

Results of RVE with cubical Inclusion

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1 Mesh configuration

For the analysis of the problem with a cube (RVE) fixed on one side and displaced on the opposite one by -100 mm in y -direction, a cubical inclusion has been chosen. The RVE is a squared block with length $l_{rve} = 1000\text{ mm}$ with a cubical inclusion with length $l_{inc} = 480\text{ mm}$ on the origin. The following options has been used to generate the hexahedral mesh:

option	hexahedral
mesh algo.	frontal-Delaunay for Quads
mesh algo. 3D	Delaunay
subdivision algo.	all hexahedra
recombination algo.	blossom

The mesh has been configured to have 40 elements along the RVE length and 60 elements along the inclusion length. The mesh has about 350k elements.

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 chosen:

- $-x$ -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, namely epoxy.

3 Results

3.1 Result on the RVE with hexahedral mesh

The loadcase results are in the following figures.

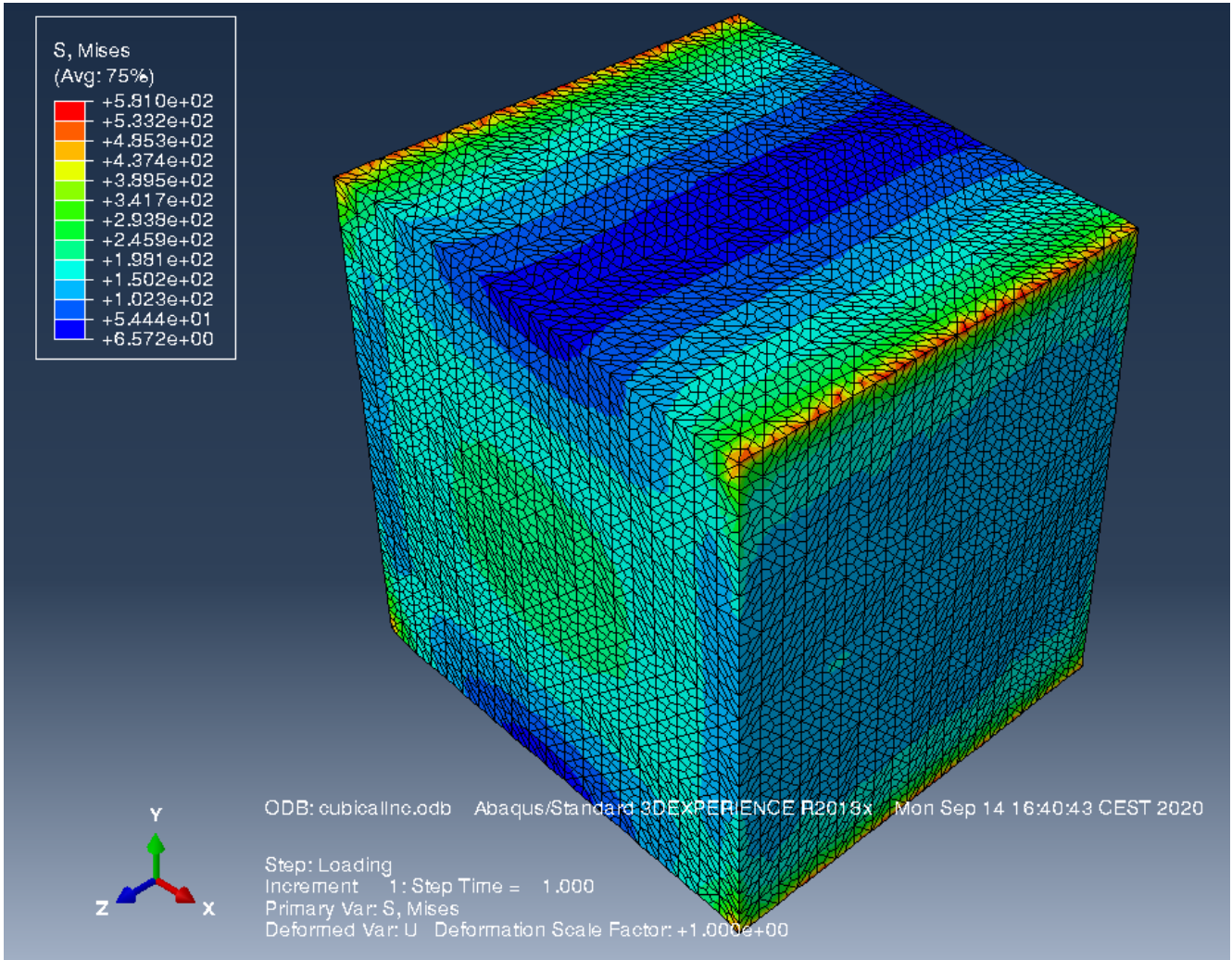


Figure 1: Mises stress result on the RVE

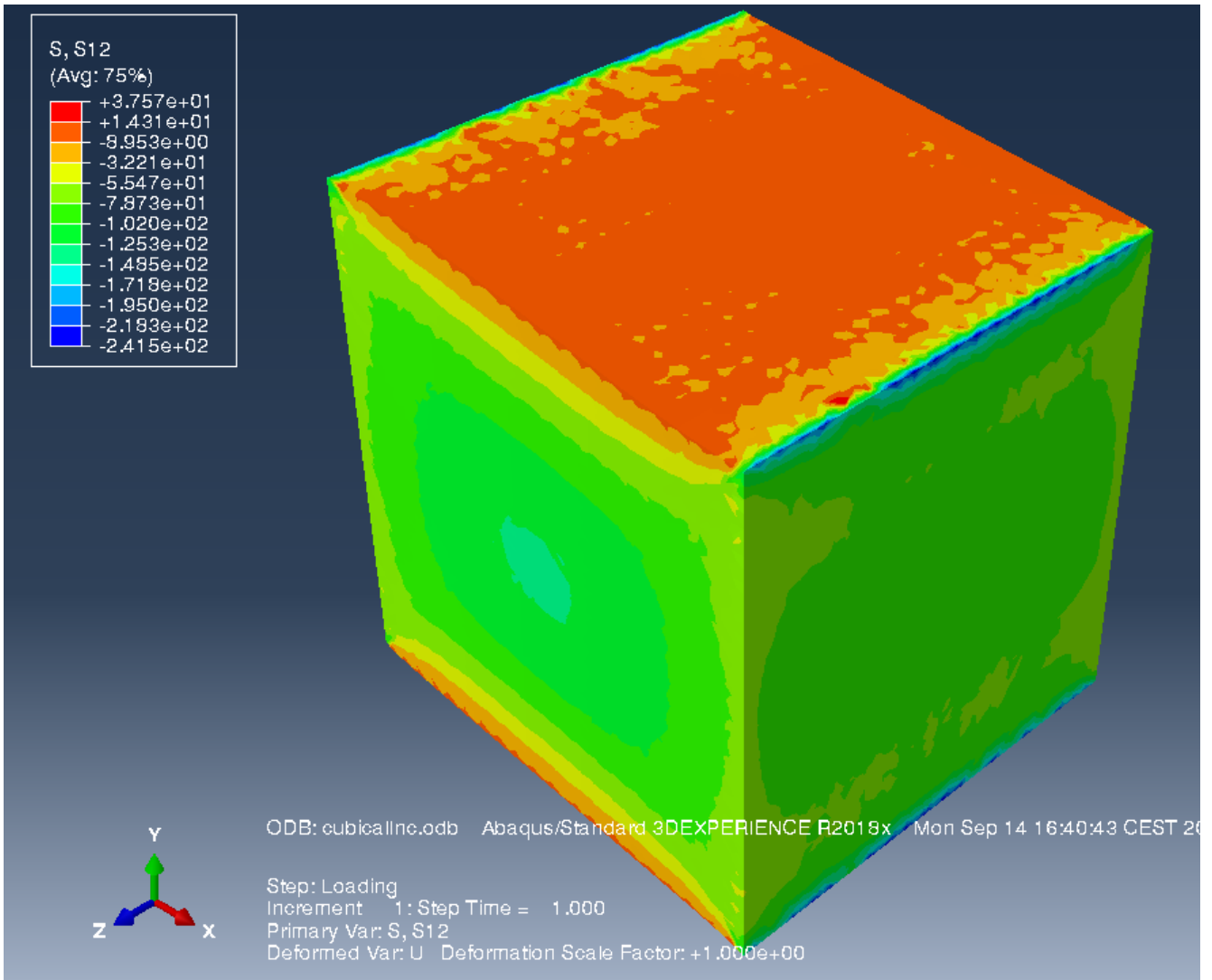


Figure 2: S12 stress result on the RVE

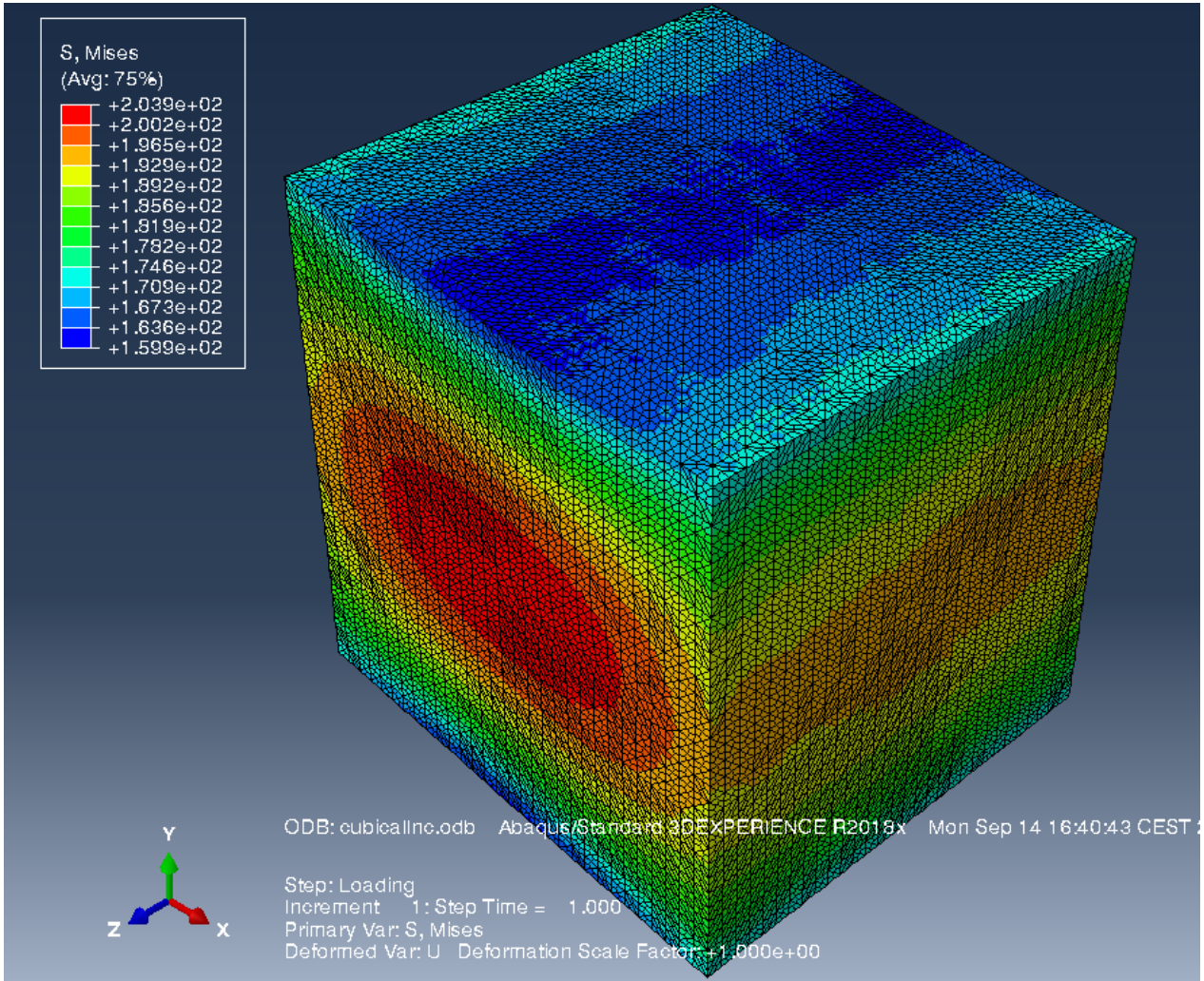


Figure 3: Mises stress result on the inclusion

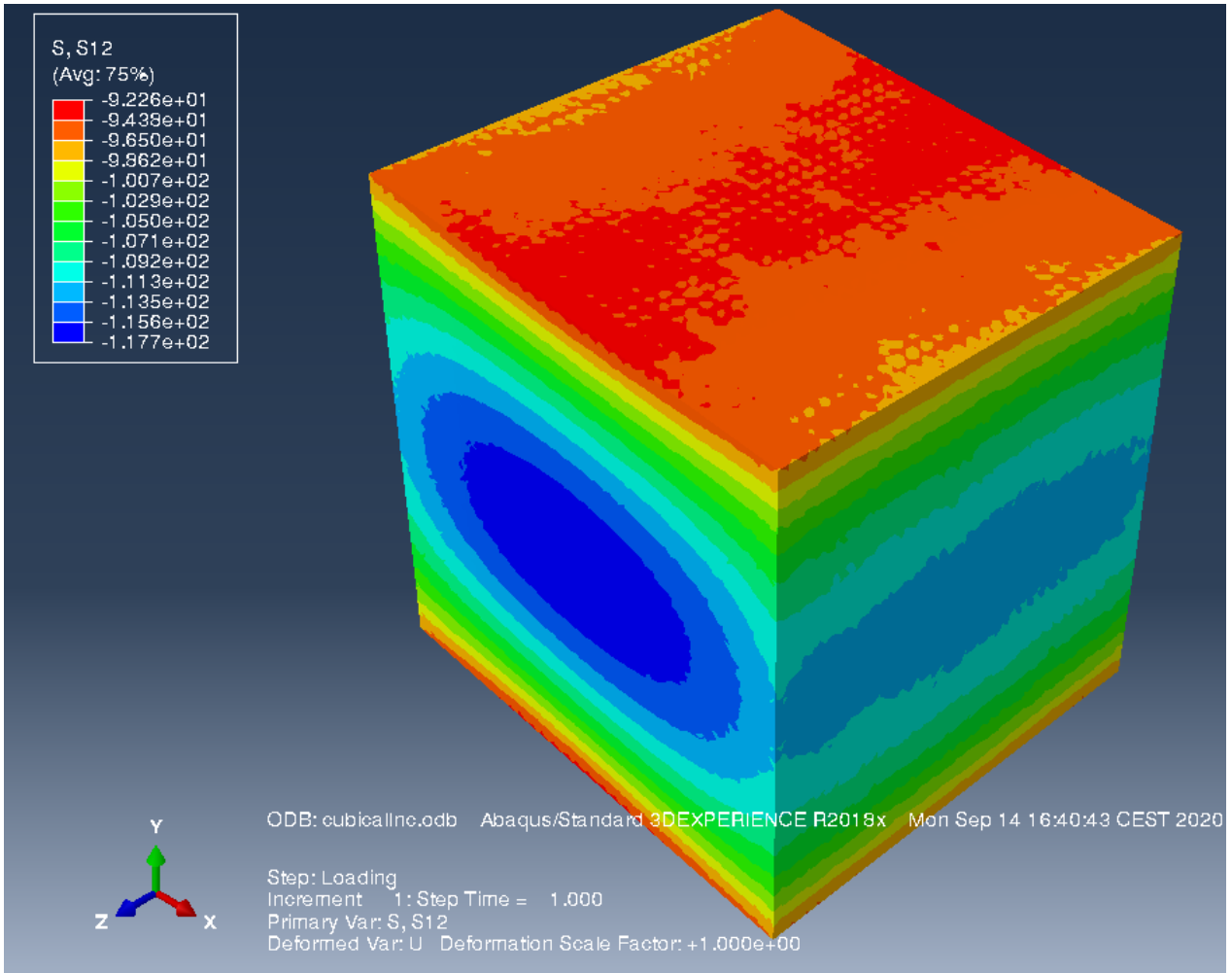
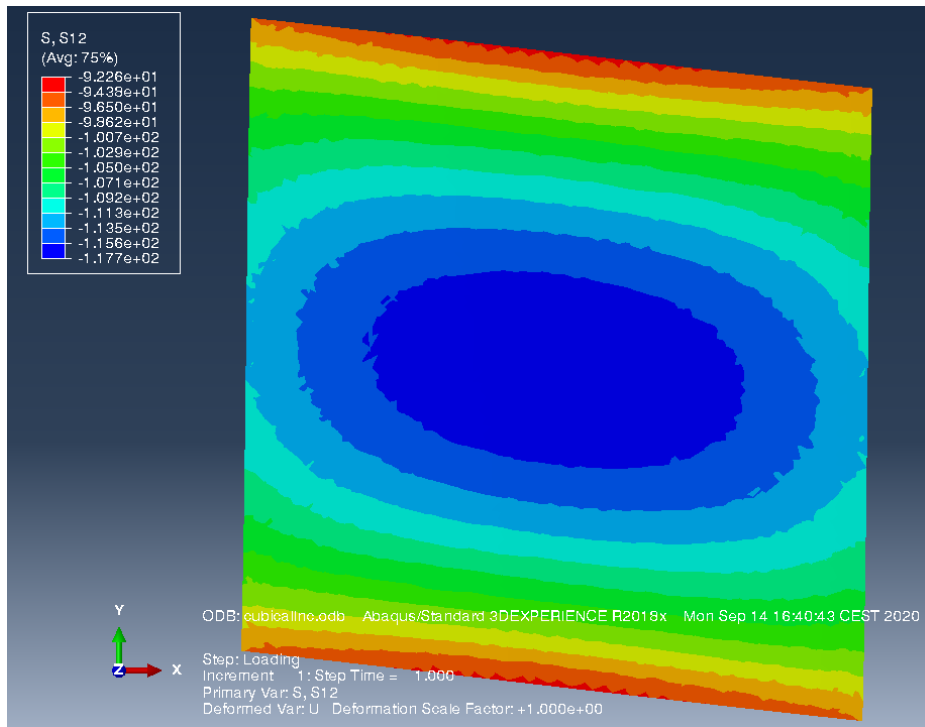
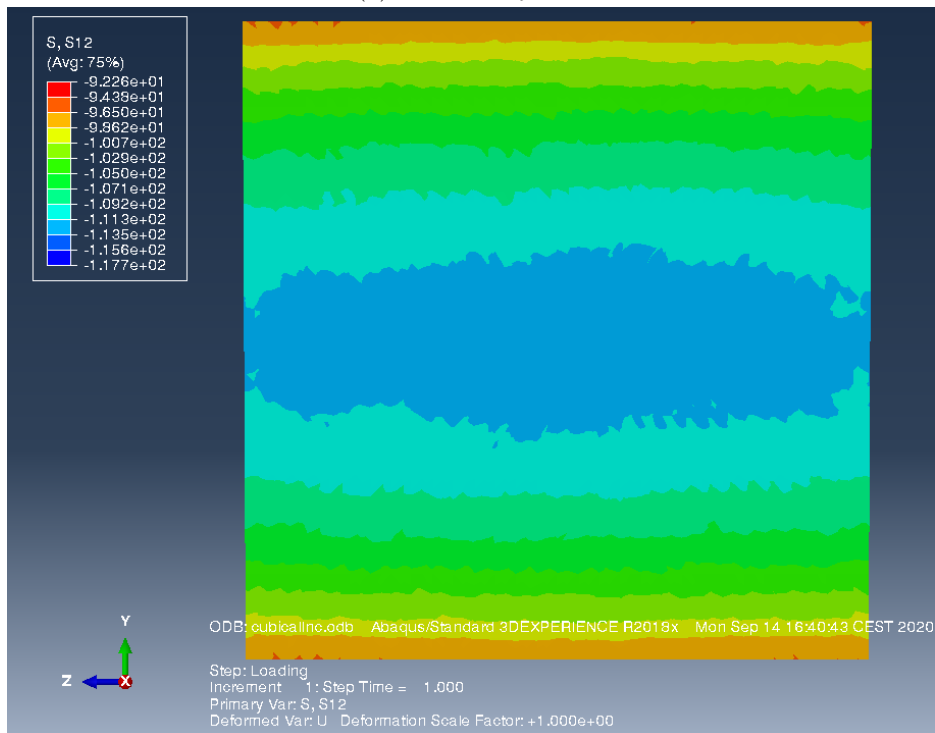


Figure 4: S12 stress result on the inclusion



(a) View of x-y-side



(b) View of y-z-side

Figure 5: S12 stress result on the inclusion

3.2 Result on the RVE with bricked mesh

The loadcase results of the bricked mesh are in the following figures. The number of elements on the inclusion are 30. In total there are 64.000 elements.

