ANSYS Fluent Meshing Watertight Geometry Workflow

Workshop 2: Battery Module

For this workshop, a battery module was made by a single battery unit using the linear mesh pattern in the ANSYS Meshing, and a conformal mesh was generated using "Share topology" function.

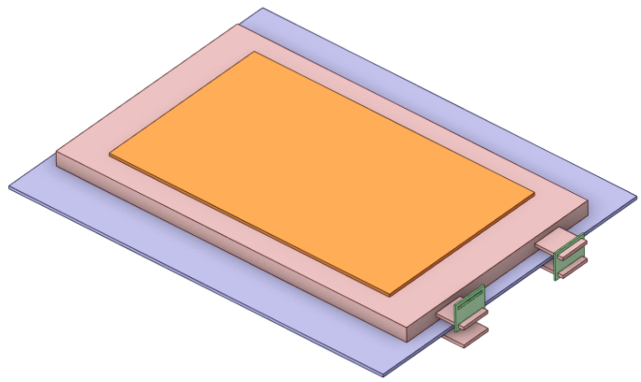

Fig 1: CAD geometry of the Battery unit

Fig. 1 shows the CAD geometry of the Battery unit. The available unit consists of two cells, with a blue rectangular cooling fin and an orange spacer on one side of the unit.

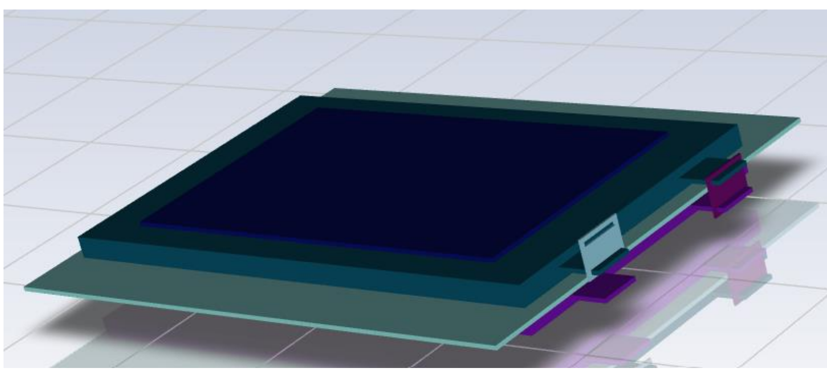

Fig 2: Imported geometry in ANSYS meshing

The CAD geometry was then imported into the ANSYS Watertight meshing workflow. Fig. 2 shows the imported geometry in ANSYS meshing.

During the surface meshing following tasks were performed:

- As the parts are thin, the cells per gap is put to 2, to ensure the presence of sufficient cells in the thin geometrical features. Fig 3 shows the surface mesh in the thin regions. The number of cells in the gap can be increased to better predict the temperature gradient in the thin regions.

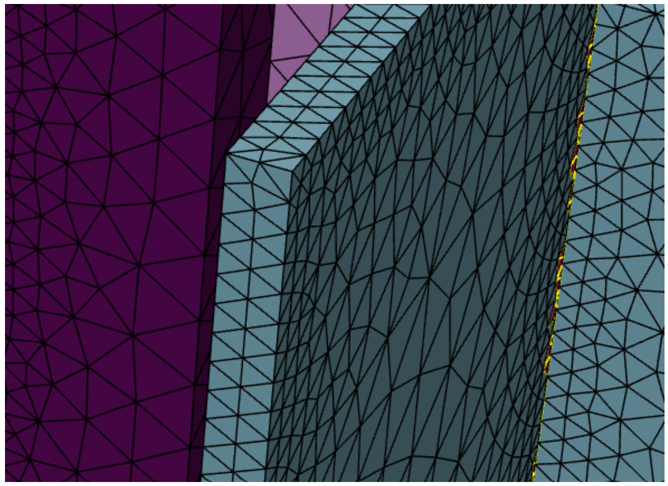

Fig 3: Surface mesh showing 2 cells in the thickness

- A linear mesh pattern task is added in the surface mesh to create the pattern of the complete battery module. A total of 6 battery units were attached to create the battery module. Fig. 3 shows the preview of the linear mesh pattern.

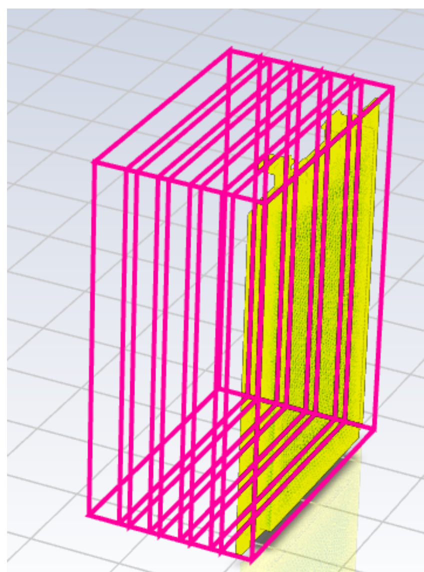

Fig 4: Linear mesh pattern

- "Highlight unit alignments" are switched 'ON' to highlight the interfaces between the pattern units or any other geometry it is attached to. Fig. 5 shows the interfaces between the pattern units.

