



Ennova Technologies

Training - Ennova

Basics

07th January 2025

Ennova Technologies

ennova-cfd.com

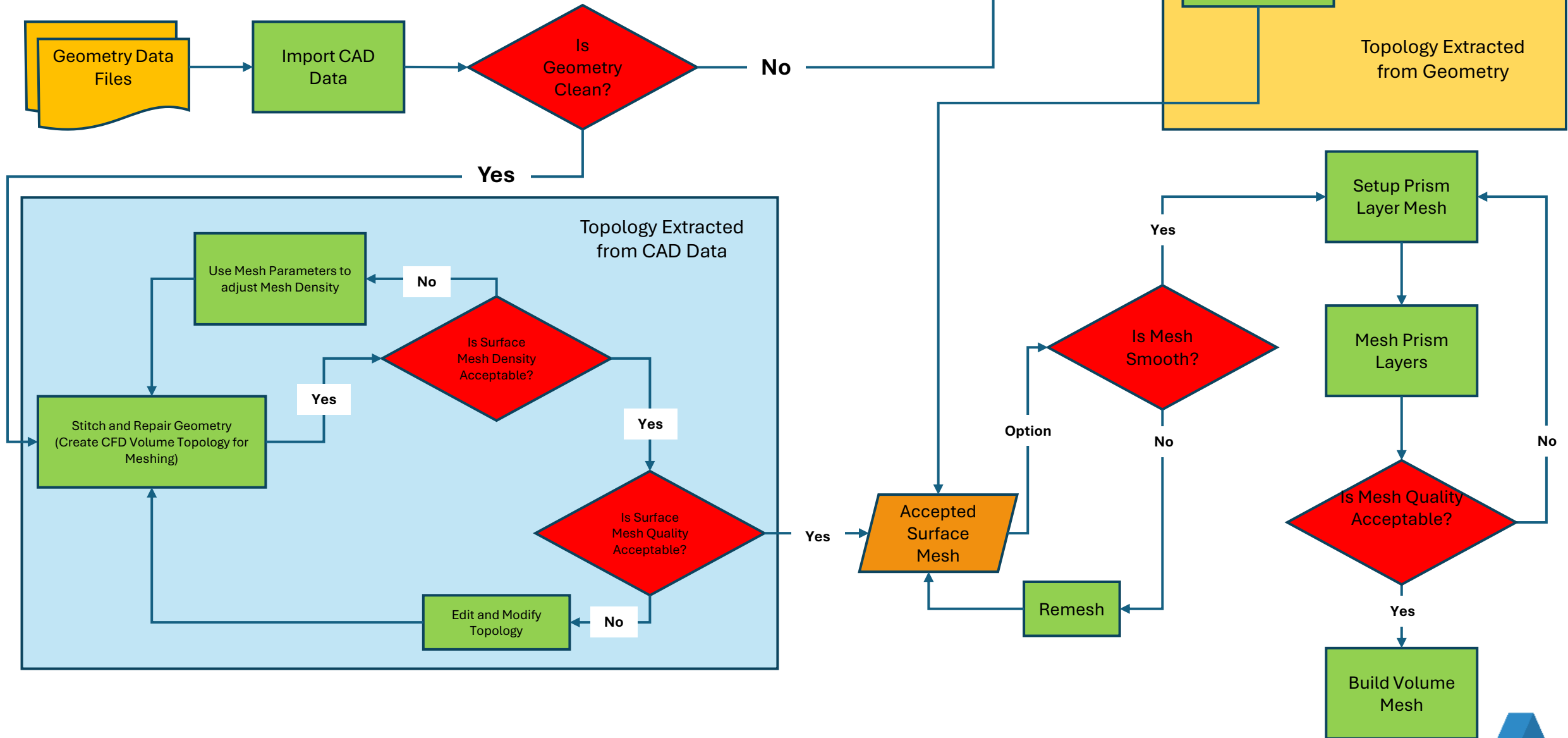


Ennova

- At Ennova our goal is simple
 - To enable the CAE/CFD engineer to build models in hours that previously took months (or in minutes that took hours) without sacrificing quality or accuracy.

Feature	Ennova	Traditional Tools
Automation	High degree of automation in geometry repair, meshing, and export.	Limited automation; often relies on manual intervention.
User Interface	Intuitive GUI with easy-to-navigate options.	Less intuitive interfaces; requires advanced user expertise.
Quality Checks	Integrated CAD and mesh quality checks with real-time problem highlighting.	Often requires exporting files to third-party tools for quality checks.
Efficiency	Faster processing due to parallel computation and advanced algorithms.	Time-consuming due to multiple manual steps and external dependencies.
Solver Compatibility	Direct export options for popular solvers.	Requires additional steps for compatibility or third-party plugins.
Boundary Layer Setup	Automated with user-friendly parameter sliders and visual feedback.	Manual setup prone to errors, requiring trial-and-error corrections.

Roadmap of the Process

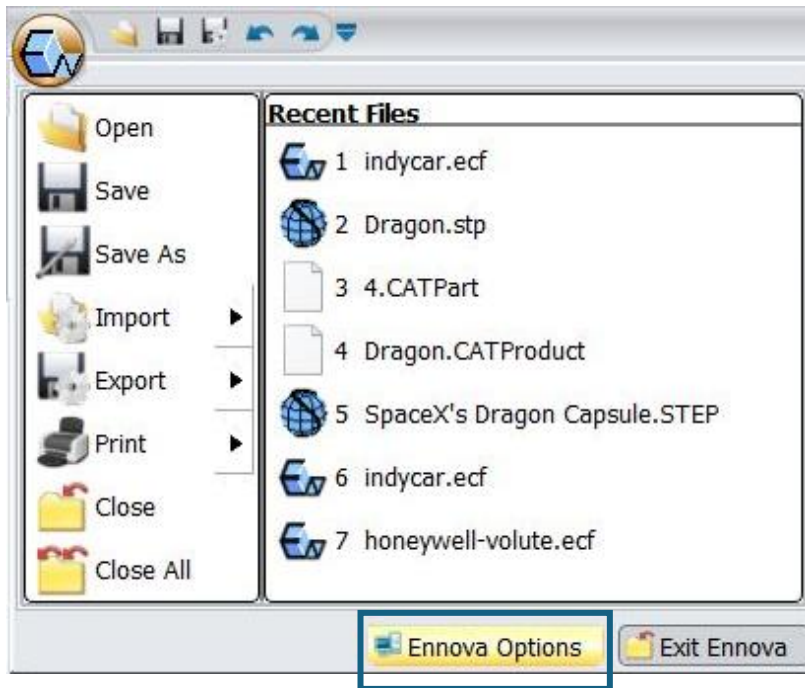


Ennova Interface

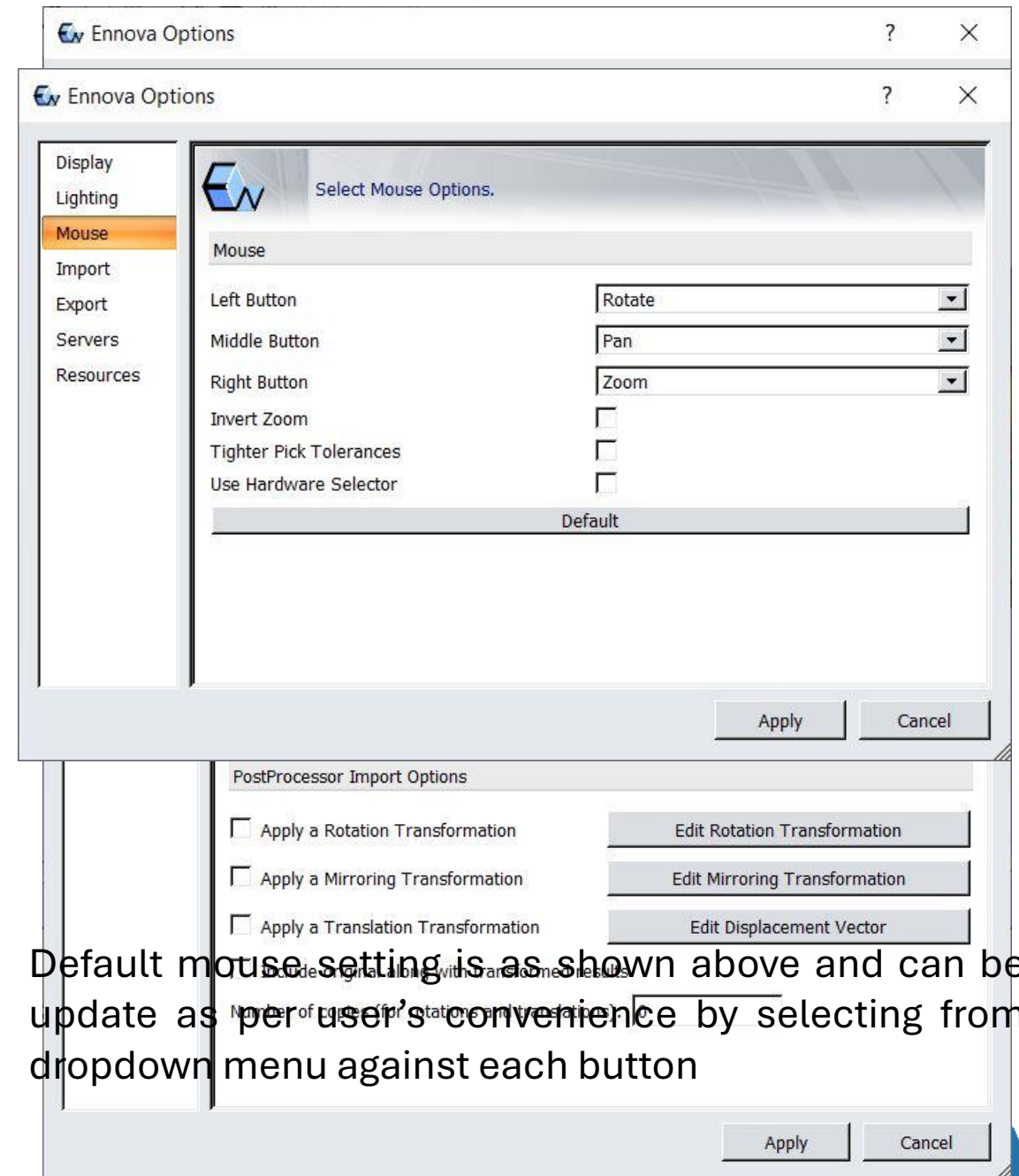
The screenshot displays the Ennova software interface with several components labeled and connected by blue lines:

- Quick Access Toolbar:** Located at the top of the window, containing icons for Save, Undo, and Redo.
- Application Menu:** The main menu bar at the top, including options like File, Edit, View, and Help.
- Ribbon:** A horizontal bar below the application menu, divided into tabs such as CAD, Geometry, Mesh, Setup OpenFOAM, and PostProcess. Each tab contains a set of icons for specific functions.
- Group list:** A panel on the right side of the interface showing a hierarchical list of objects in the model, including 'view', 'local coordinates', 'geometry', and various mesh components like '.nodes', '.single edges', 'batcar', 'side', 'wheel_fr', 'wheel_rr', and 'windshield'.
- Messages/Processes Explorer Tab:** A panel at the bottom left showing a log of messages and processes, including 'INFO: Writing 0 free edges', 'INFO: 273 bodies in model, 273 written to Reds file', and 'File import finished'.
- 3D Viewer:** The central area of the interface where the 3D model is displayed.
- Stop Current Process:** A button located at the bottom center of the interface, labeled 'Ennova Options' and 'Exit Ennova'.
- Model Properties:** A dialog box on the right side of the interface, titled 'Model Properties', which allows users to configure various settings for the model, including Units (mm), Author, Organization, Created, Notes, Scale (1.0), Tolerance, Reference Size (376.637), and Is Proprietary (Yes/No).

Application Menu

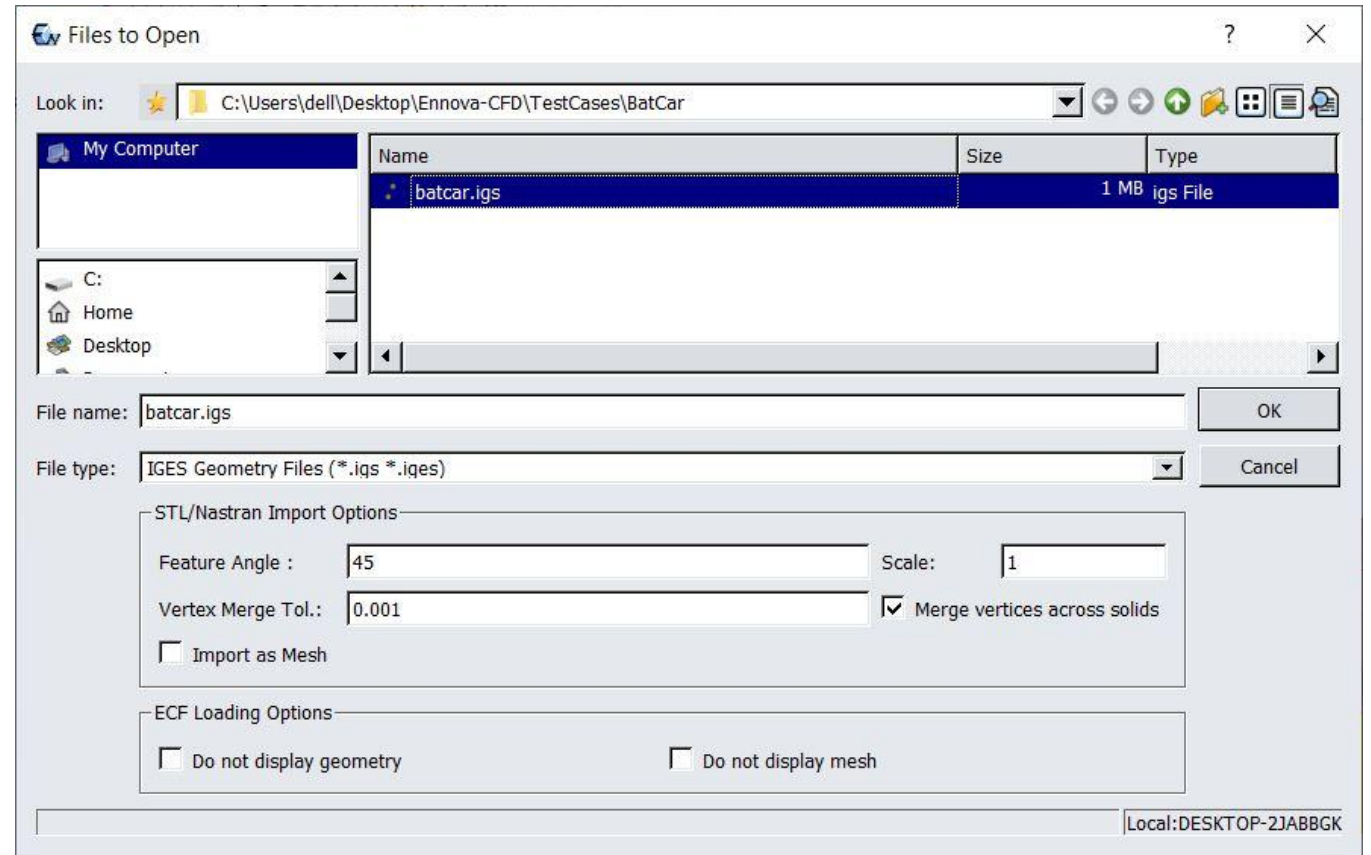
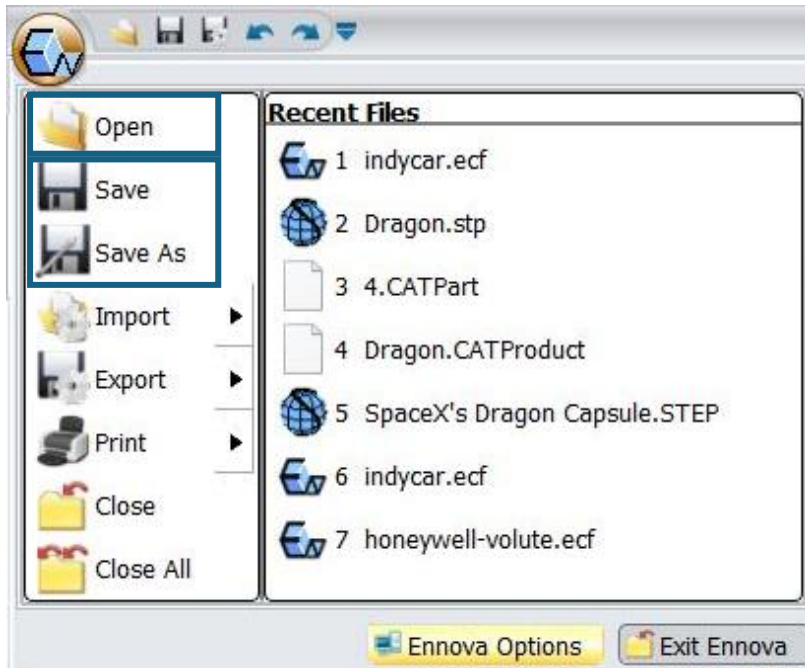


Core development over the years have enabled Ennova to import most of the CAD formats. Most common of which are, Seimens NX, IGES, STEP, Parasolid, ICEM Geometry, solidworks, CATIA parts, jt, STL, etc..