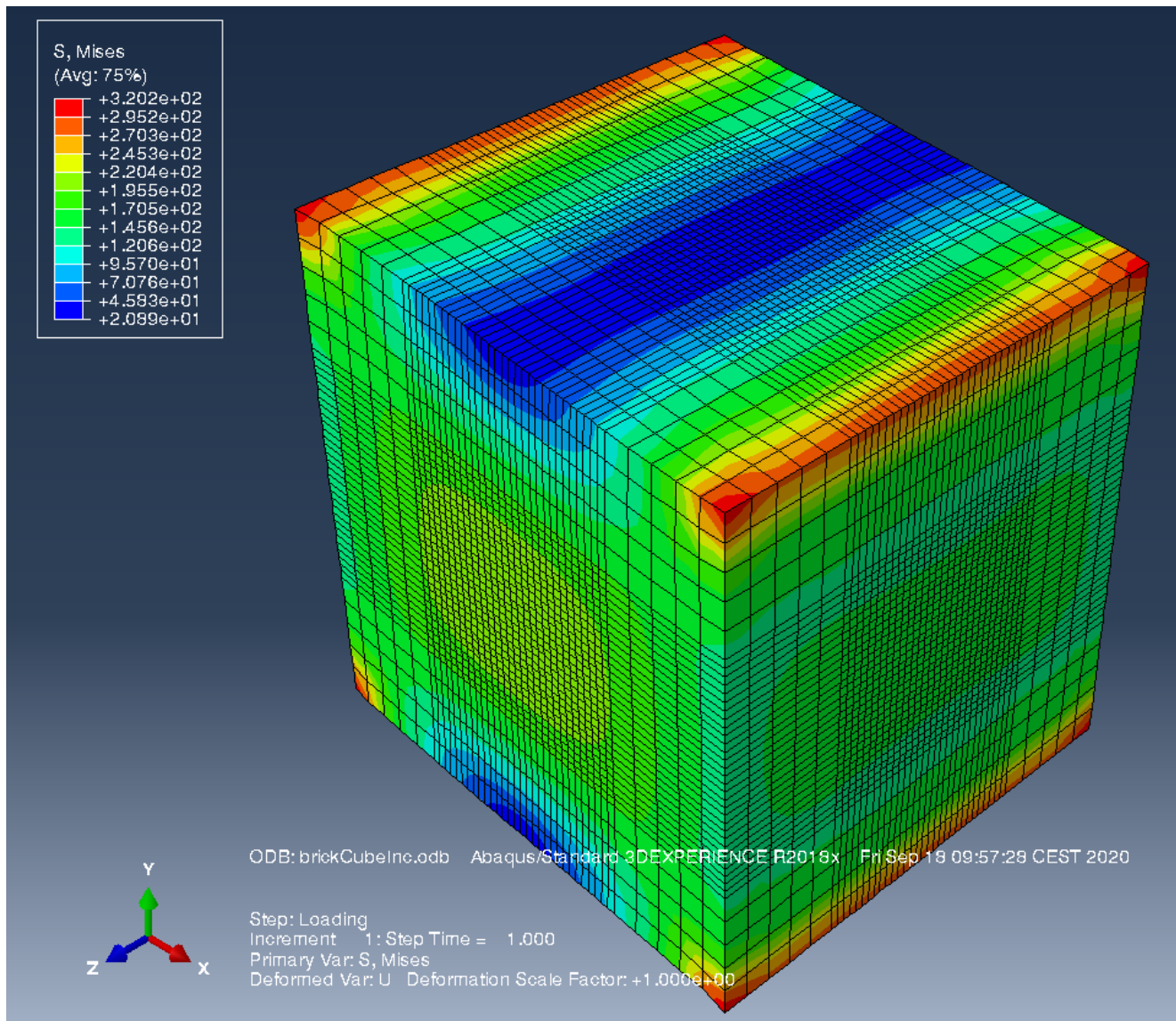


Figure 6: Mises stress result on the RVE

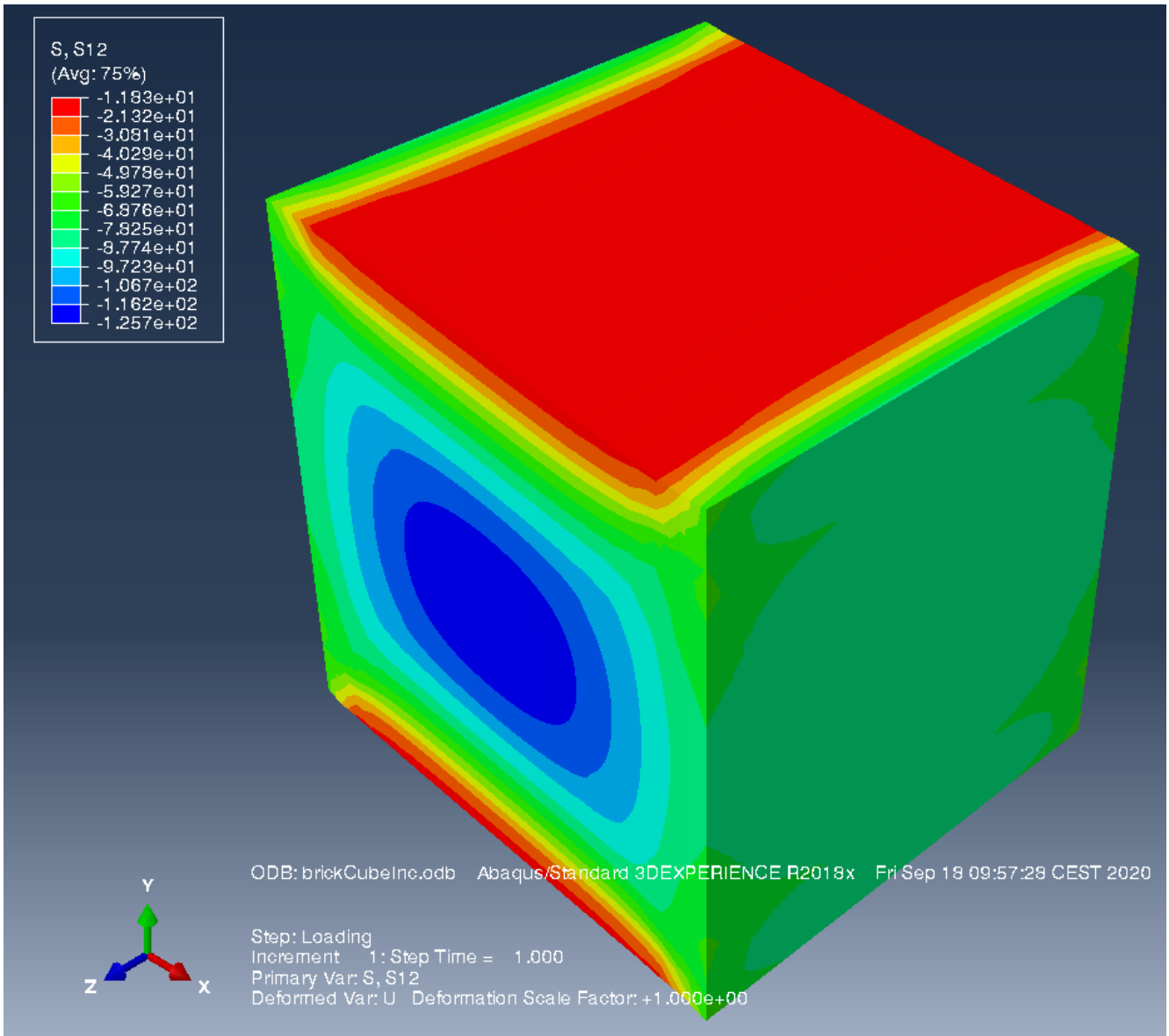


Figure 7: S12 stress result on the RVE

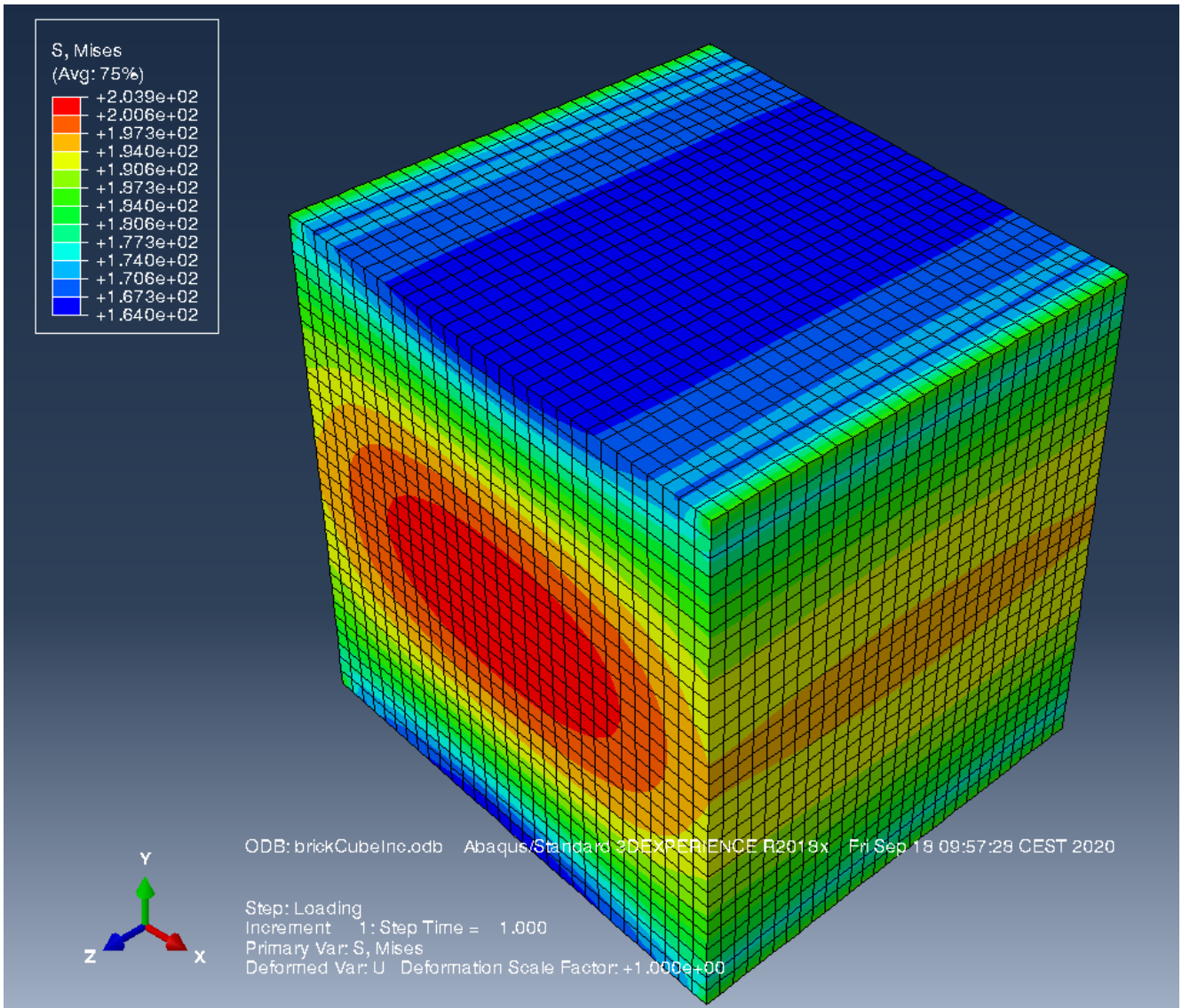


Figure 8: Mises stress result on the inclusion

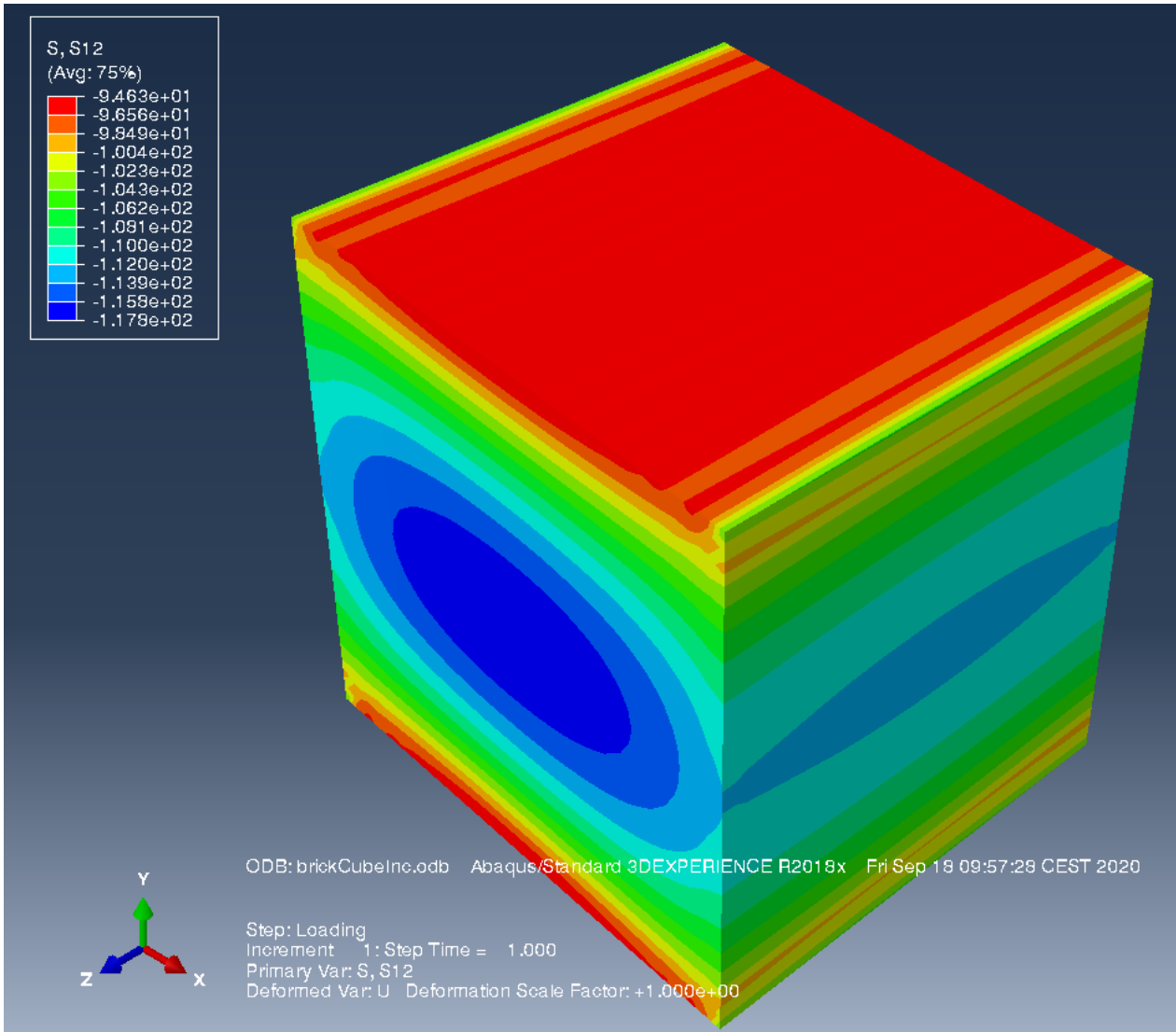
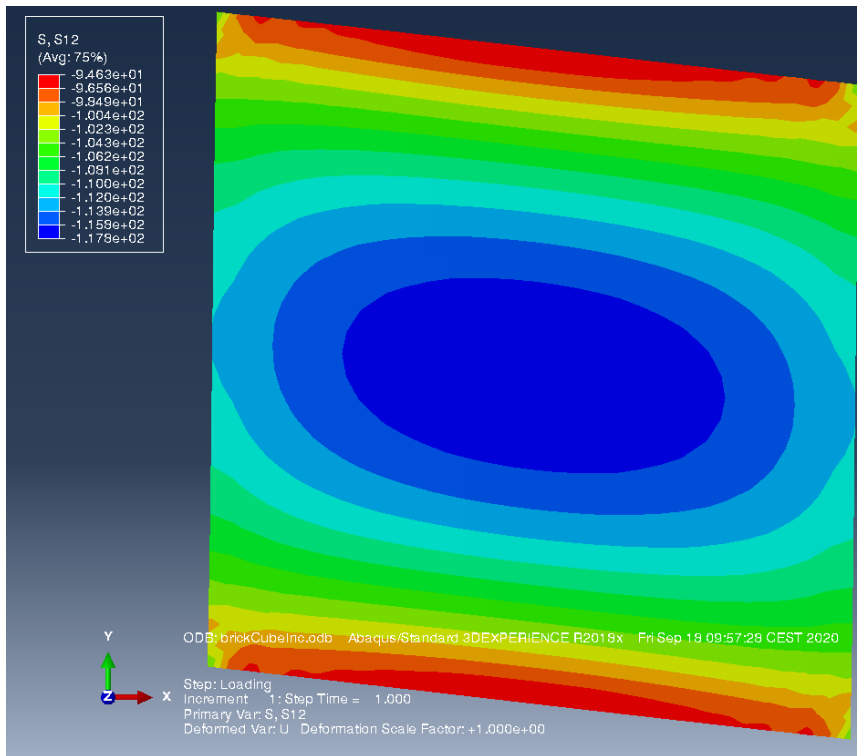
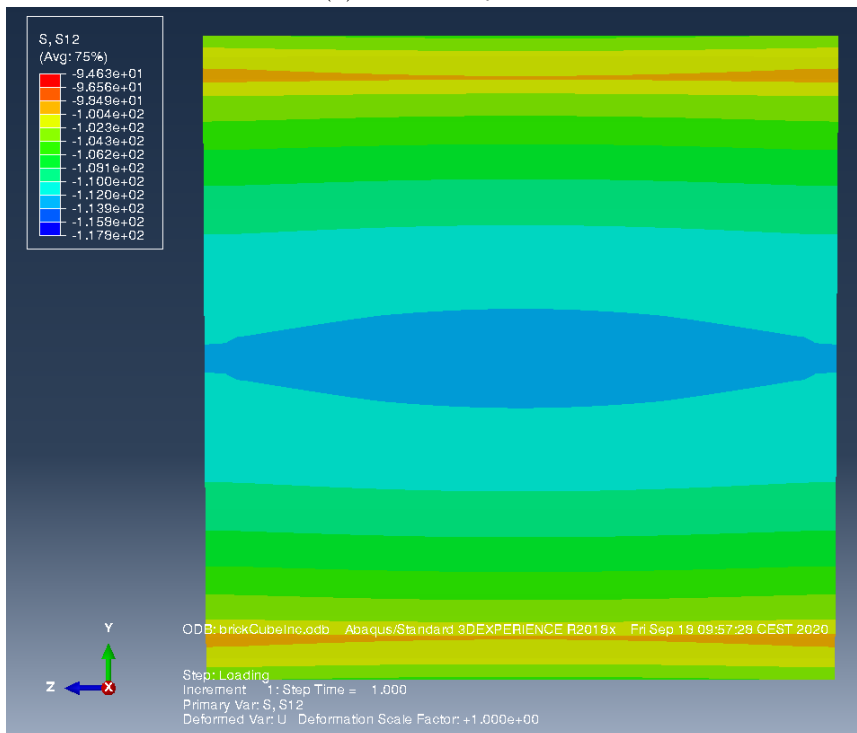


Figure 9: S12 stress result on the inclusion



(a) View of x-y-side



(b) View of y-z-side

Figure 10: S12 stress result on the inclusion for different views

3.3 Result on the RVE with fine bricked mesh

The loadcase results of the bricked mesh are in the following figures. The global elements size is 16 such that on the edge of the inclusion are still 30 elements. In total there are 238.328 elements.

