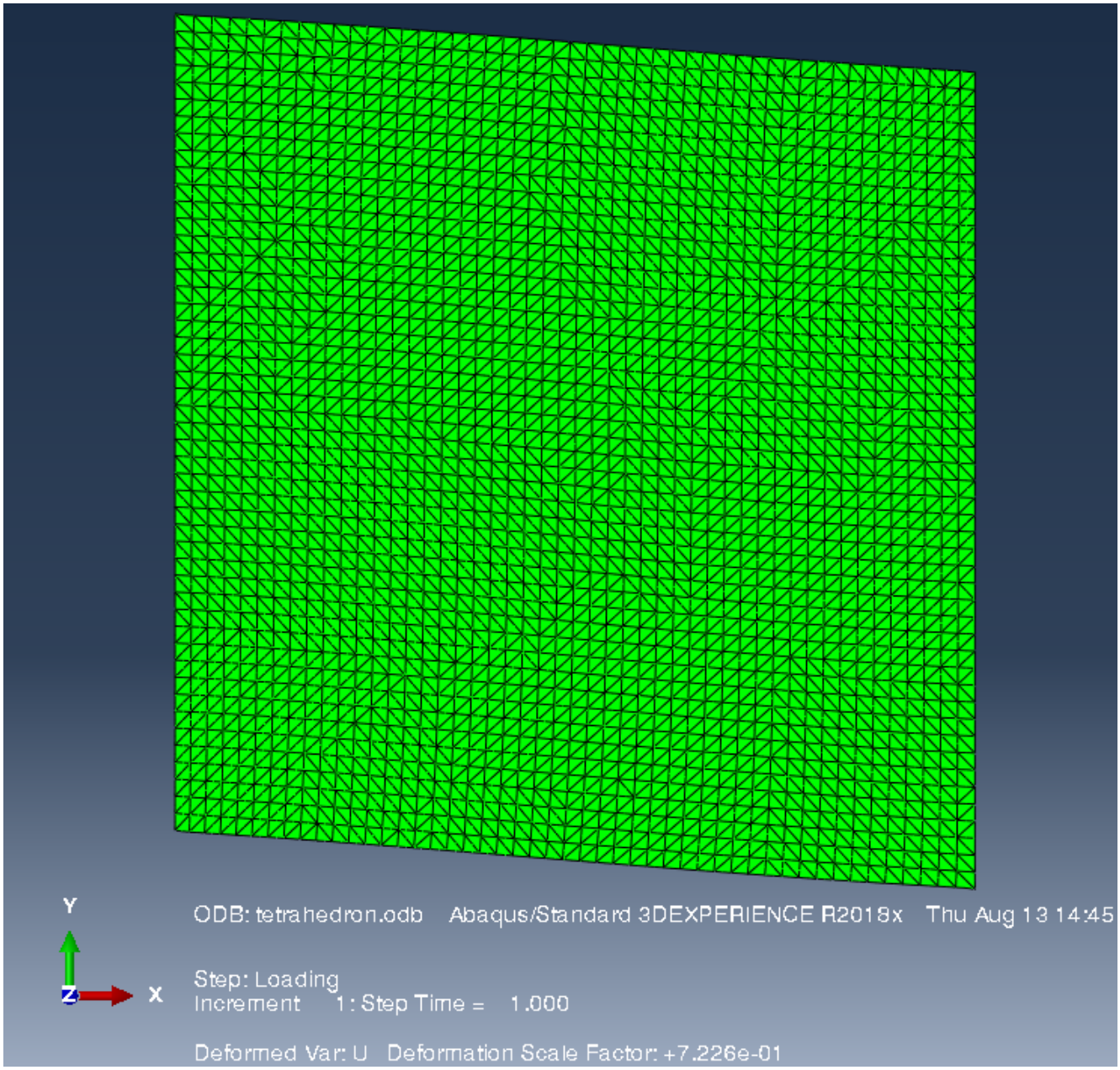
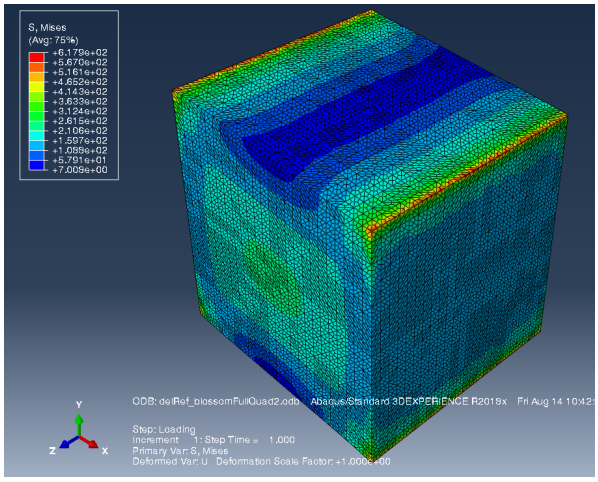
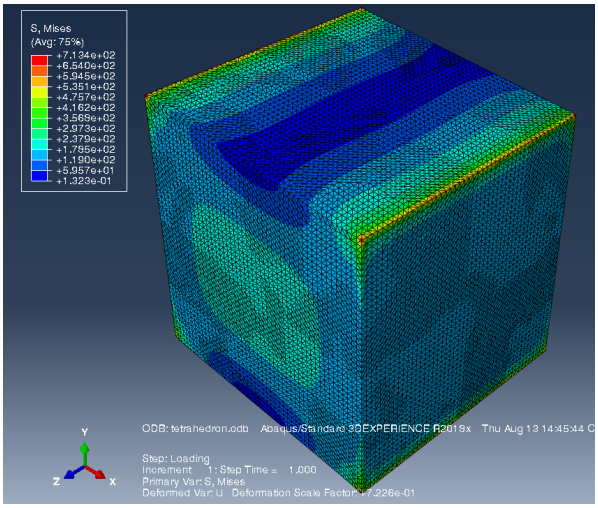