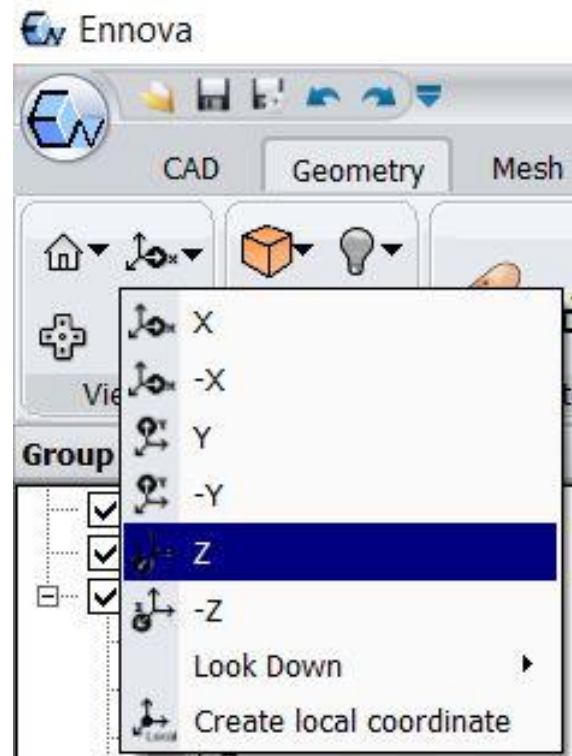
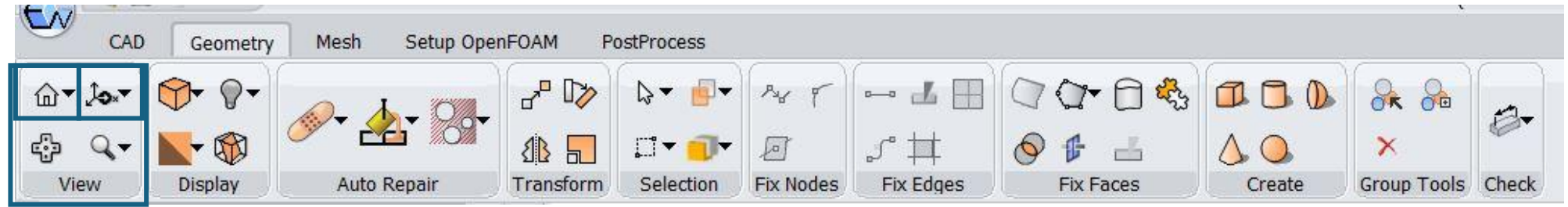
Default mouse setting is as shown above and can be update as per user's convenience by selecting from dropdown menu against each button

Application Menu

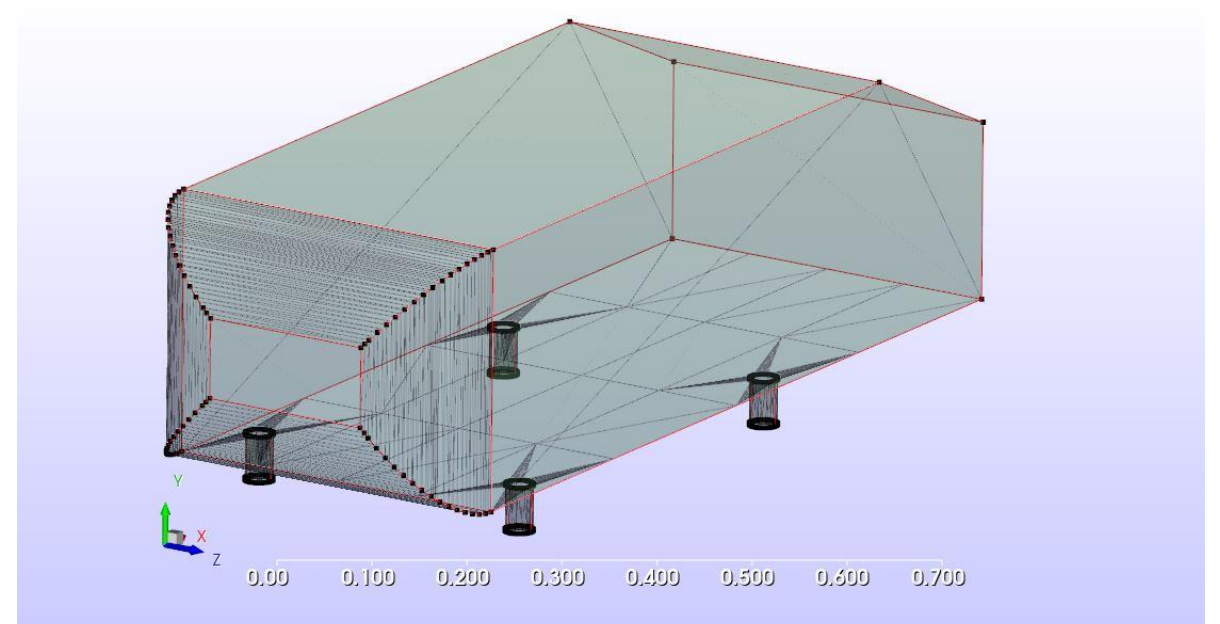
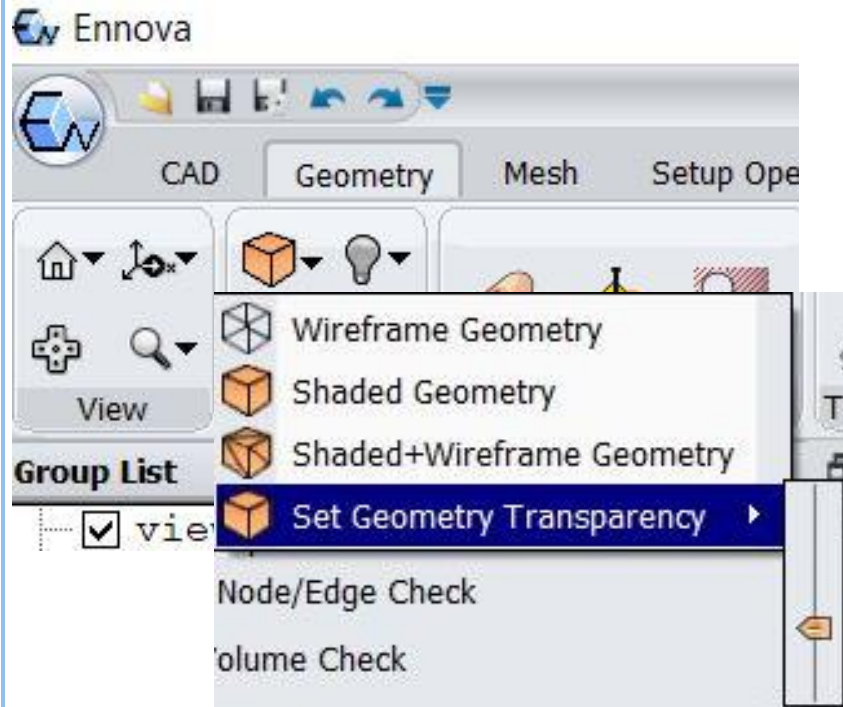
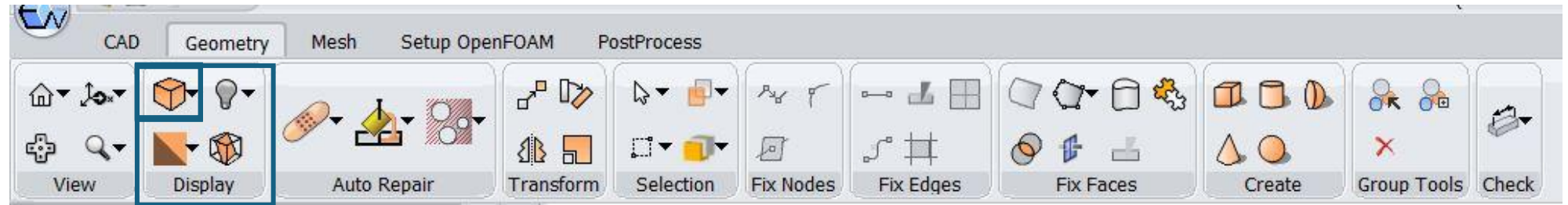


CAD Options

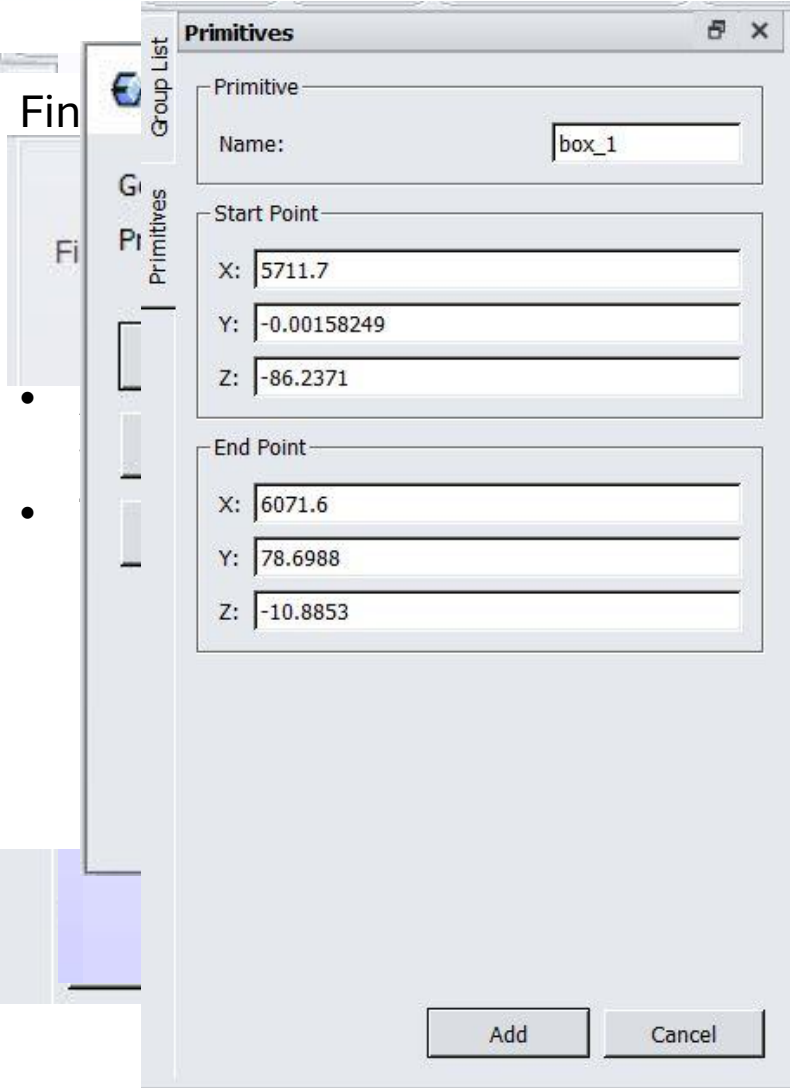
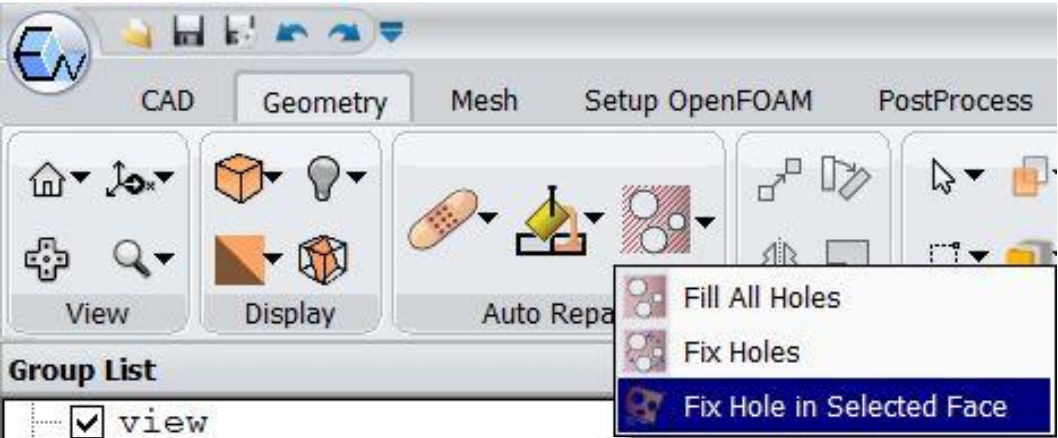
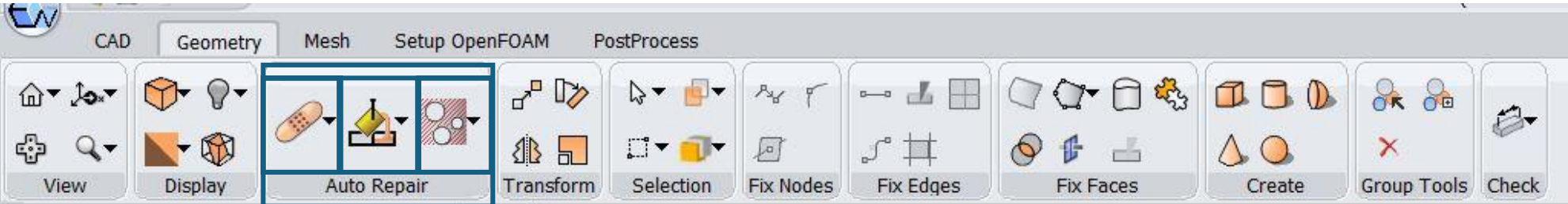
View