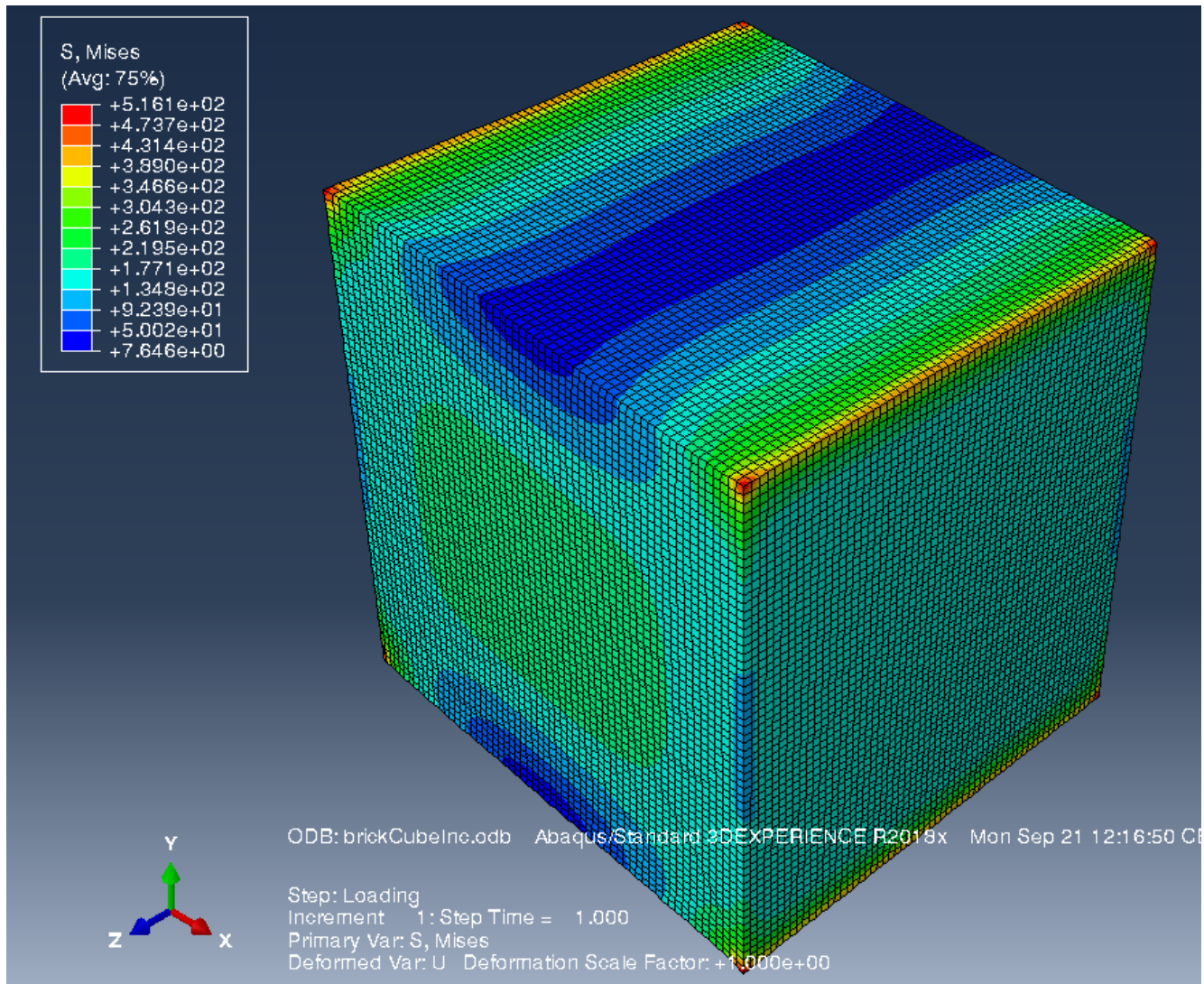


Figure 11: Mises stress result on the RVE

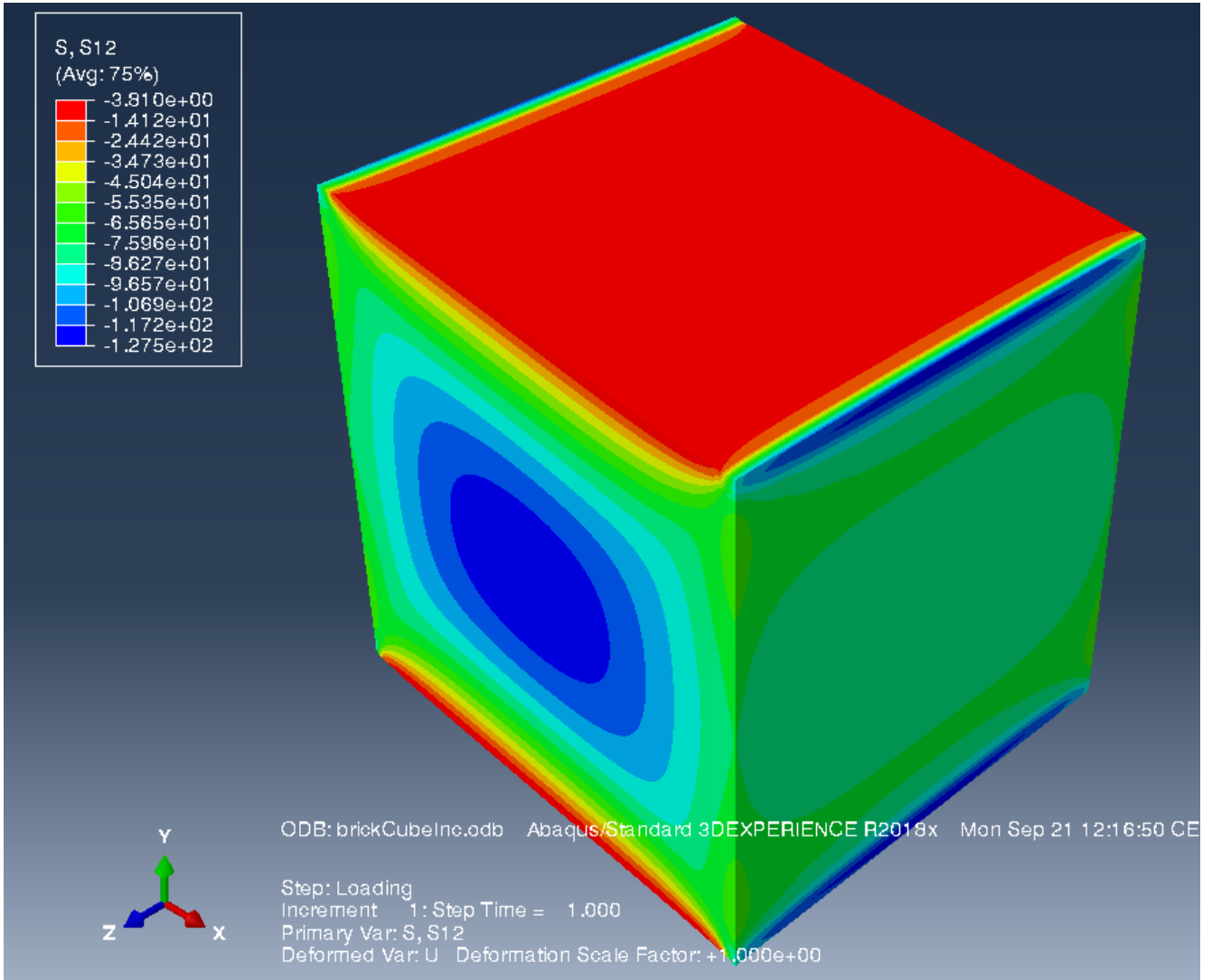


Figure 12: S12 stress result on the RVE

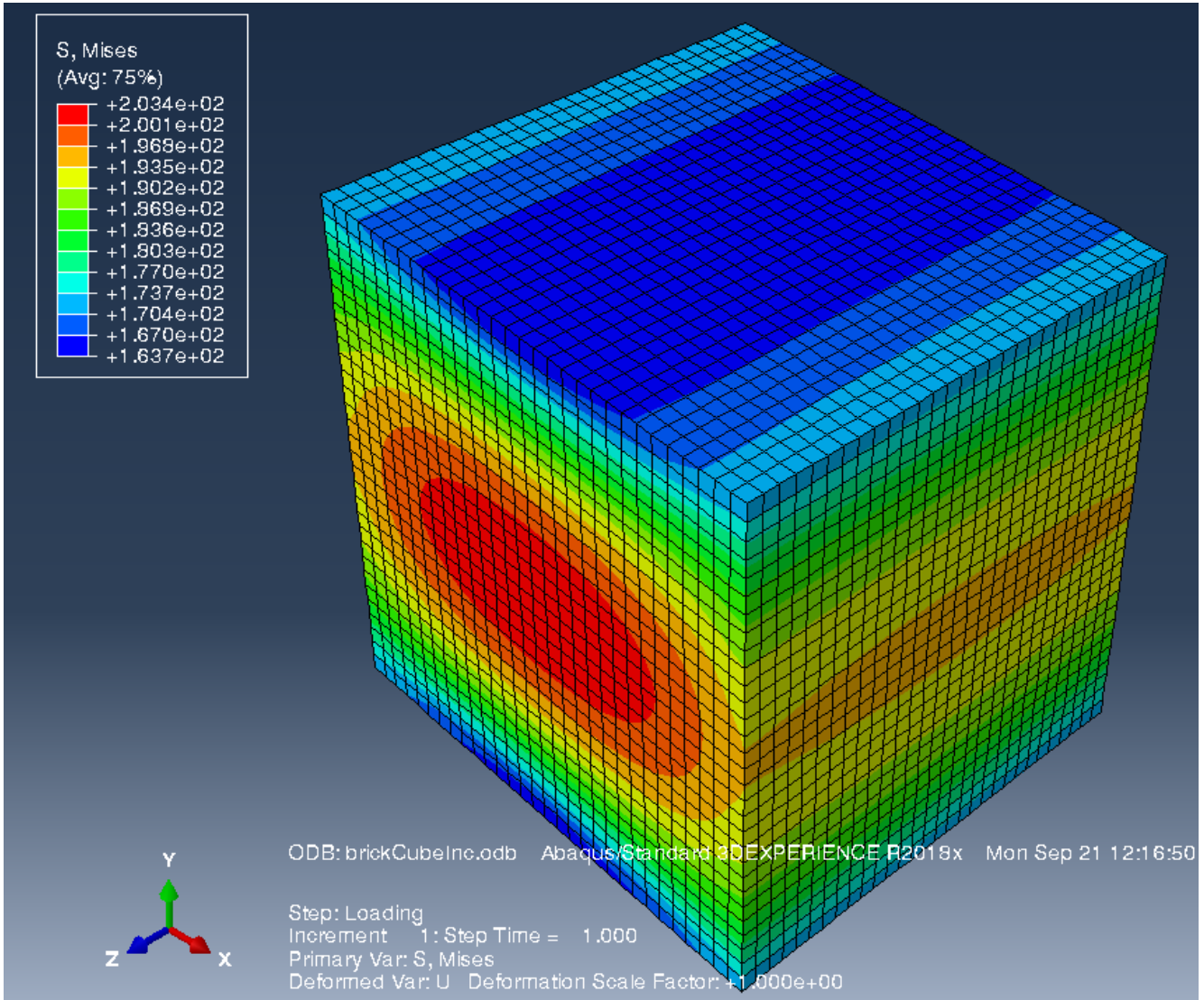