Figure 1: Deformation of the body in the x-y-plane

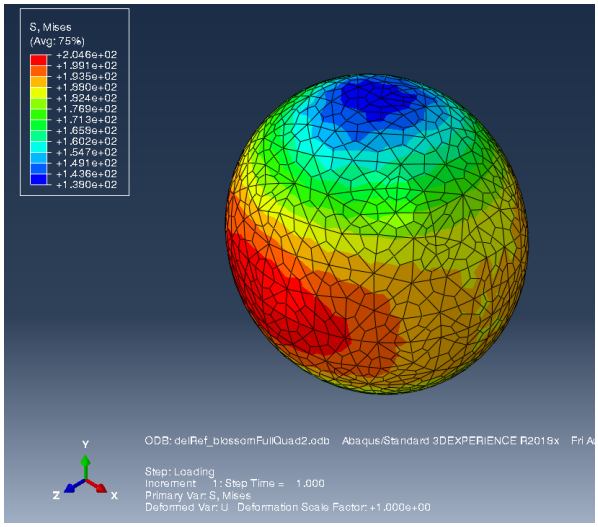


(a) Hexahedral mesh of RVE

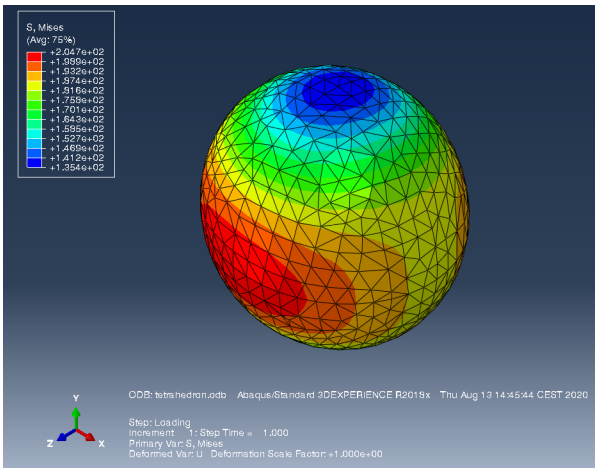


(b) Tetrahedral mesh of RVE

Figure 2: Stress result on RVE

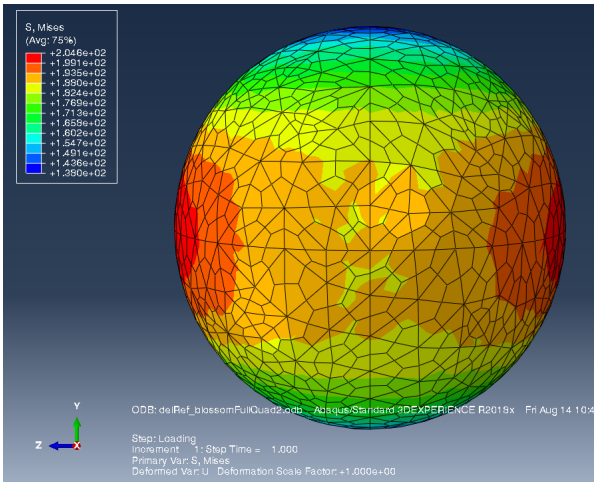


(a) Hexahedral mesh of RVE

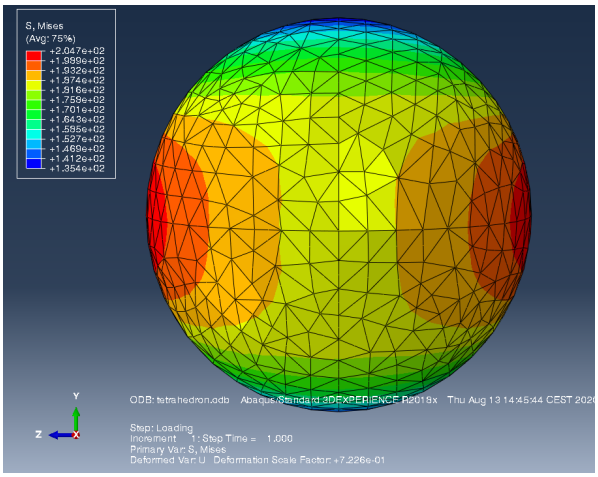


(b) Tetrahedral mesh of RVE

Figure 3: Stress result on inclusion



(a) Hexahedral mesh of inclusion



(b) Tetrahedral mesh of inclusion

Figure 4: Critical view of inclusion