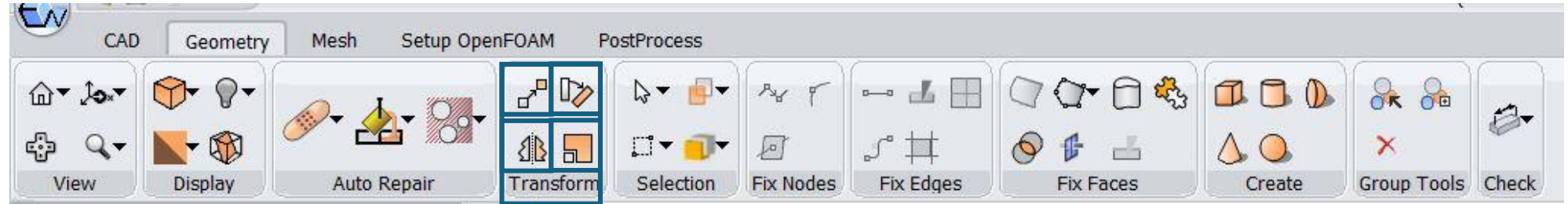
Display



Auto Repair

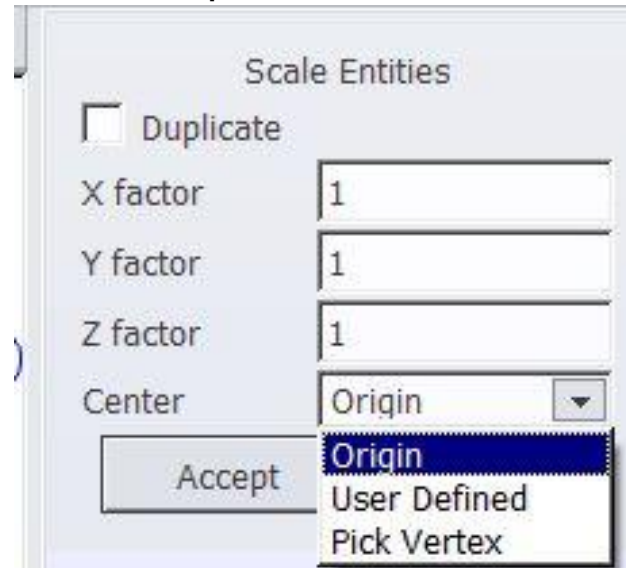


Transform

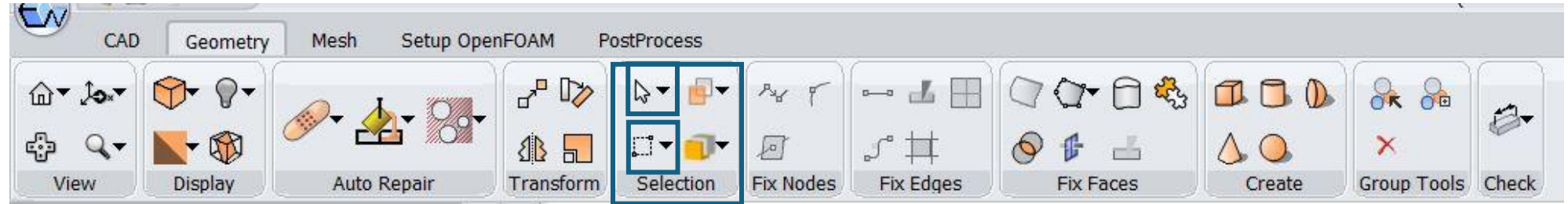


Transform : Select face/edge/node and click on respective tab

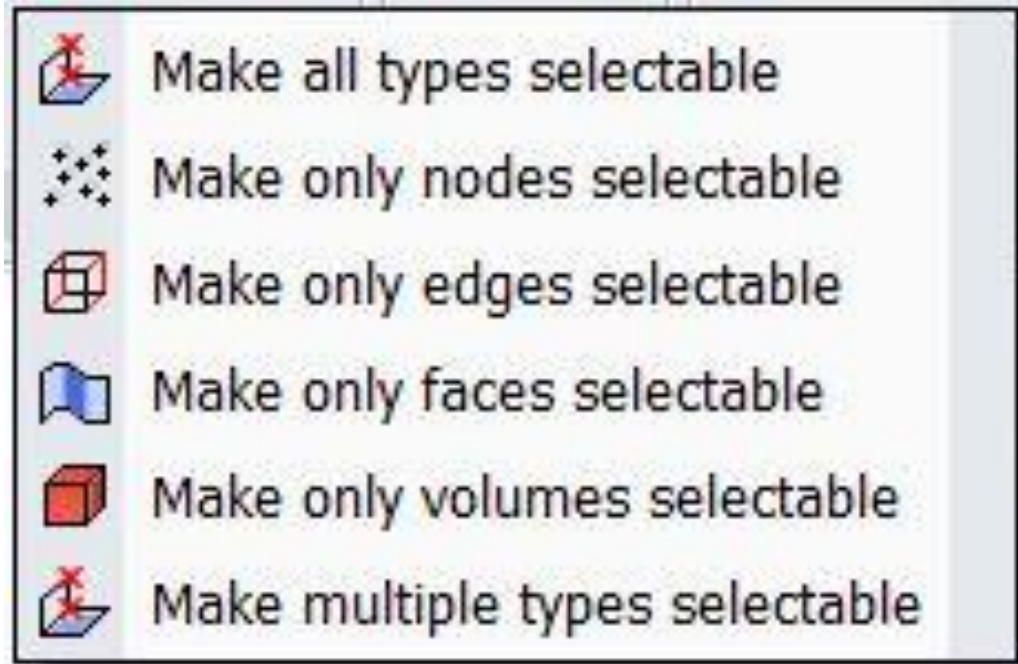
- Translate
- Rotate
- Mirror
- Scale



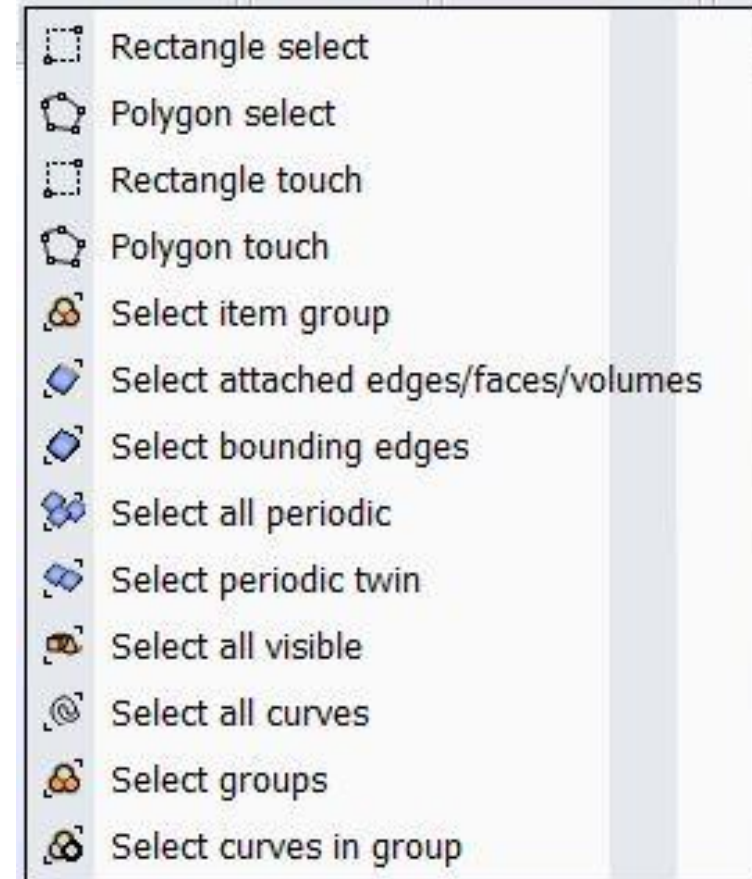
Selection



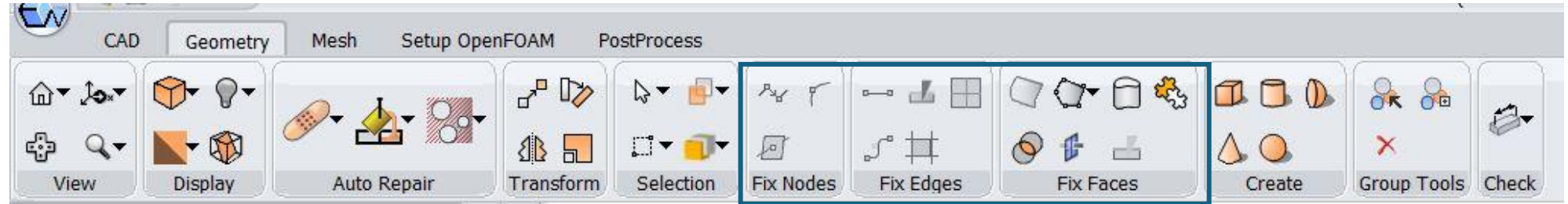
Cursor selection



CAD selection options

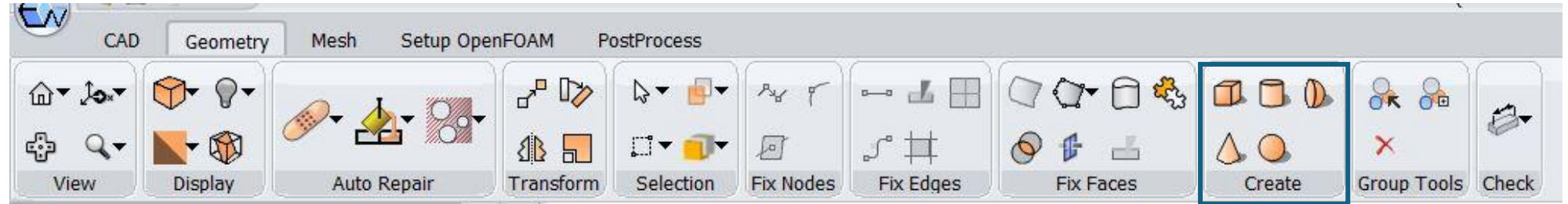


Repair



These options will be discussed during CAD repair hands-on

Create Shapes



With this primitive shapes as shown in the icons can be created.

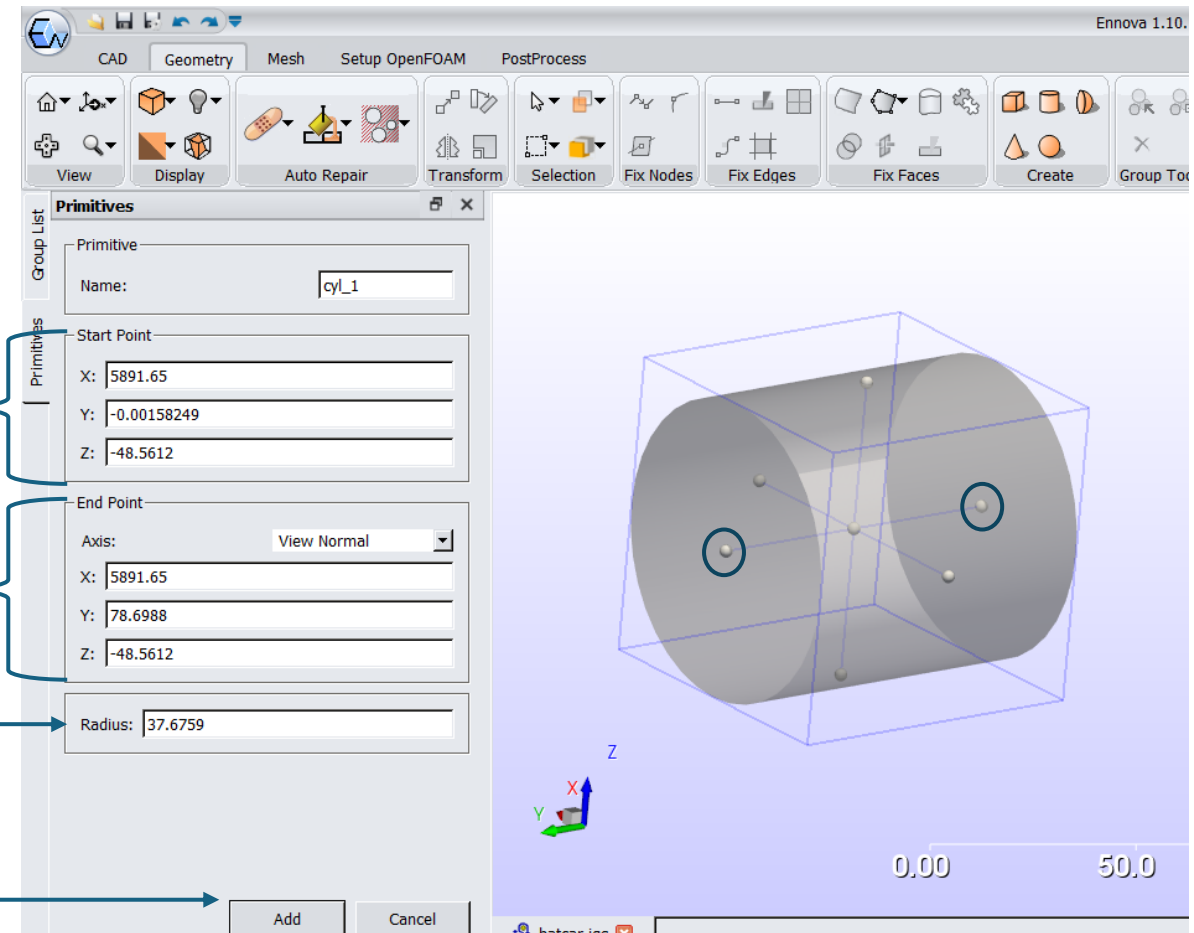
For e.g.
Cylinder

Update start point co-ordinates

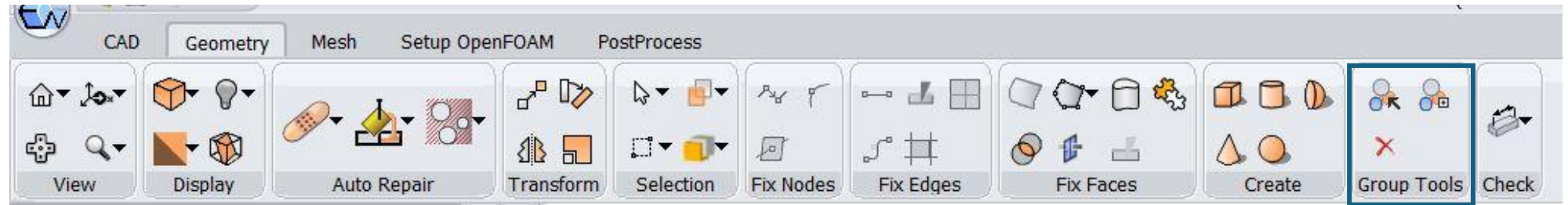
Update end point co-ordinates

Update Radius of a cylinder

Click Add



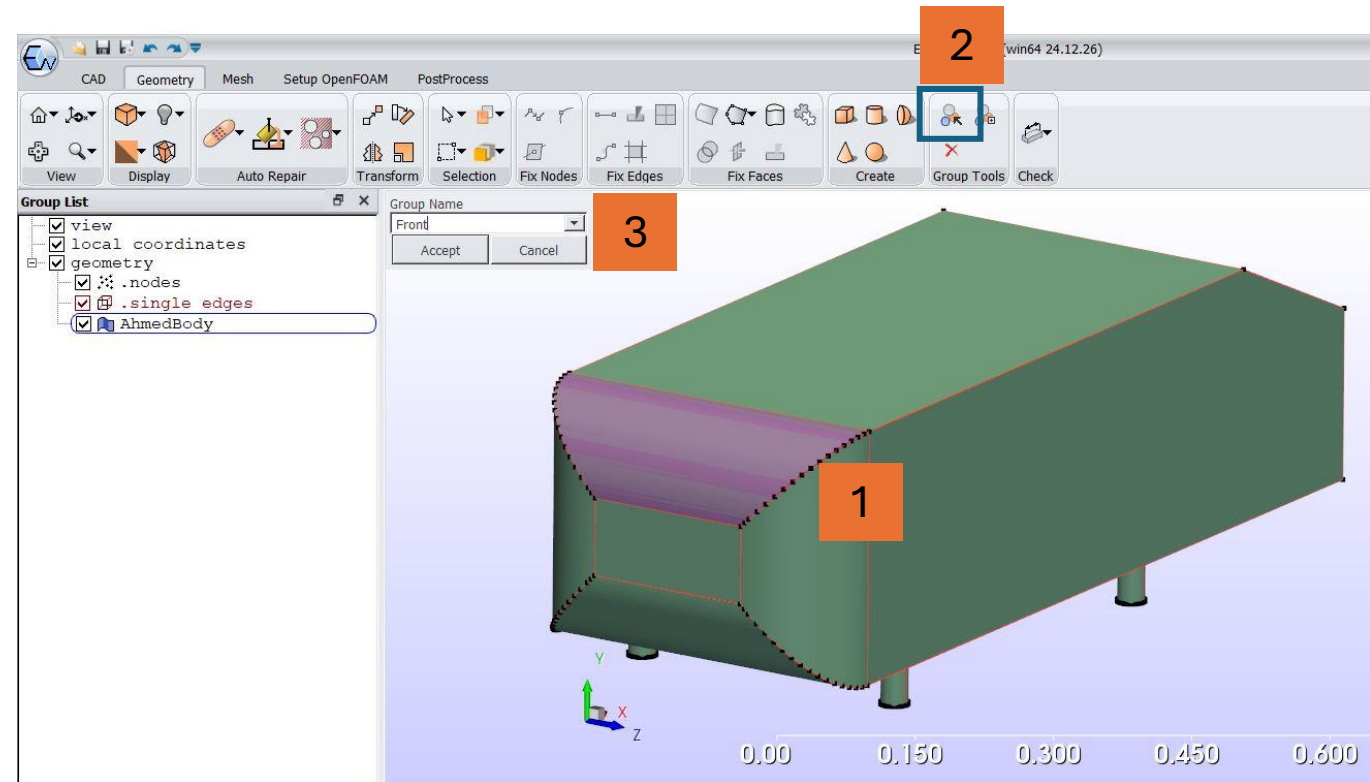
Updating Part names



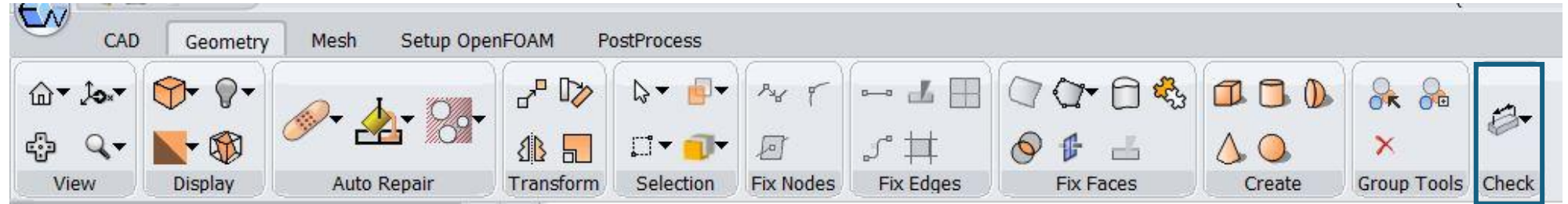
Updating Part names

In Ennova Part names are termed as group.

1. Select face or entire part/group
2. Click on move to group
3. Update part name in pop up window



Check



Measuring Tool

- Various options available to check coordinates, distance, angle and areas.