Figure 13: Mises stress result on the inclusion

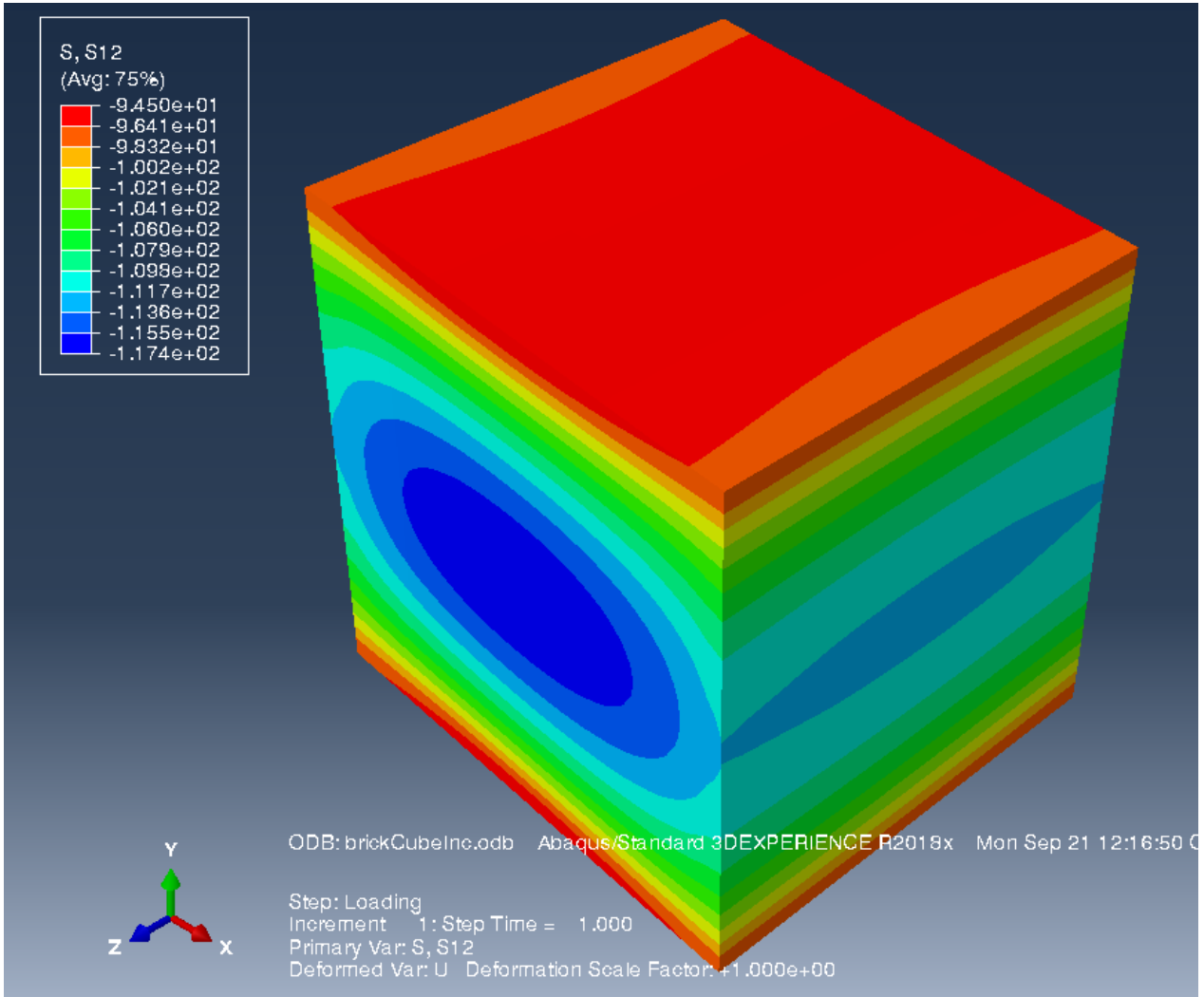
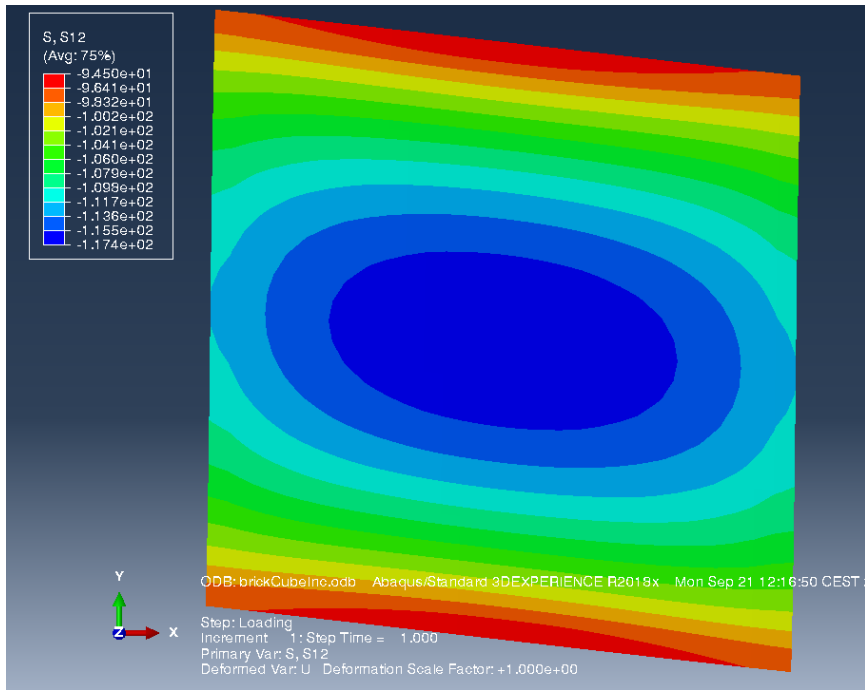
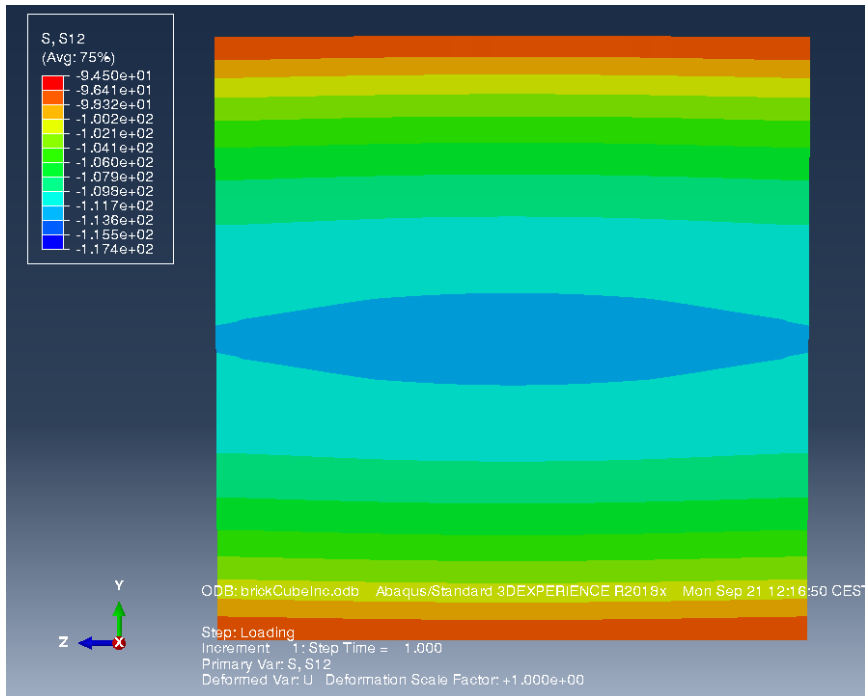