Shared topology is provided to ensure proper connection between the battery units and a conformal mesh is achieved at the intersection of the different bodies. The maximum gap distance was kept at 0.25 mm.

Boundary layers can be added to ensure better prediction of temperature gradients near the boundary of the solid. But in this case, boundary layers were not added because of the presence of cuboidal-shaped thin regions. Adding boundary layers in the 90-degree corners can lead to mesh distortions which will reduce the overall quality of mesh generated.

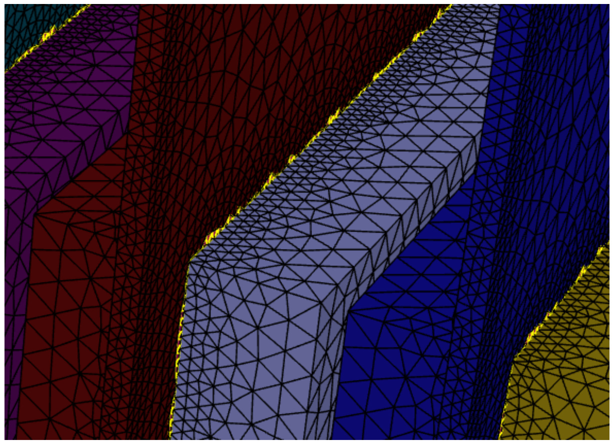
Fig 5: Highlighted interfaces between the walls

For the volume mesh generation, the Polyhedra fill with method is selected to generate a conformal polyhedral mesh throughout the battery module. The overall mesh orthogonal quality was 0.2 and the mesh count was 906424. Fig. 6 shows the generated polyhedra mesh in the battery module.

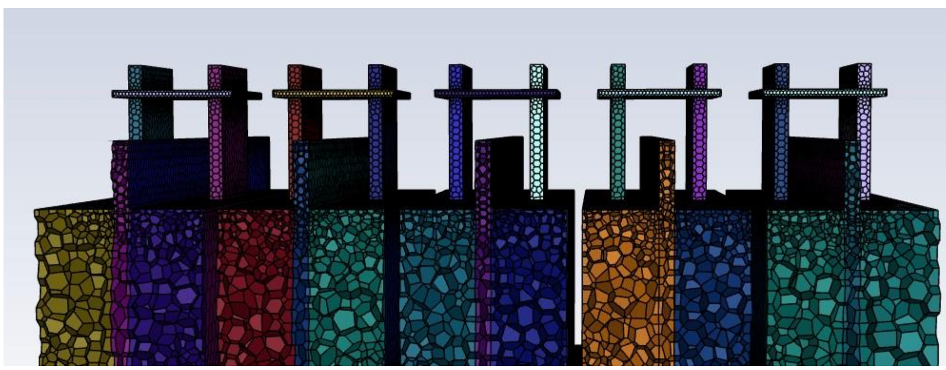
Fig 6: Polyhedra mesh in the battery module

Fig. 7 shows the added boundary layers in the volume mesh. Adding boundary layers in this meshing leads to an overall reduction in the mesh orthogonal quality to 0.05 due to the reasons discussed above, and even the total mesh count increases to 2375645. **Hence, in this case, the boundary layers were removed from the final volume mesh.**

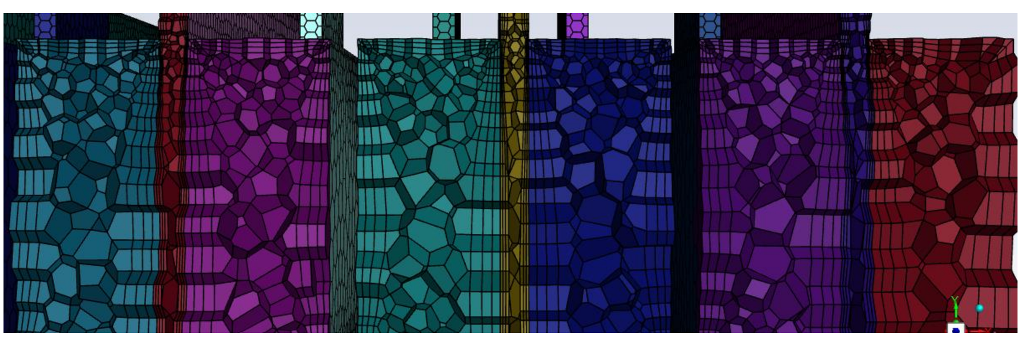
Fig 7: Boundary layers in the volume mesh