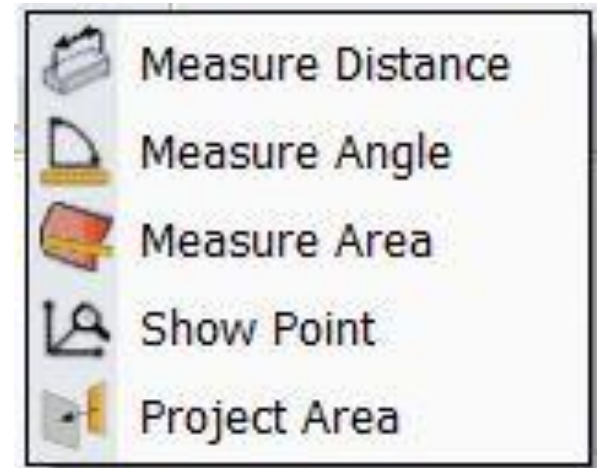
Select nodes/edges/faces to find distance between them

Select 3 nodes to find angle between them

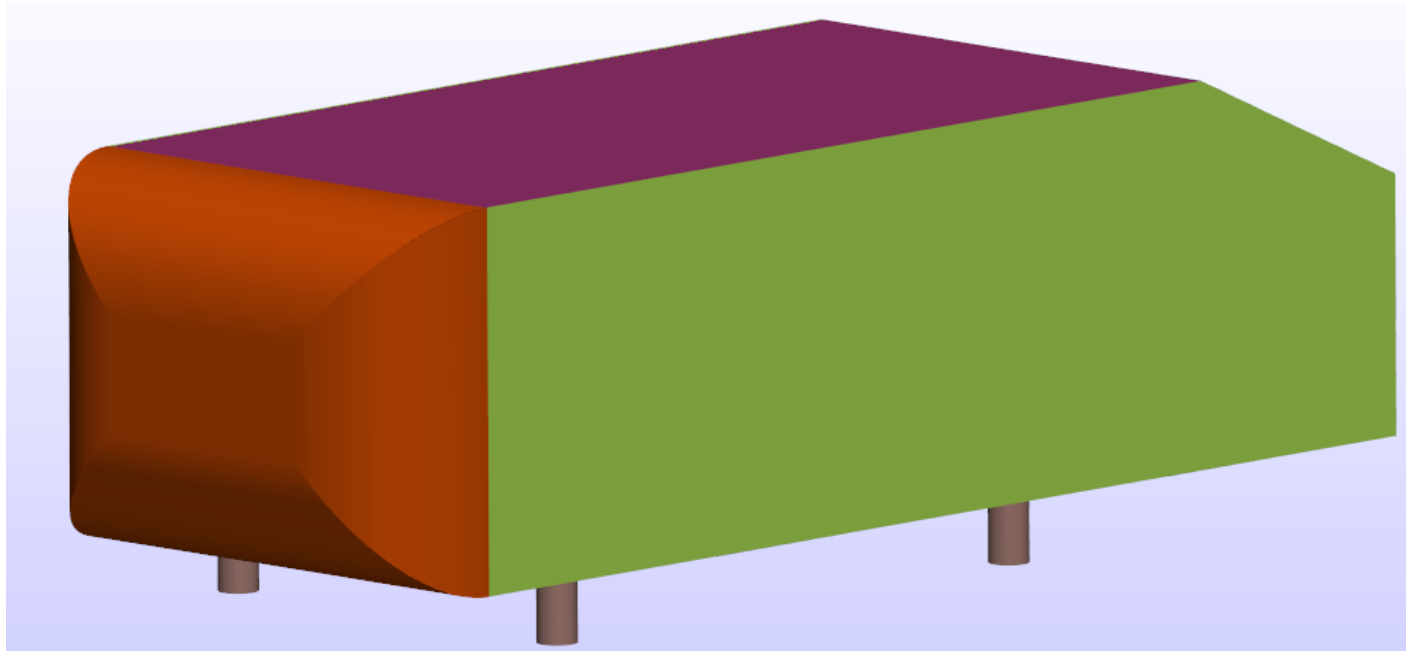
Select part/face to find its area

Select node/point to get its co-ordinates

Keep CAD aligned to the respective axis

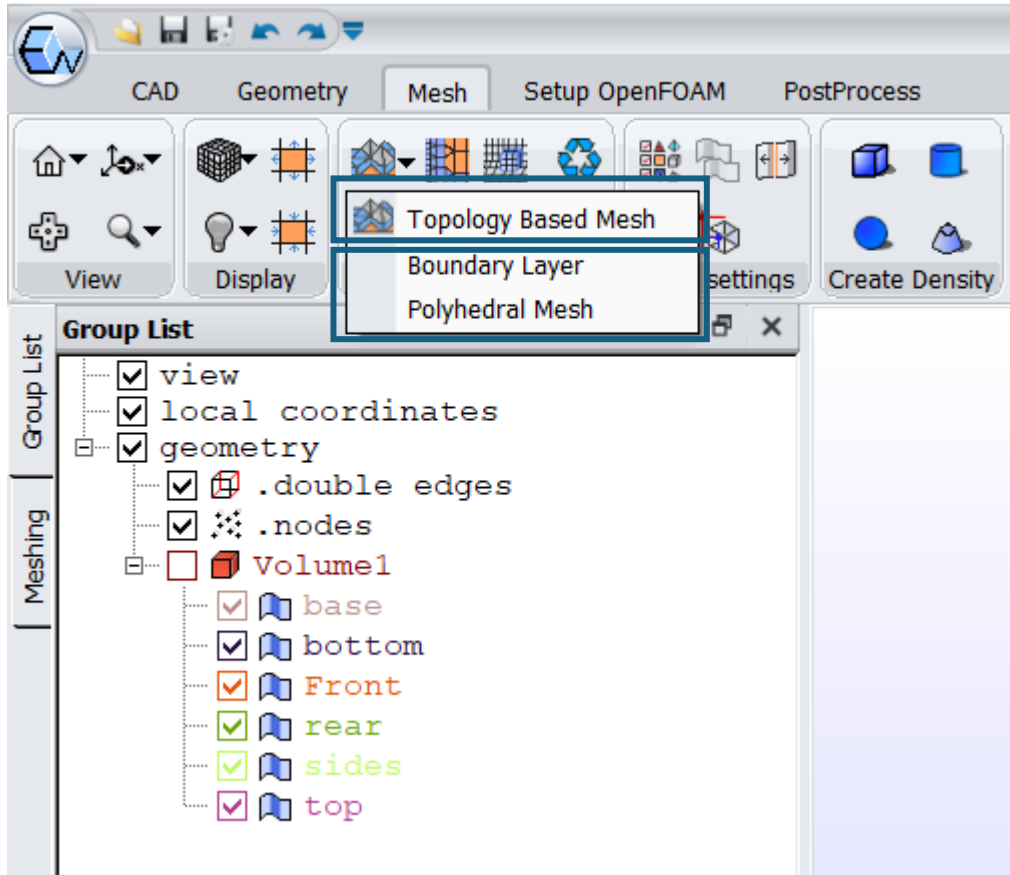
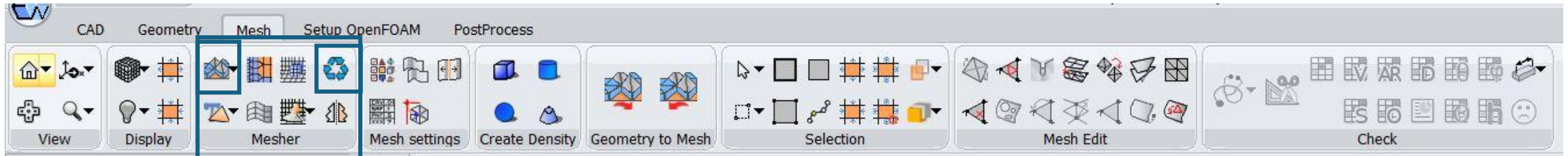


Lets Start with Ahmed body Hands on practice



Mesh Options

Mesher



Topology based mesh

- If only surface mesh is checked in the global mesh settings, this will create only surface mesh

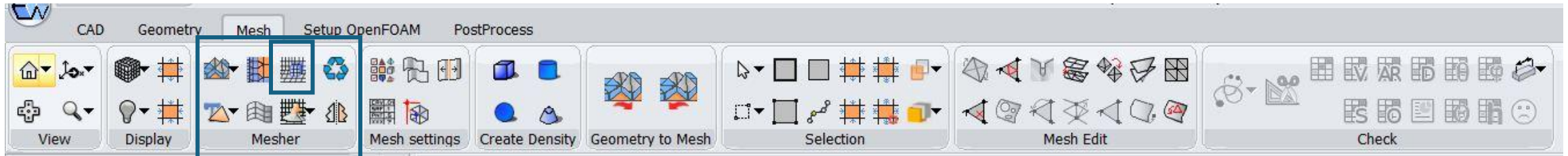
Boundary Layer & Polyhedral Mesh

- These options are checked when surface mesh + volume mesh(with BL) is selected in global mesh settings

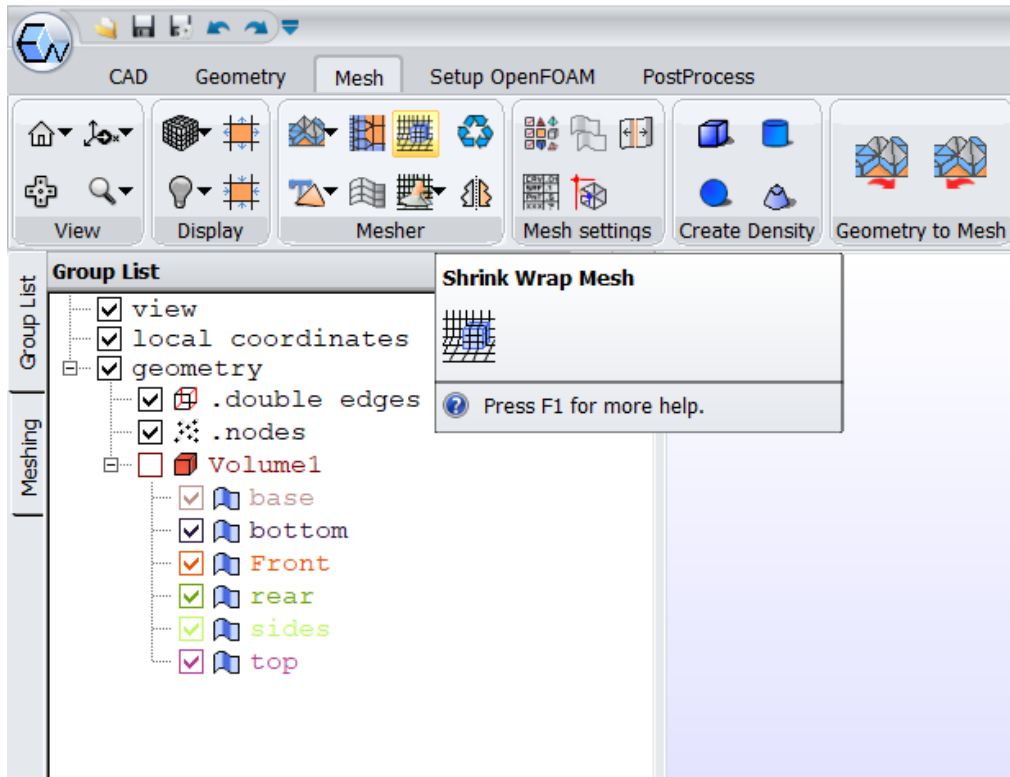
Re-mesh

- This is executed once Surface mesh is generated
- It redistributes mesh by remeshing the entire CAD

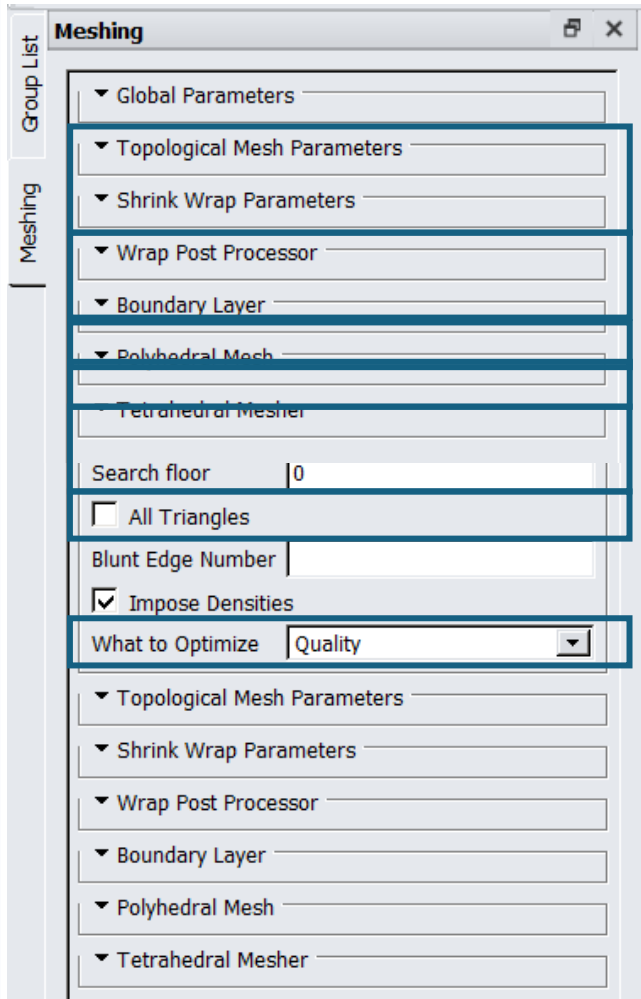
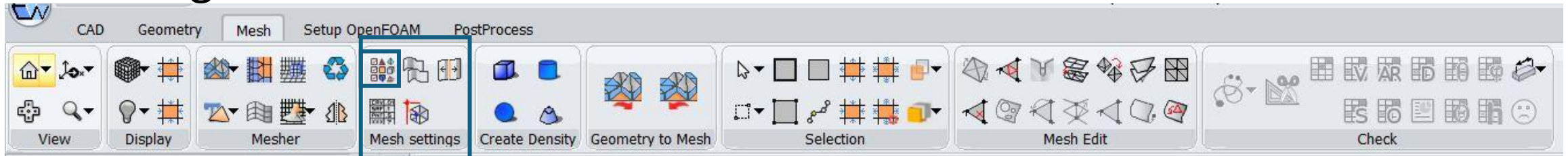
Mesh



Shrinkwrap Mesh



Mesh settings - Global



Element Size

- Max and min mesh element size

Sag Number & Refinement Number

- Deviation of an element center from the actual surface of the CAD
- Sag number and refinement number are eventually same. Changing value of one will alter the other
- Higher the value of refinement number (corresponds to lower value of sag number) more accurate is the geometry capture

Size Ratio

- It is an expansion ratio
- Default value is 1.2

Run Booster

- Applicable for volume mesh
- Improves volume mesh quality

Elements in gap

- No. of elements to be placed in the gap. (No. should be greater than zero)

Search Floor

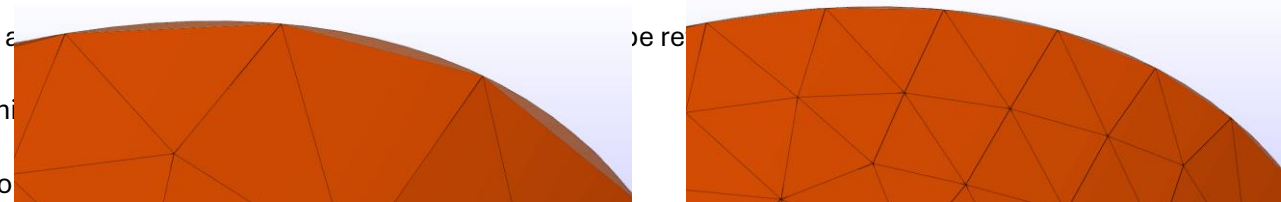
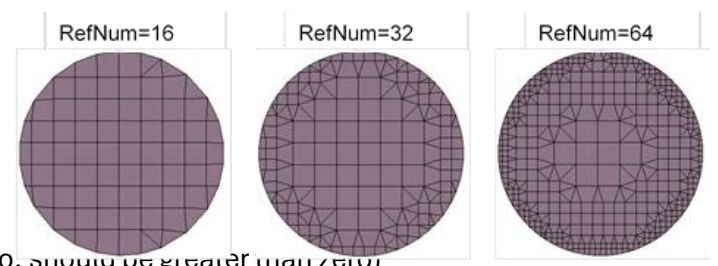
- If elements in gap is > 0 then gaps which are not closed will be refined

All Triangles

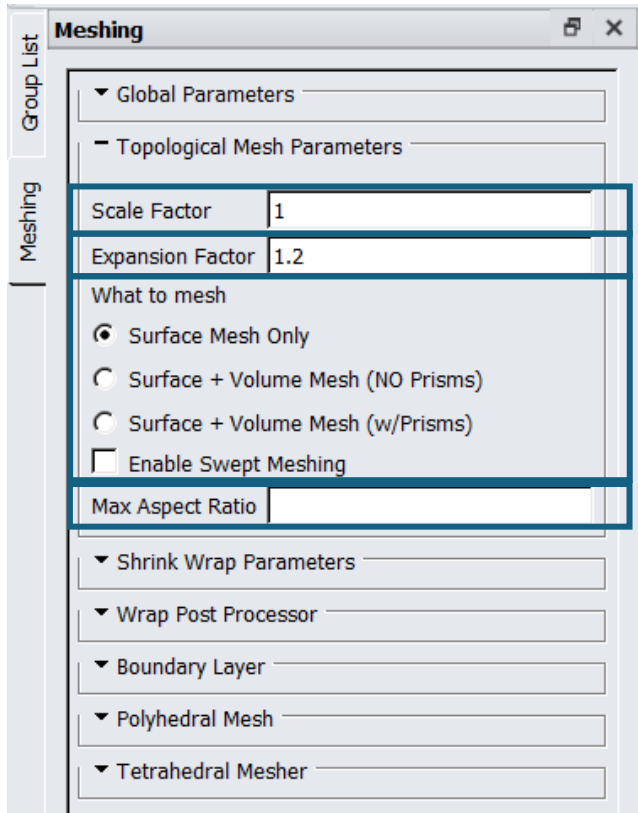
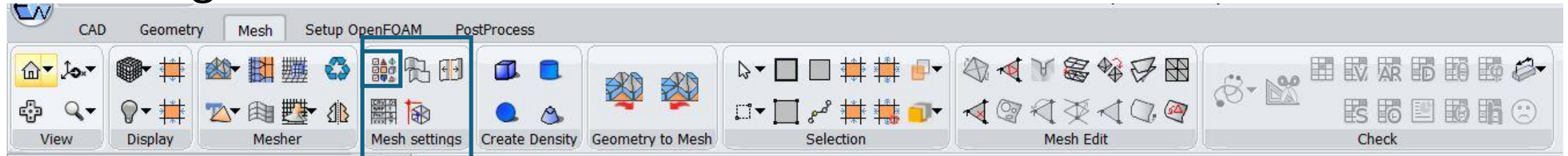
- Ennova by default creates mix mesh. If this option is checked, it will create a mesh of all triangles