Figure 14: S12 stress result on the inclusion



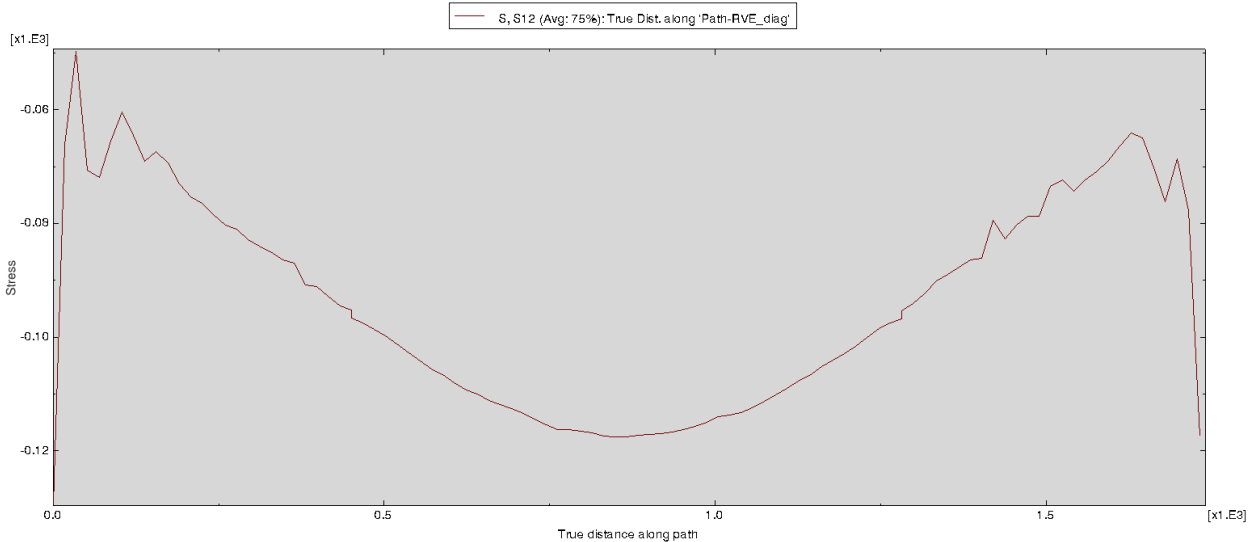
(a) View of x-y-side



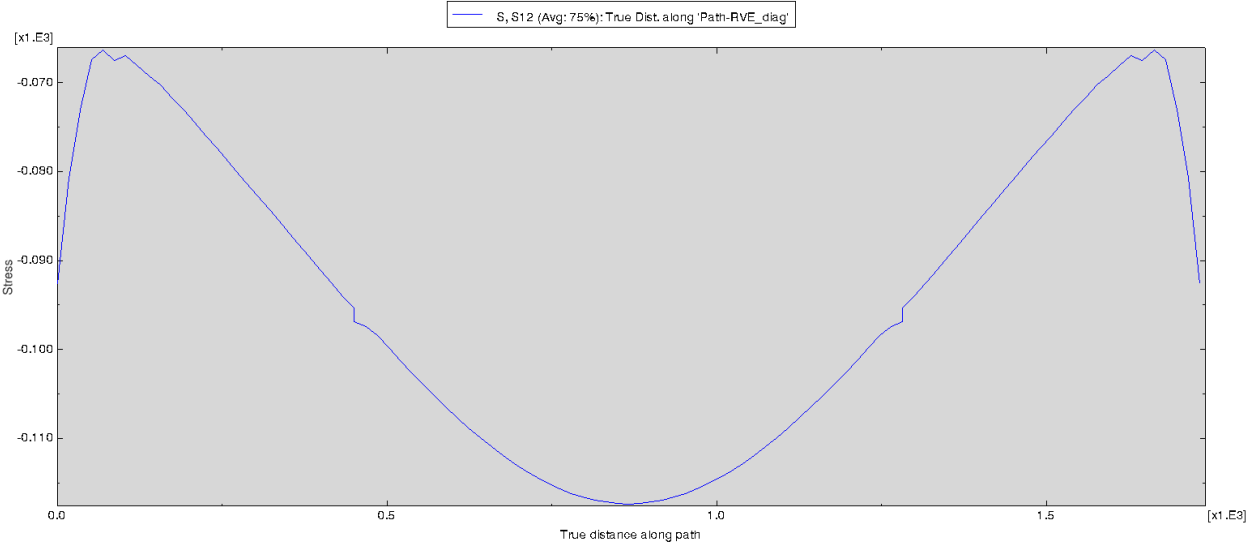
(b) View of y-z-side

Figure 15: S12 stress result on the inclusion for different views

3.4 Comparison of S12 stress path measurements of the delauney hex and fine brick mesh

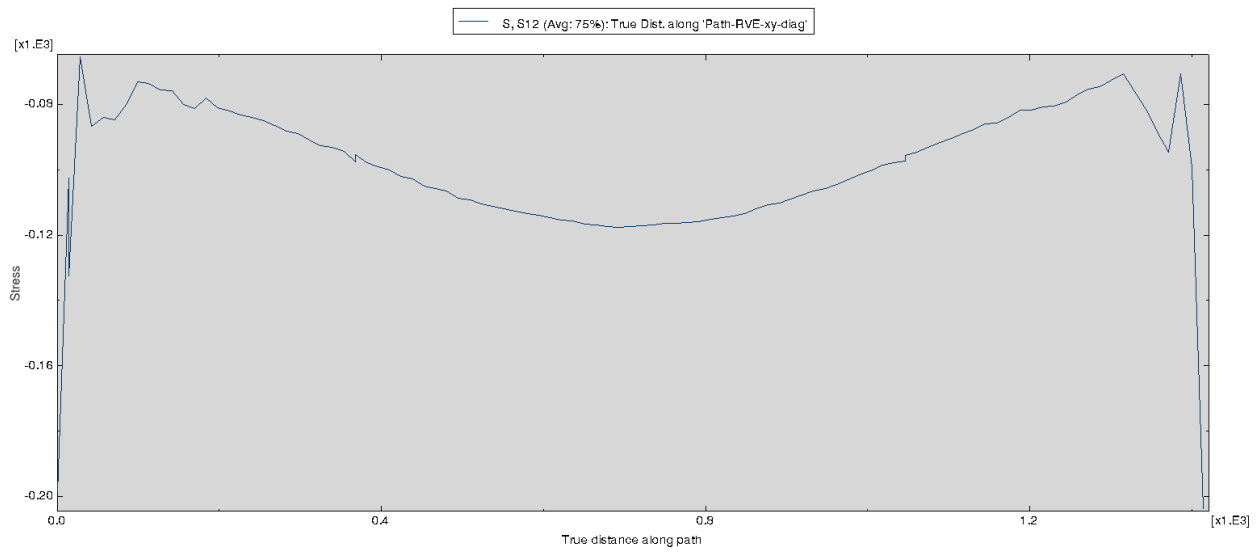


(a) delauney hex mesh

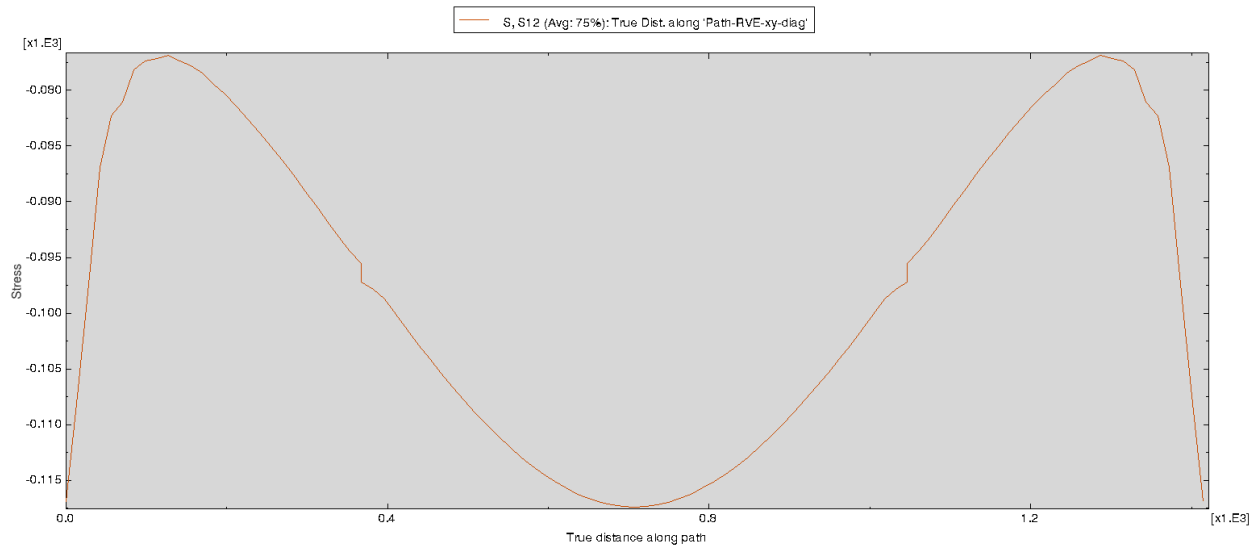


(b) fine brick mesh

Figure 16: S12 path stress result on the diagonal of the RVE



(a) delauney hex mesh

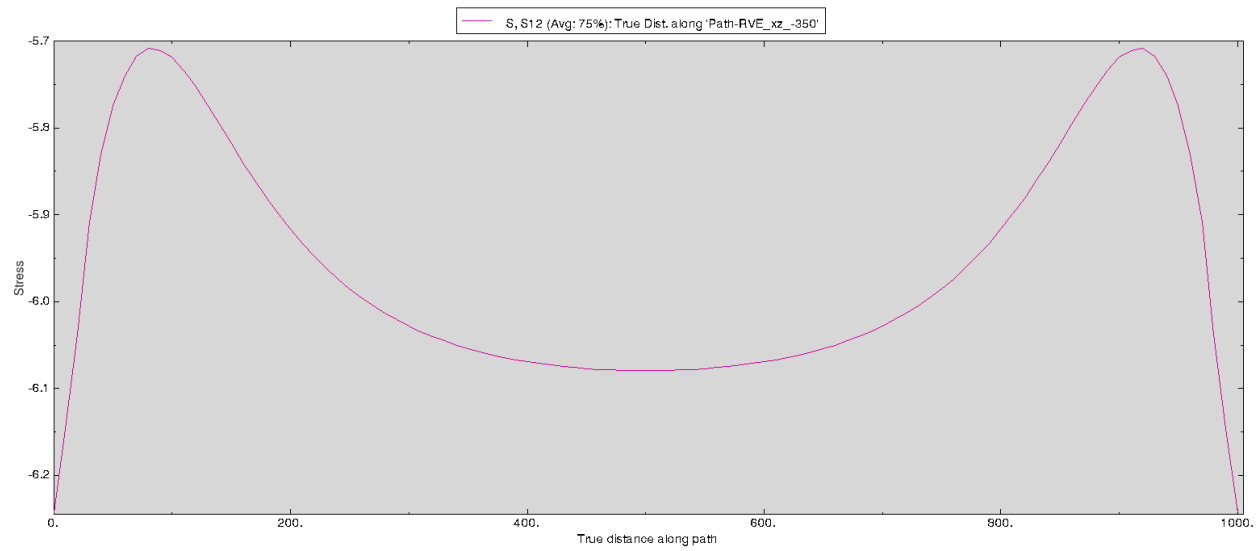


(b) fine brick mesh

Figure 17: S12 stress path result the diagonal of the x-y-plane in the middle of the RVE ($z=0$)