What to optimize

- Various options available according to solver
 - Skewness, aspect ratio, orthogonality
- Default is Quality, which optimizes over all quality



Mesh settings - Global



Scale factor

- Scale factor to scale the element size. (Default is 1)

Expansion factor

- This is same as size Ratio

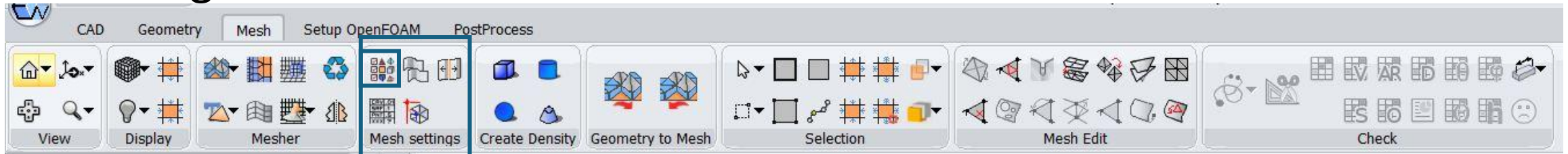
What to mesh

- Selection will define what to mesh
- For the scope of this tutorial, only surface mesh is considered

Max aspect ratio

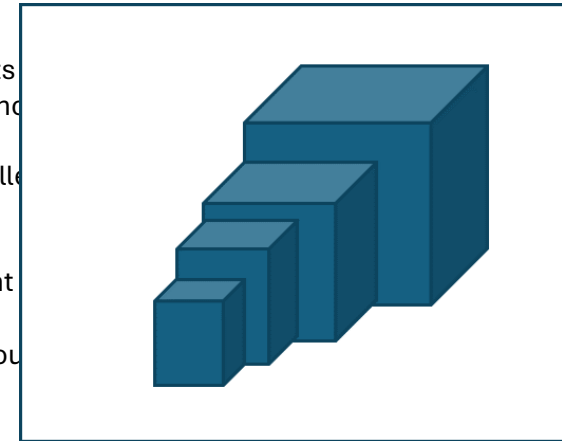
- Limits quad elements to the provided value of aspect ratio

Mesh settings - Global



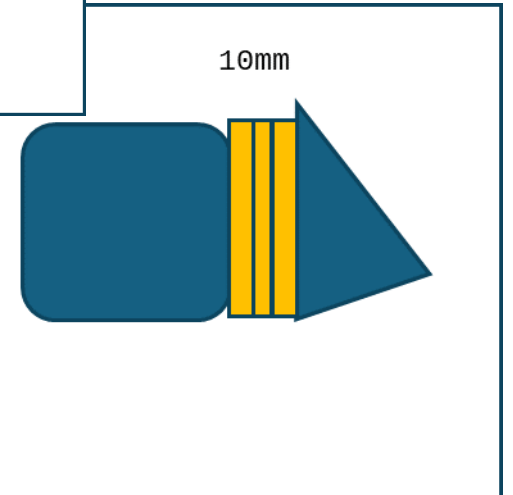
Shrinkwrap

- Widely used for complex geometries which would require lots of elements
- Keep internal Shells – This should be unchecked if there are no internal shells
- Gap Close Tolerance
 - This will close any gap between parts/surfaces which is smaller than the specified tolerance
- Gap Close Refinement
 - It will create number of elements specified here
- E.g. if gap close tolerance is 10mm and Gap close refinement is 10, it will create 10 elements per 10mm
- Scale Down Factor
 - If number is < 1, it will reduce the size of element by that amount
- Which Volume
 - External – Creates external wrapped mesh
 - Largest Internal – Creates internal wrap and only produces mesh of the largest volume
 - Seed Point – One has to provide co-ordinates of the point which will be considered for creating the mesh
 - Nth Largest
 - # Nth Largest – Number provided here decides for which volume wrapped mesh has to be produced for
 - For example If CAD has 4 closed volumes and number here is 3, then it will create mesh for 3 largest volumes
 - 1st to Nth Largest
 - # Nth Largest – Number provided here decides rapped mesh has to be produced for
 - For example If CAD has 4 closed volumes and number here is 2, then it will create mesh for 2 largest volumes
 - Larger than threshold
 - Creates wrapped mesh for all the volumes larger than the specified size

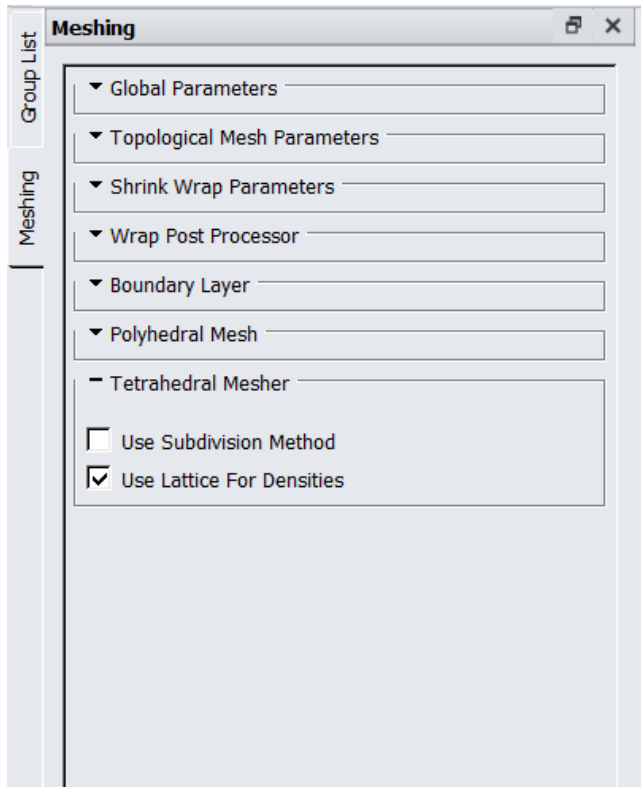
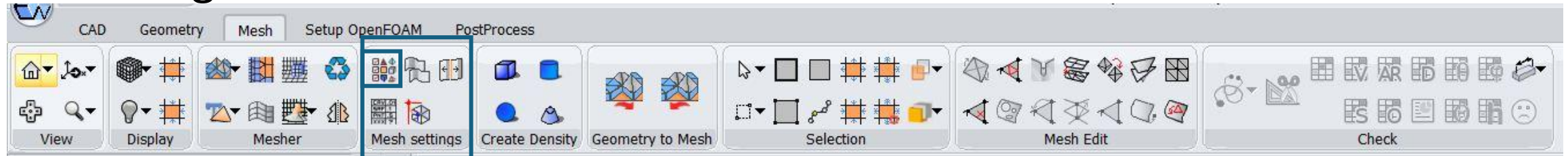


for mesh

closed gap



Mesh settings - Global



Boundary Layer

- Height – First cell height of the prism layer
- Height Ratio – Expansion ration of prism layers

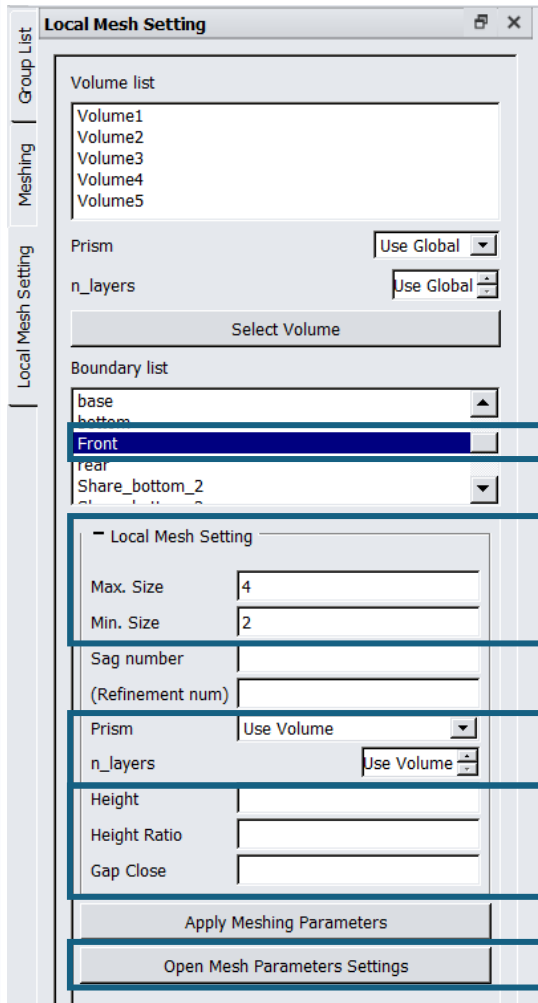
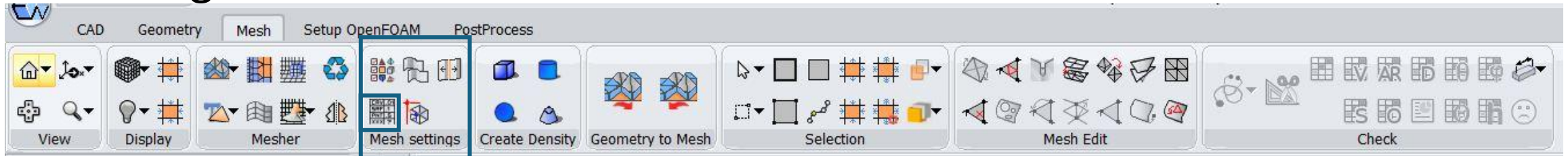
Quality Parameters

- This should be kept default

Tetrahedral Mesh

- Methods for generating tetrahedral volume mesh
- Keep it default

Mesh settings - Local



Part/Group selection

Element Size

- Provide min and max value of element size for selected

Prism Elements

- Use Volume – considers from global mesh settings
- No. of layers – default is from global mesh settings. User can provide required number of prism layers which are not same as global mesh

Height – First cell height of the prism layer

Height Ratio – Growth ratio of prism layer

Mesh Parameters

Local Mesh Setting Parameters												
name	active group	Max. Size	Min. Size	Sag number	Refinement num	Size Ratio	Prism	n_layers	Height	Height Ratio	Gap Close	Coord name
global		64.0	8.0	0.0981748	8.0		☒	0				
Groups												
Back							Off	Use Volume				
Base							Off	Use Volume				
Bottom							Off	Use Volume				
Front		8.0	8.0				Off	Use Volume				
Sides							Off	Use Volume				
Top							Off	Use Volume				

Mesh settings - Local

In Ennova, user can set sizing to an individual edge or face of the part/Group

Setting size with Edge

Edge Mesh Parameters

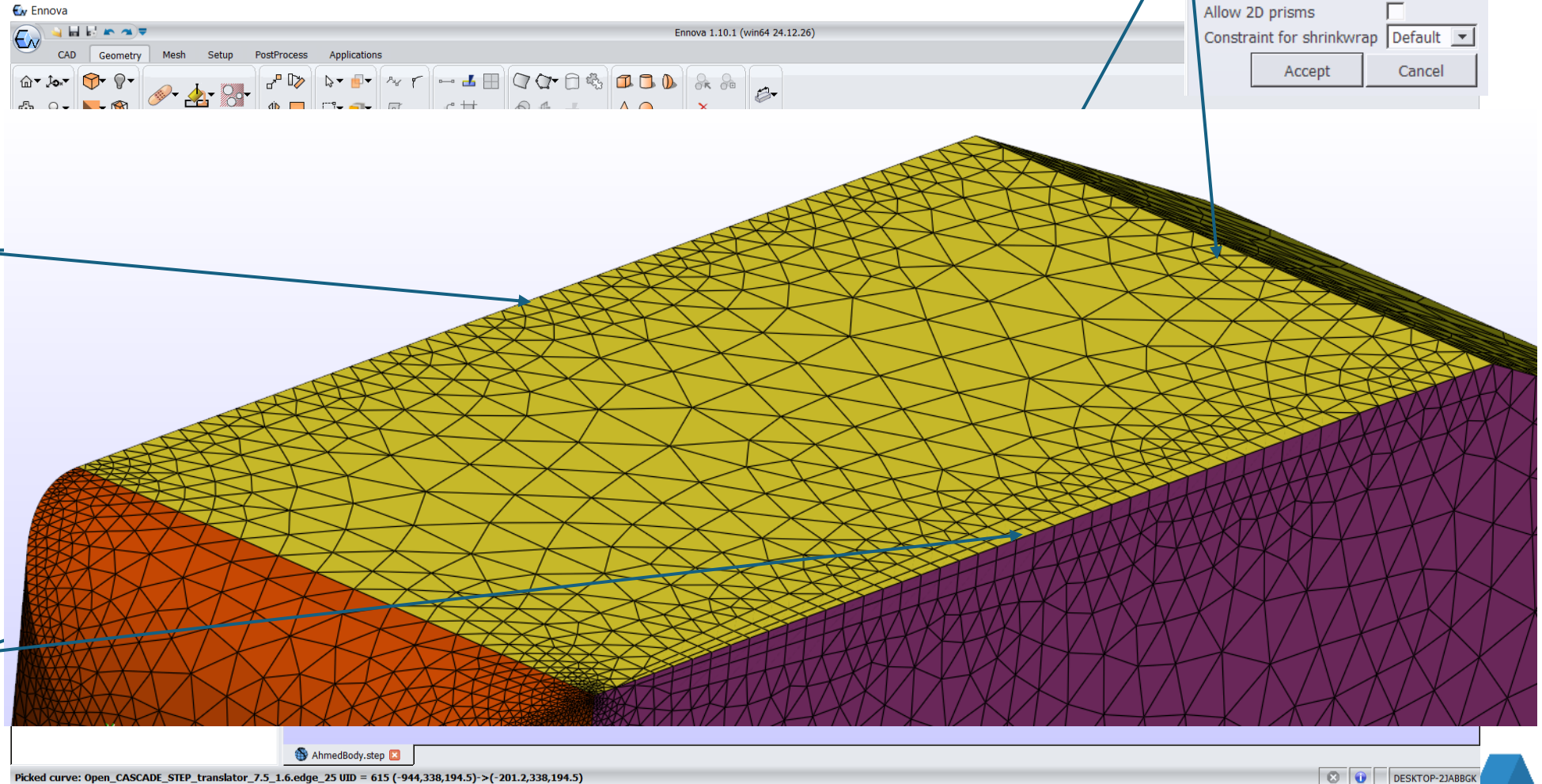
Max. Size	16.0
Number of Nodes	
Spacing 1	
Growth Ratio 1	1.2
Spacing 2	
Growth Ratio 2	
2D Prism Height	
Allow 2D prisms	☐
Constraint for shrinkwrap	Default

Accept Cancel

Edge Mesh Parameters

Max. Size	16.0
Number of Nodes	
Spacing 1	
Growth Ratio 1	1.2
Spacing 2	
Growth Ratio 2	
2D Prism Height	
Allow 2D prisms	☒
Constraint for shrinkwrap	Default

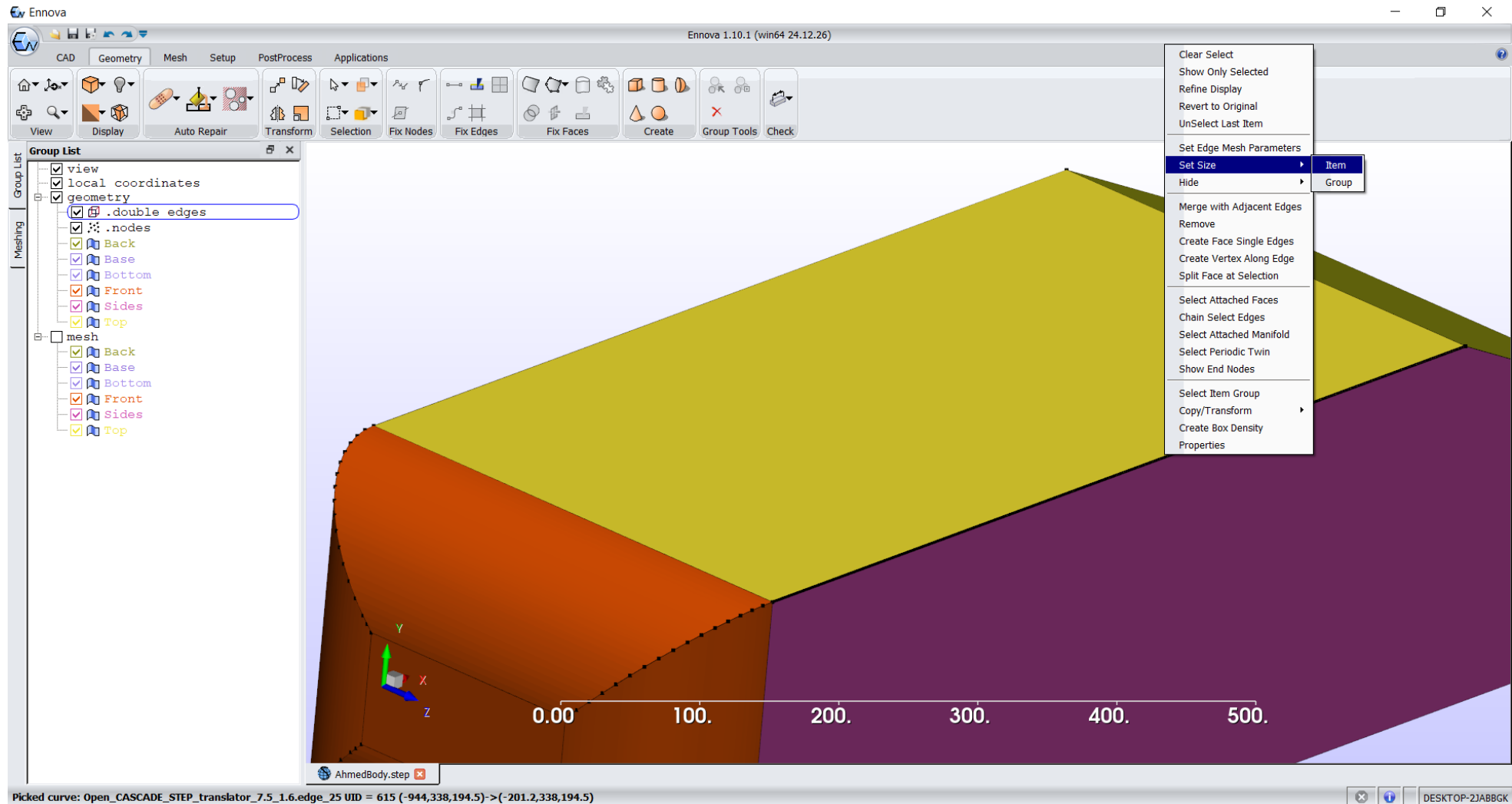
Accept Cancel



Mesh settings - Local

In Ennova, user can set sizing to an individual edge or face of the part/Group

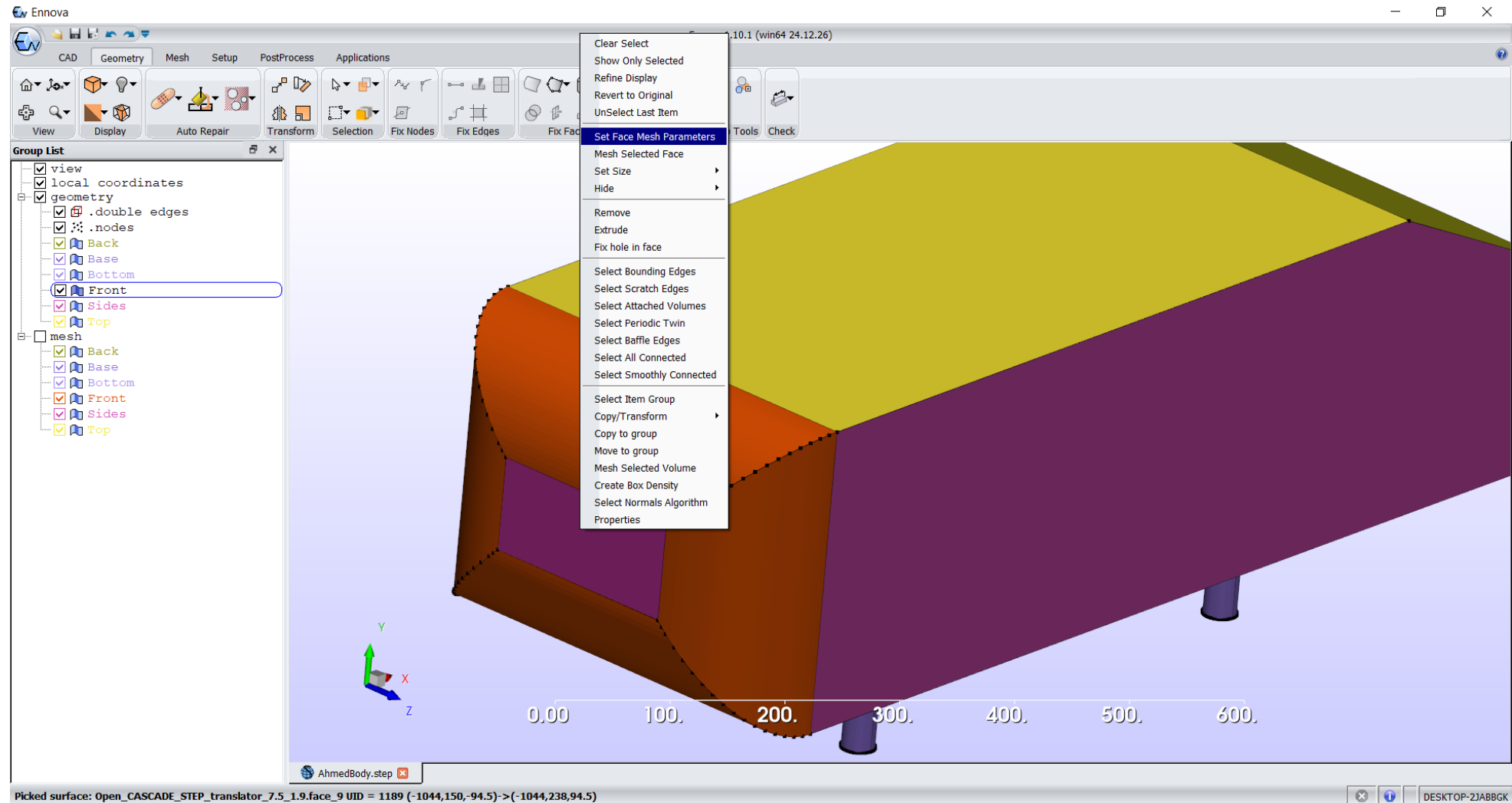
Setting size with Edge



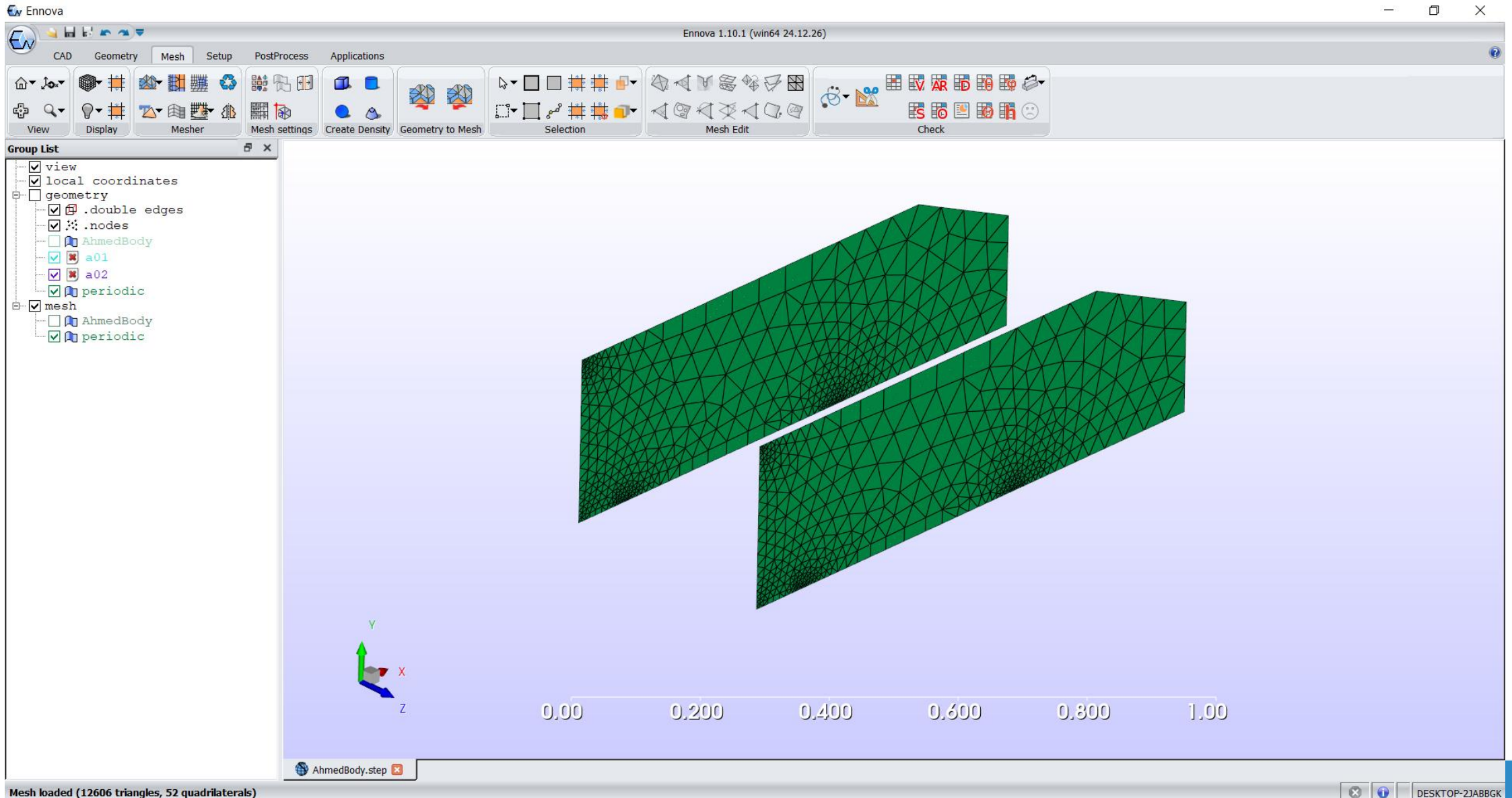
Mesh settings - Local

In Ennova, user can set sizing to an individual edge or face of the part/Group

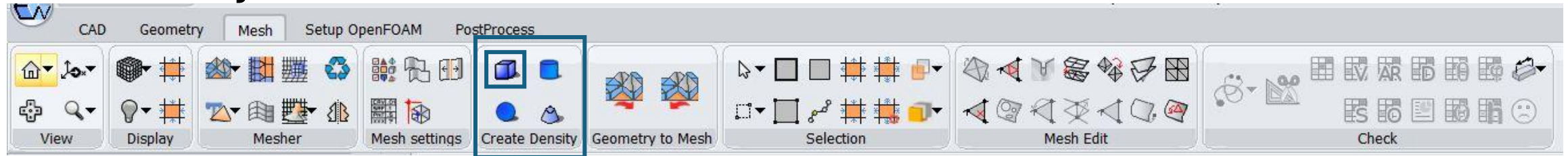
Setting size with Face



Mesh - Periodicity



Create Density



Group List

Create Density (Box)

Density

Name:

Start Point

X:

Y:

Z:

Box Dimensions

K-Axis Direction:

I Length:

J Length:

K Length:

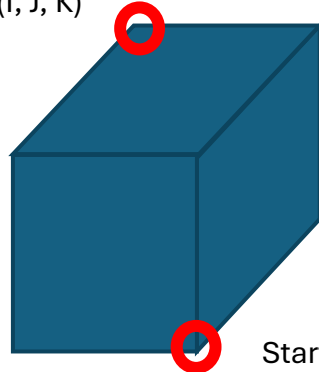
Sizing Parameters

Size:

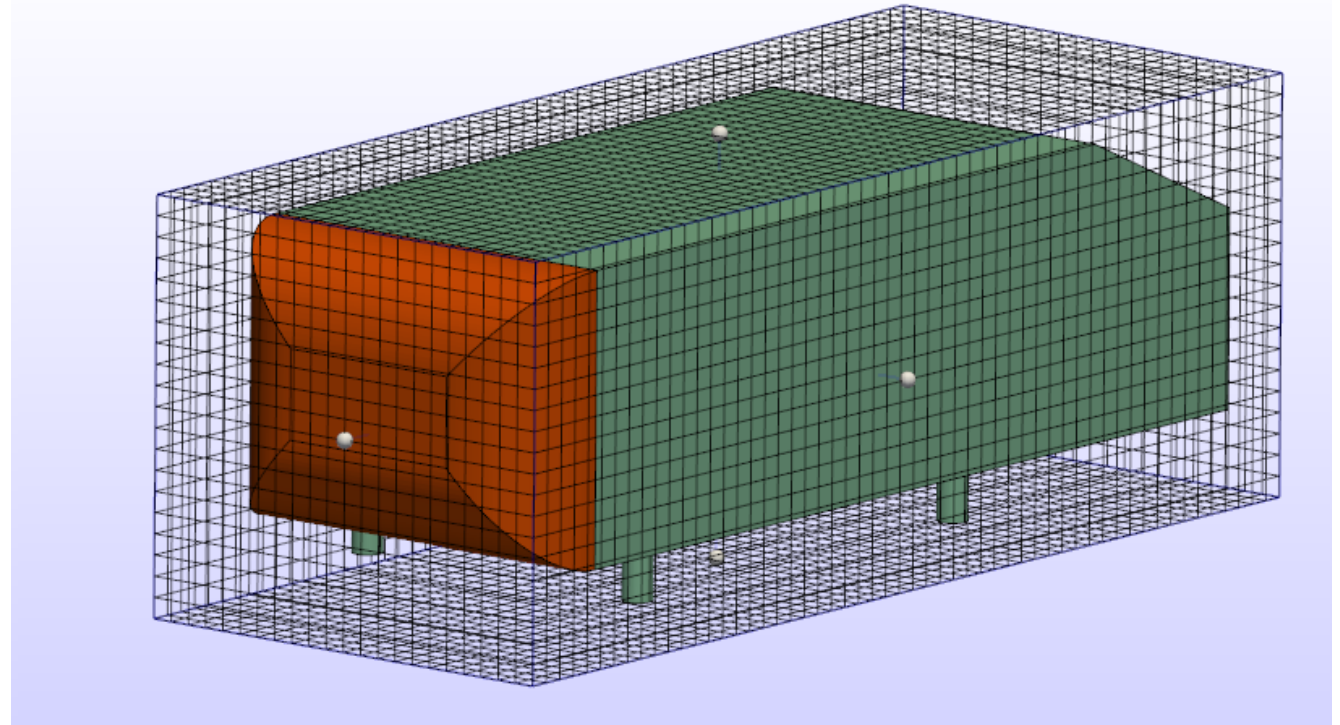
Ratio:

Ok Cancel

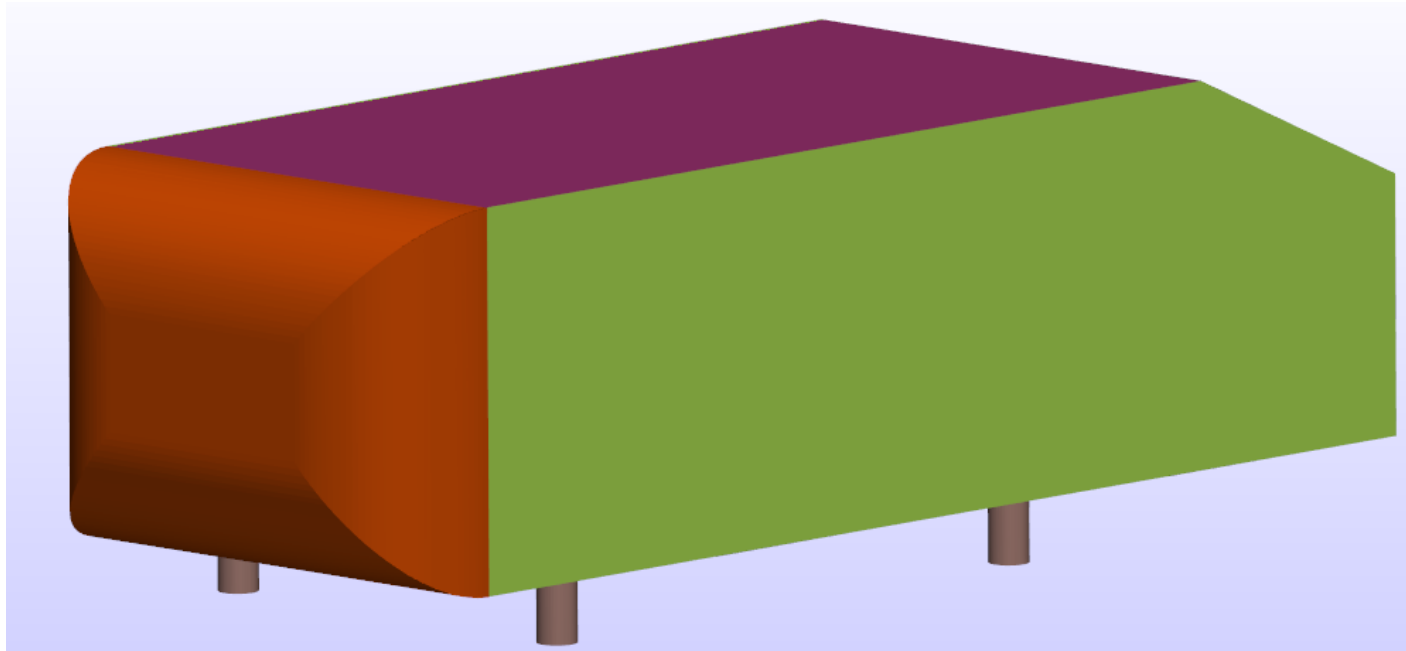
End point
(I, J, K)



Start point
(x, y, z)