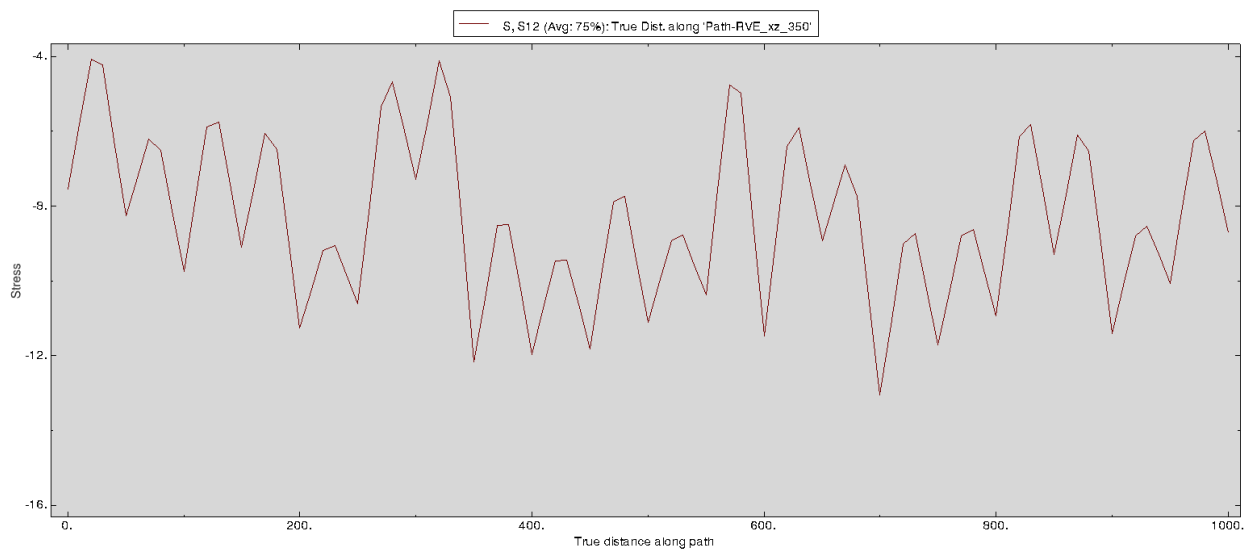


(a) delauney hex mesh

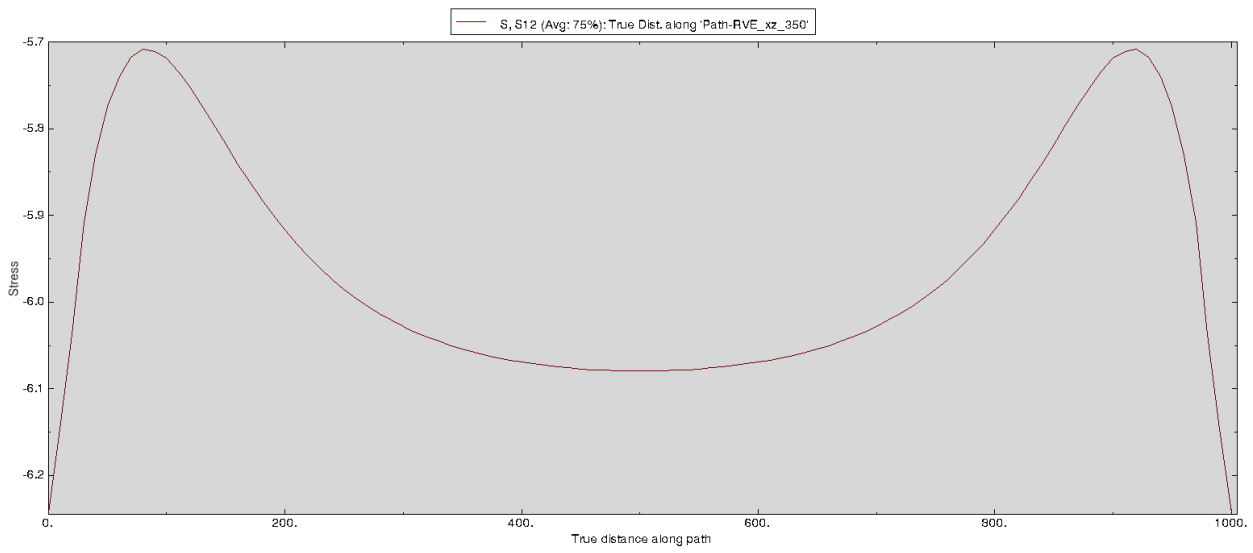


(b) fine brick mesh

Figure 18: S12 stress path result the x-z-plane at $z = -350$ on the RVE

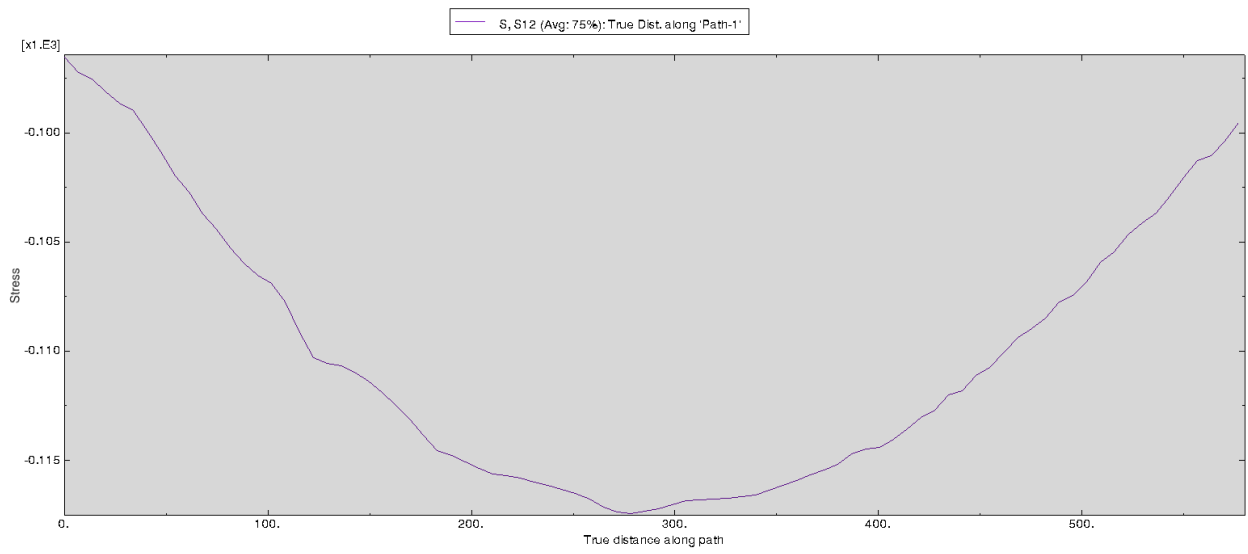


(a) delauney hex mesh

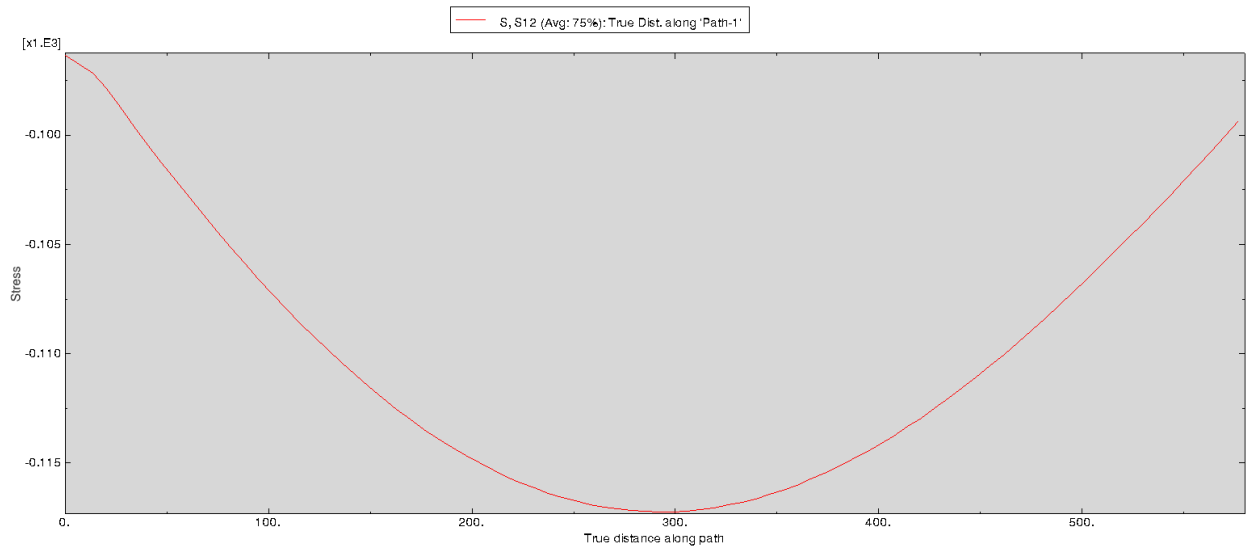


(b) fine brick mesh

Figure 19: S12 stress path result the x-z-plane at $z = 350$ on the RVE

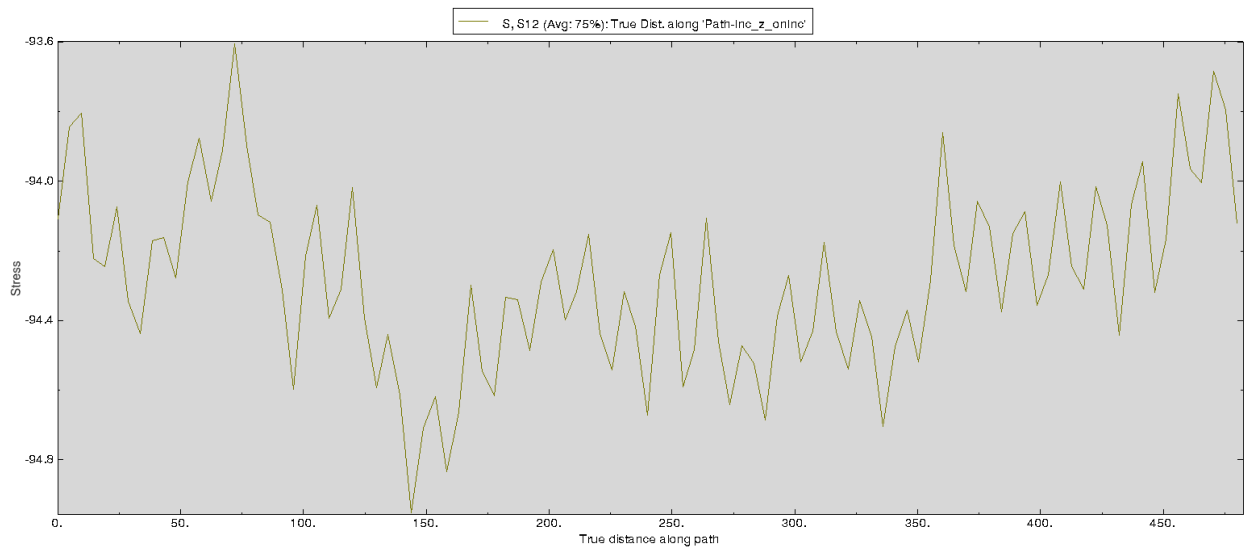


(a) delauney hex mesh

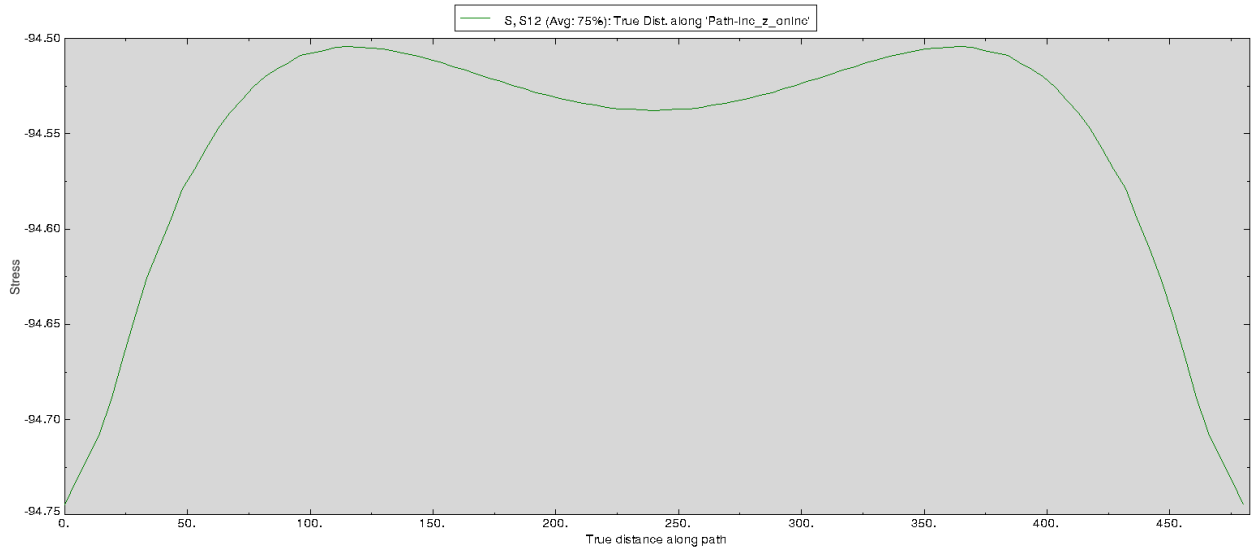


(b) fine brick mesh

Figure 20: S12 stress path result the diagonal of the x-y-plane in the middle of the inclusion ($z=0$)

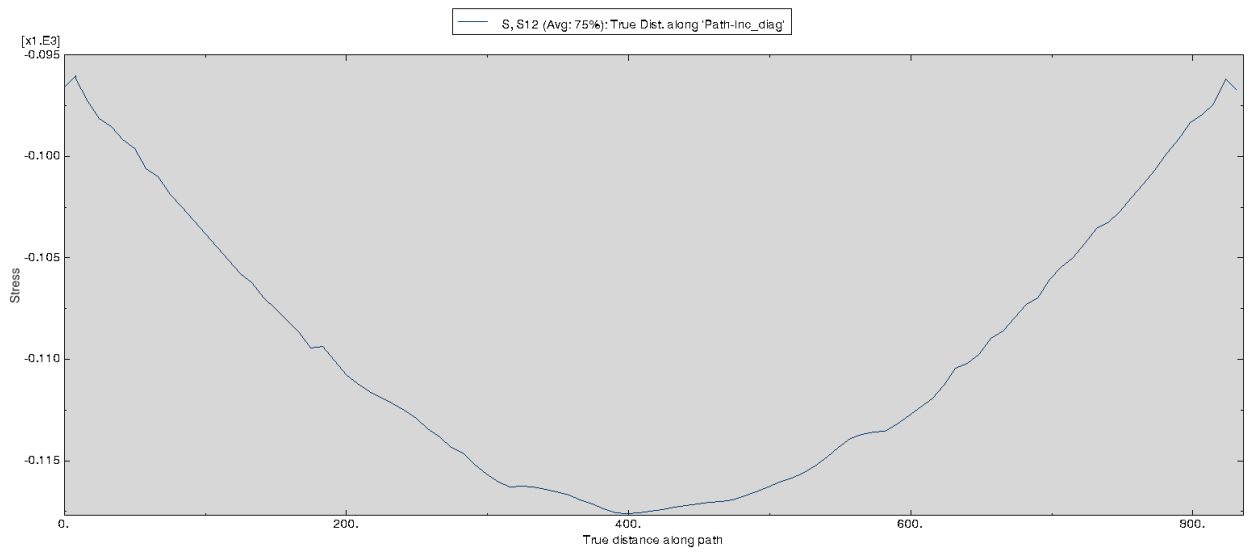


(a) delauney hex mesh

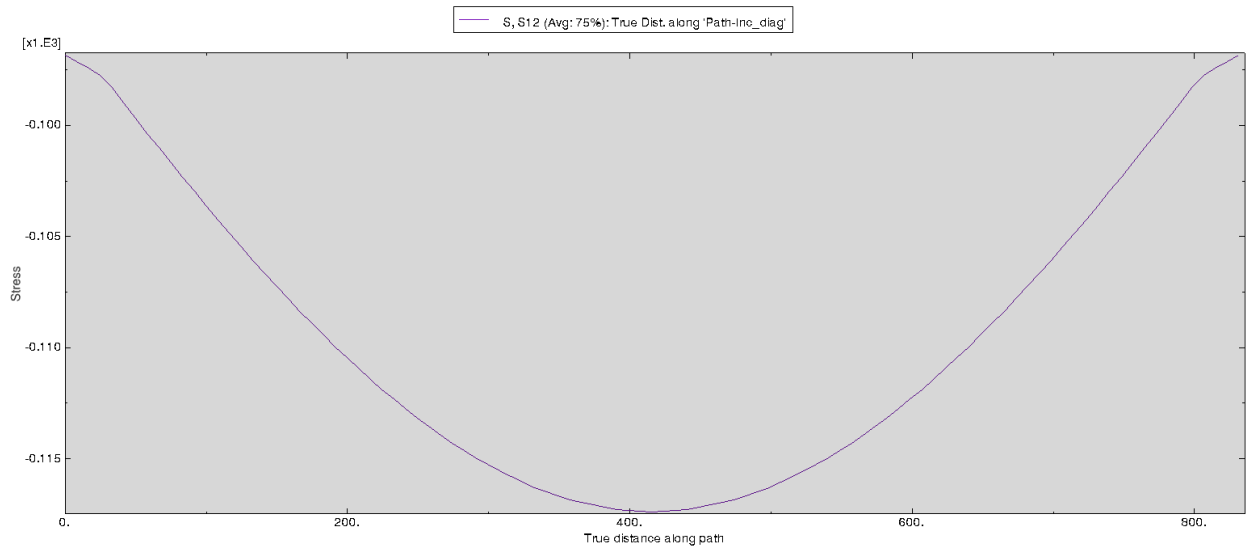


(b) fine brick mesh

Figure 21: S12 stress path result along the z-axis on top of the inclusion



(a) delauney hex mesh



(b) fine brick mesh

Figure 22: S12 stress path result on the diagonal of the inclusion