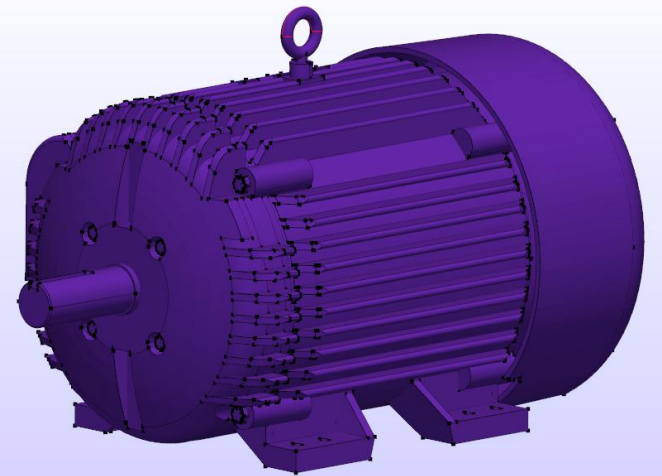
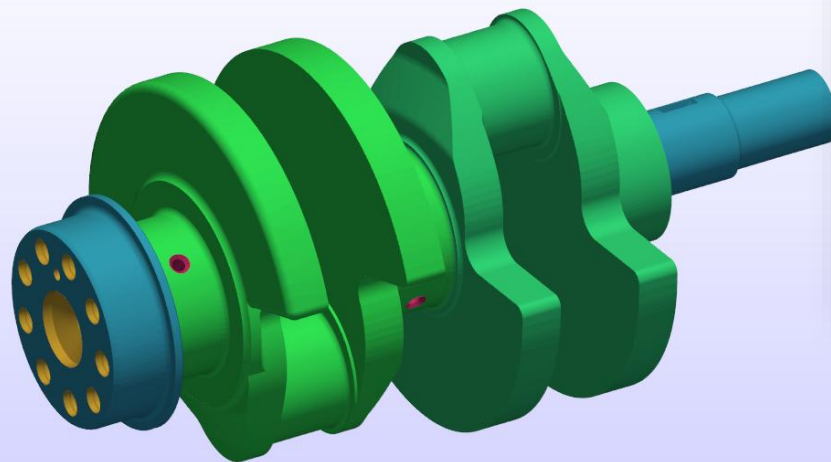
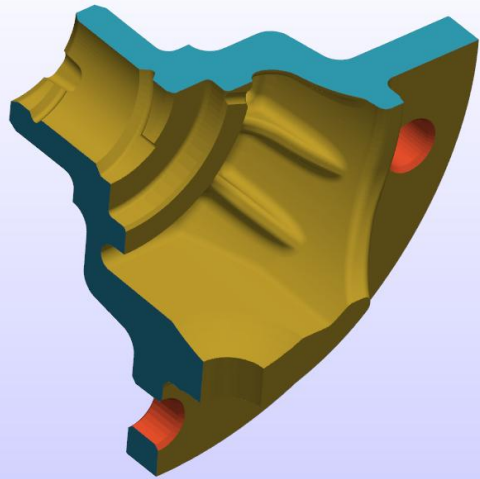
Ahmed body - Mesh Hands on practice



Day 02

Example Cases

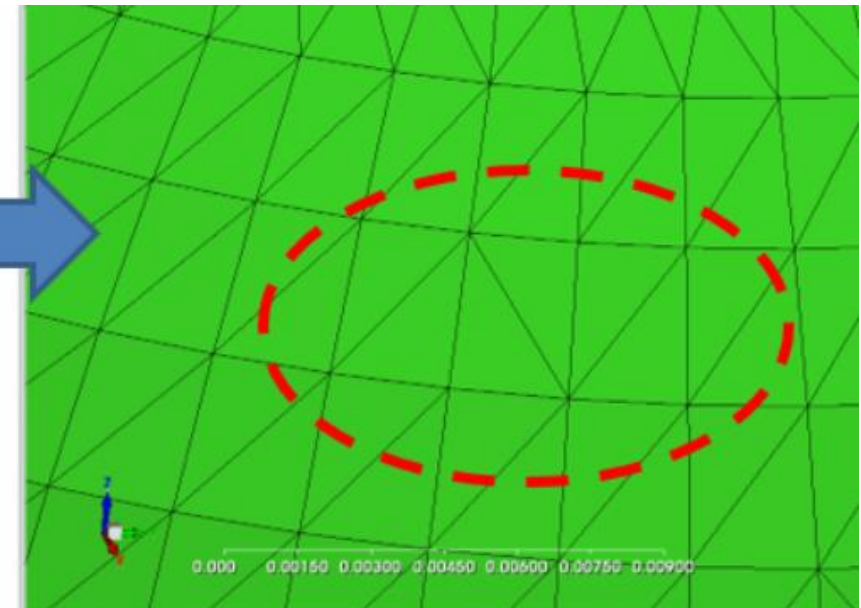
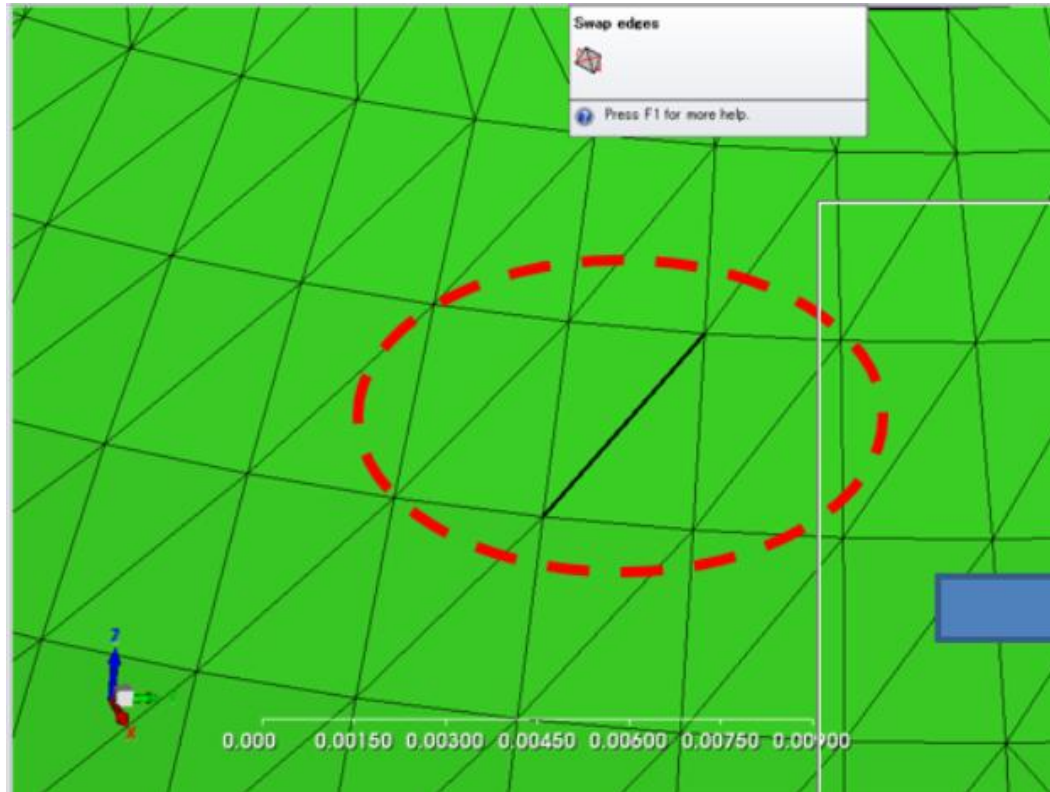
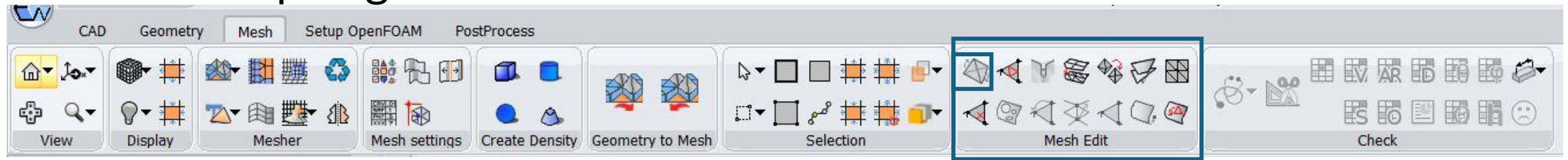
Hands on practice



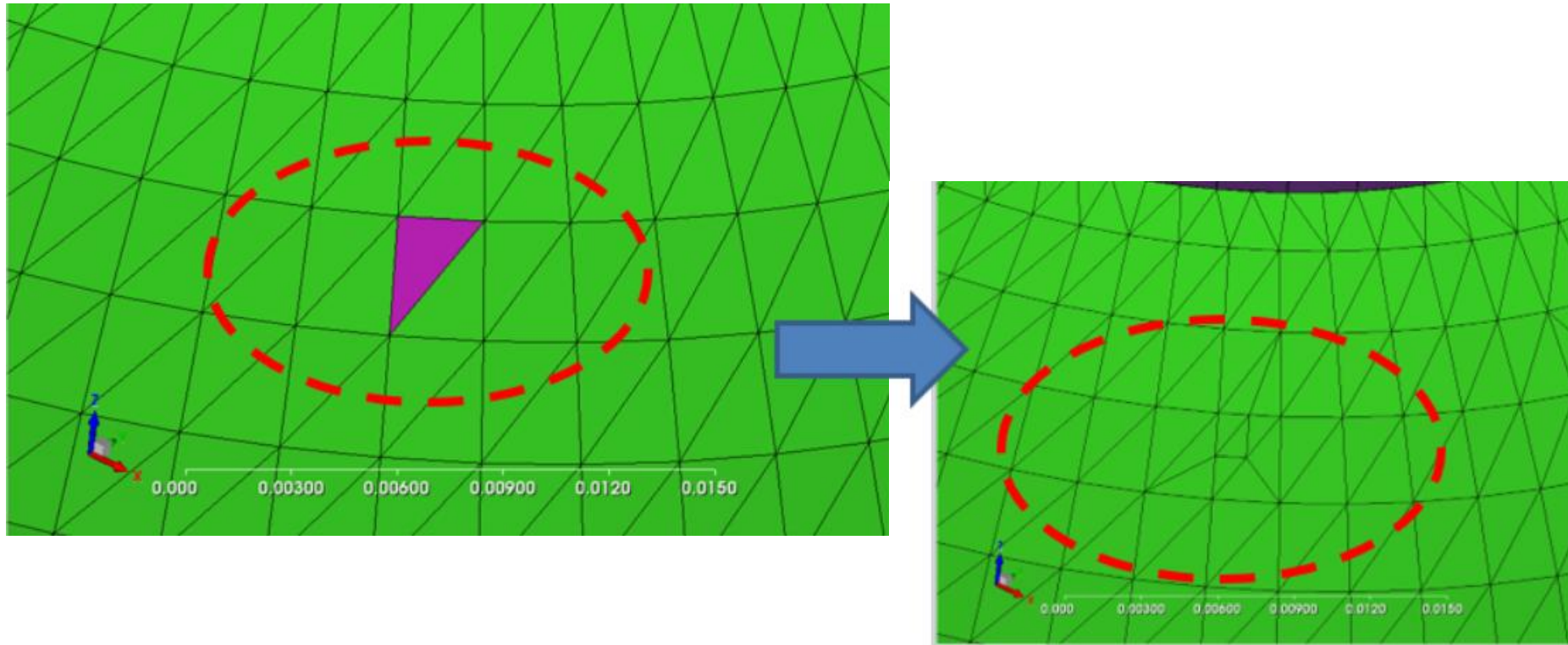
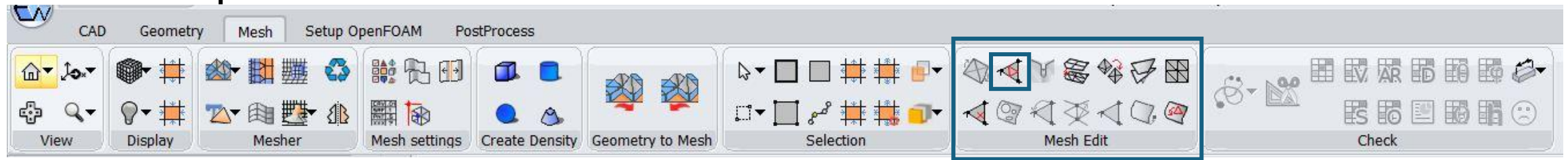
Thank You

INDEX

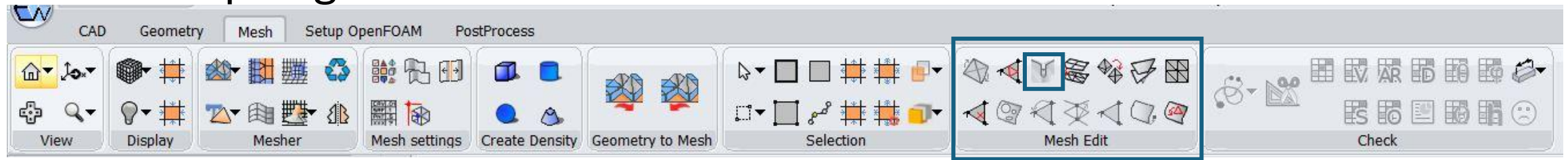
Mesh Edit : Swap Edge



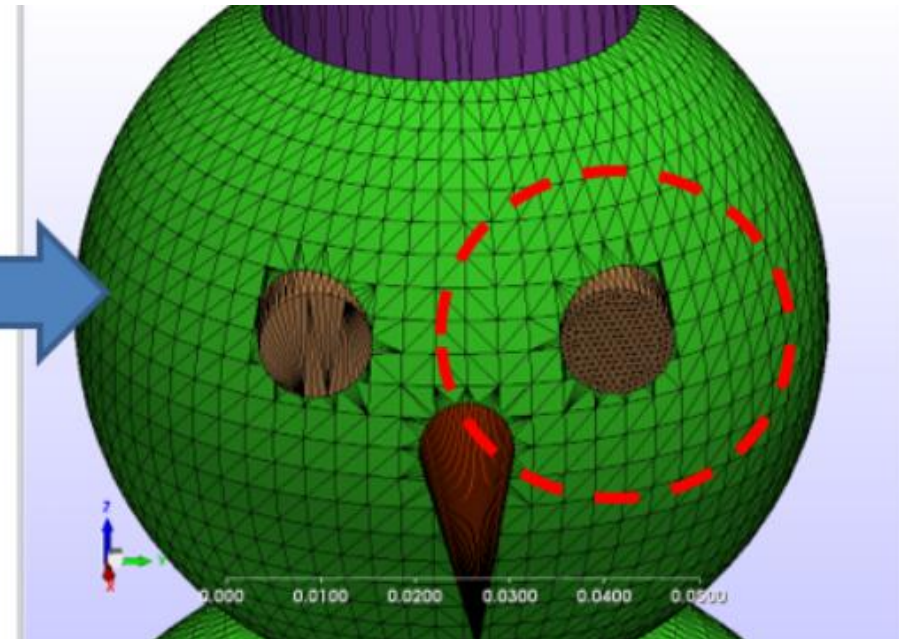
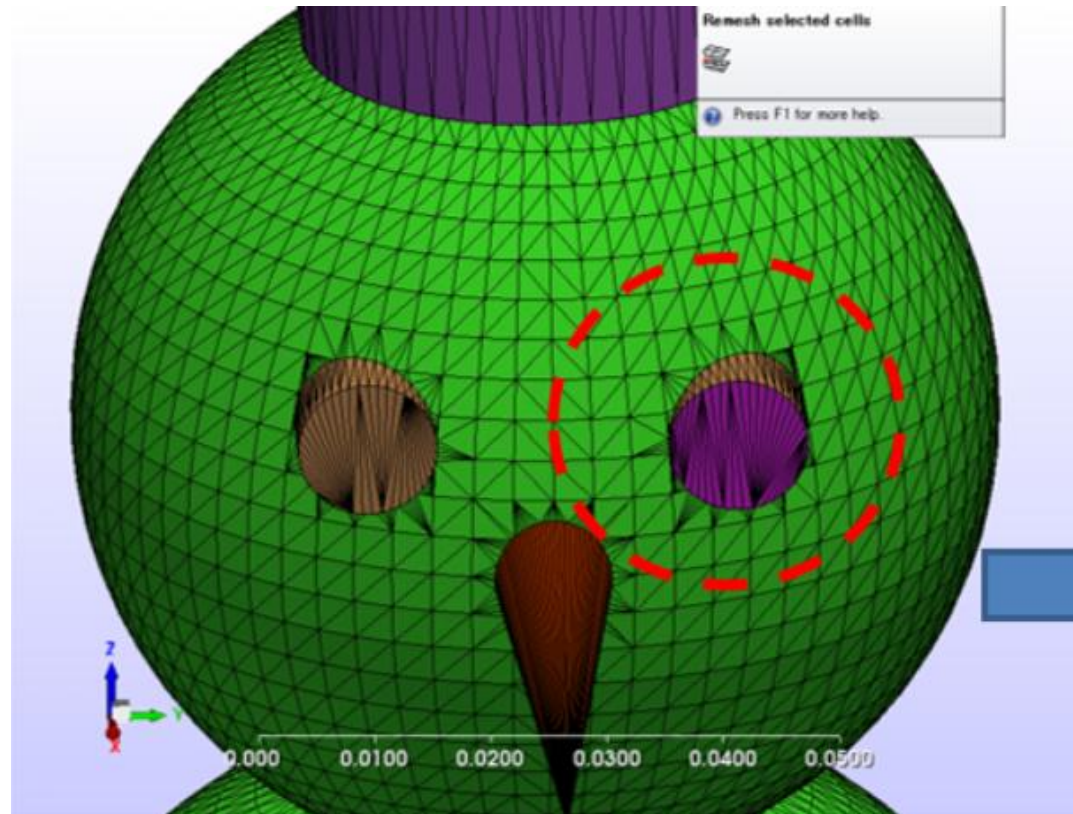
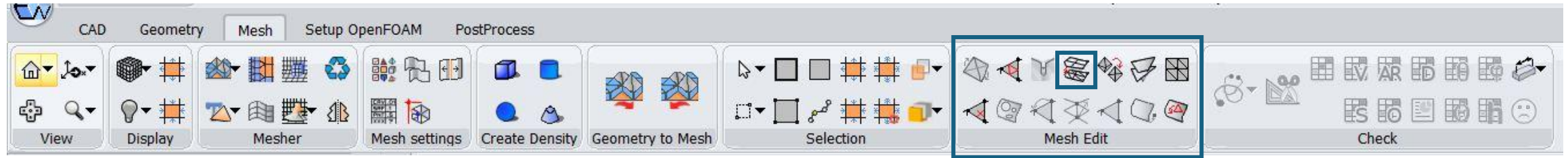
Mesh Edit : Split Mesh



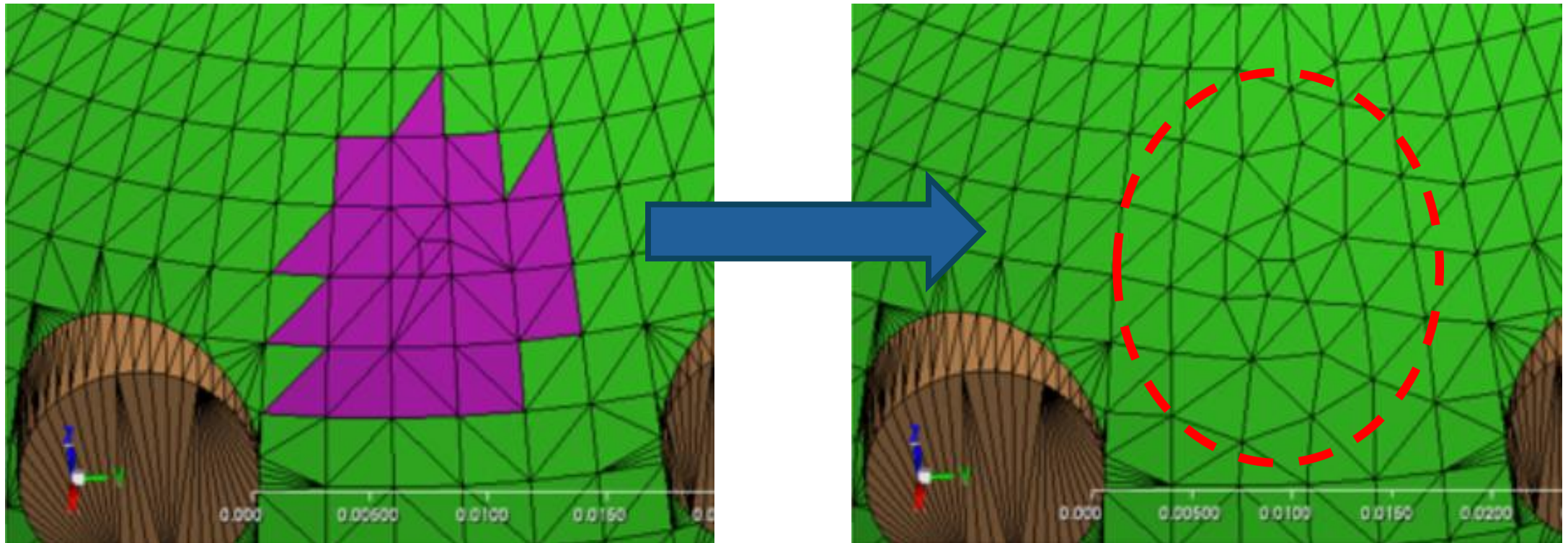
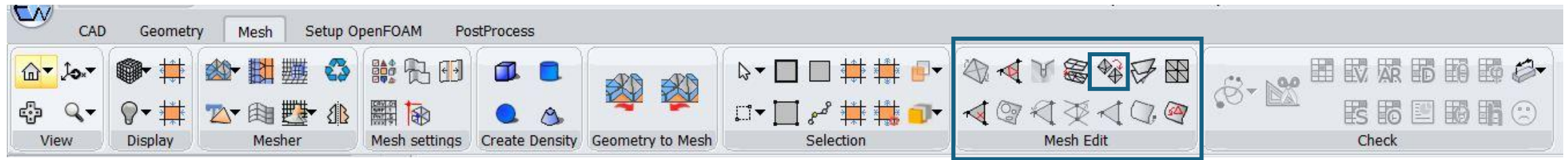
Mesh Edit : Zip Edge



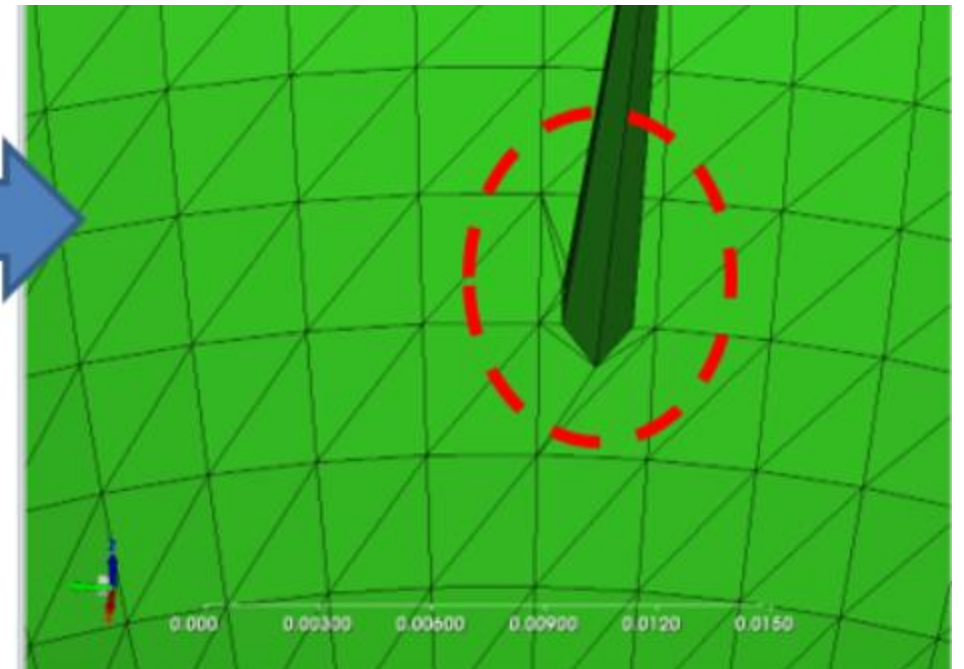
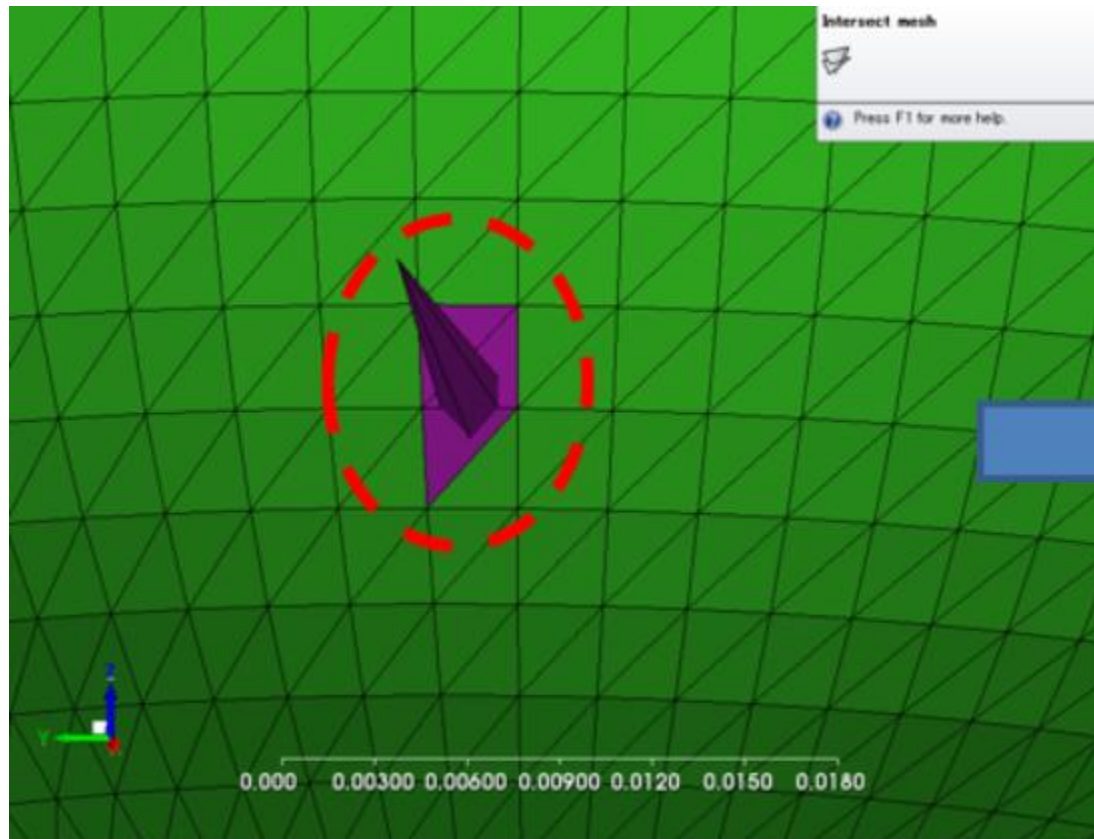
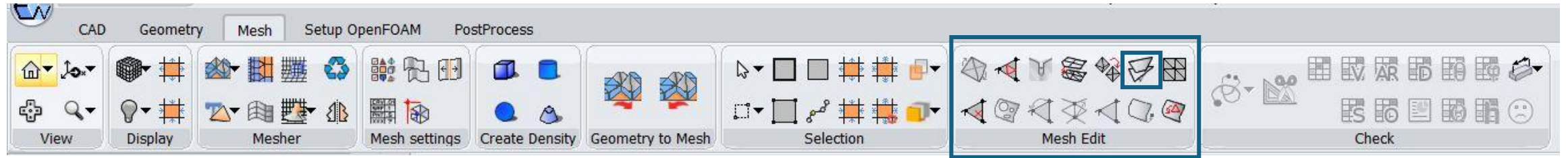
Mesh Edit : Remesh selected



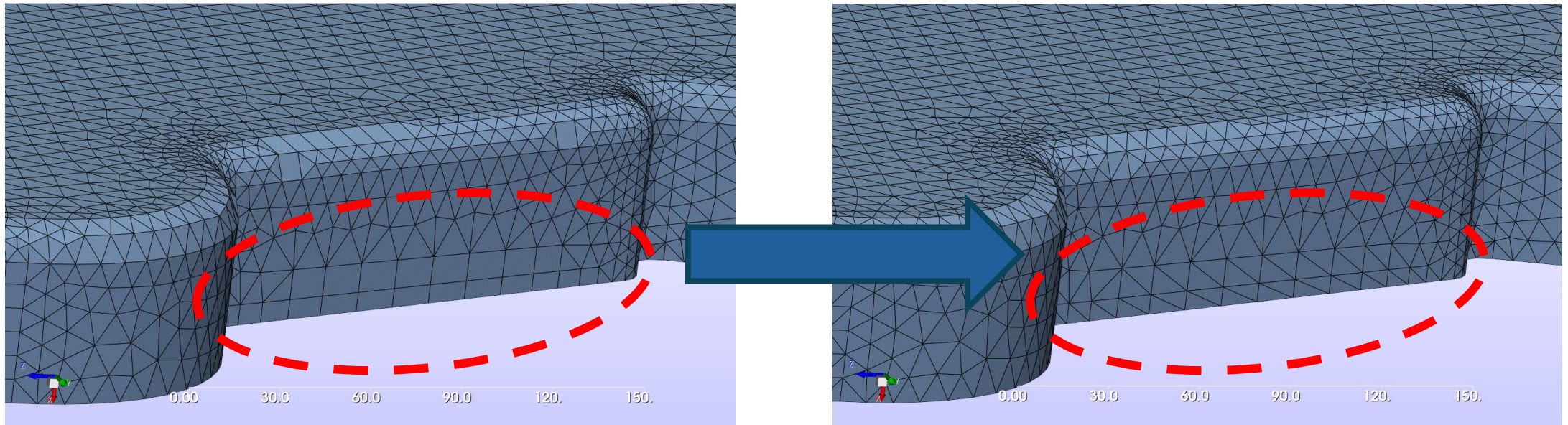
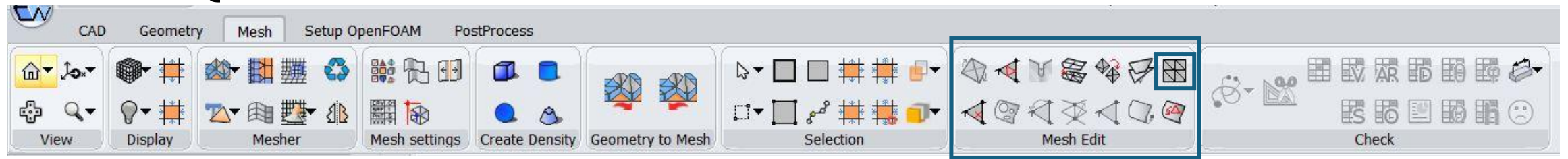
Mesh Edit : Smooth selected



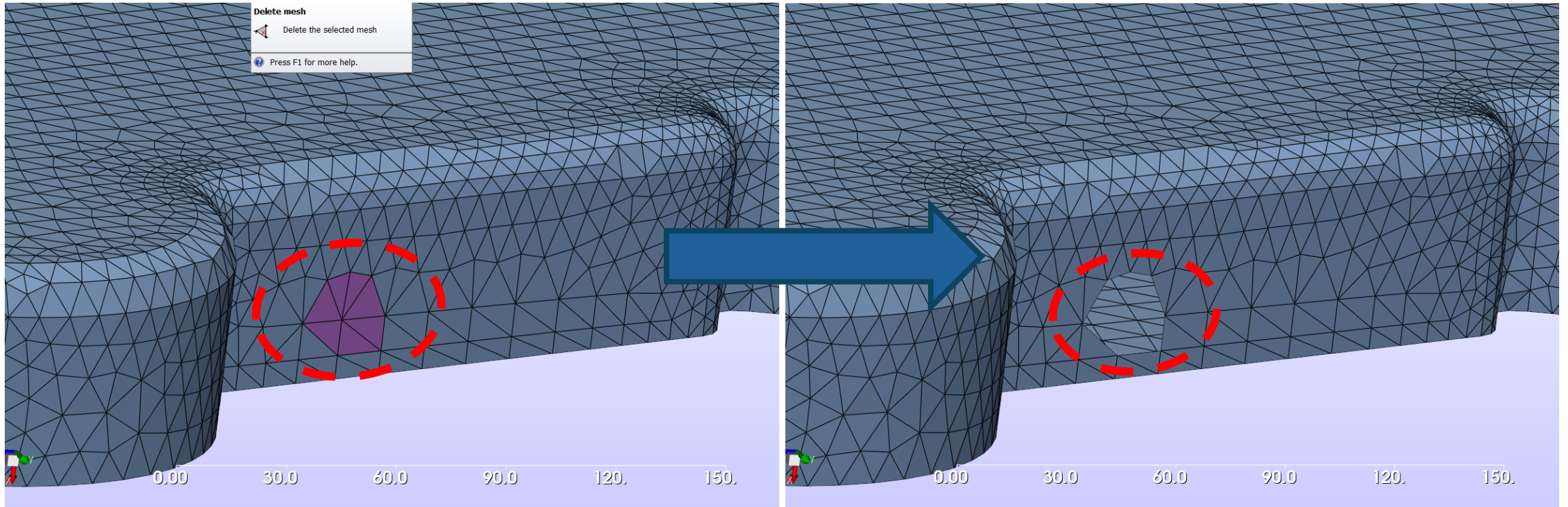
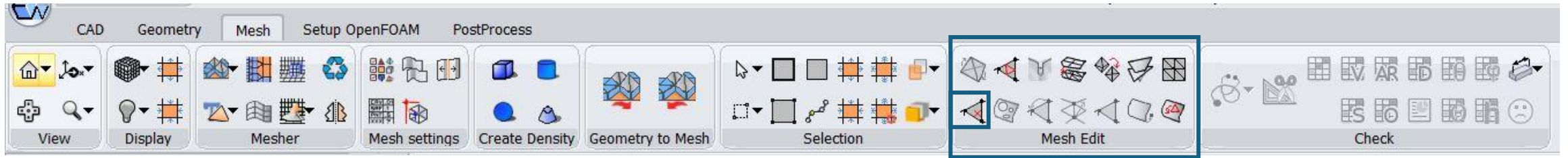
Mesh Edit : Intersect



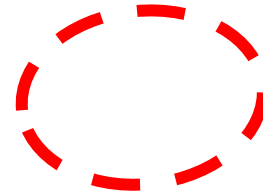
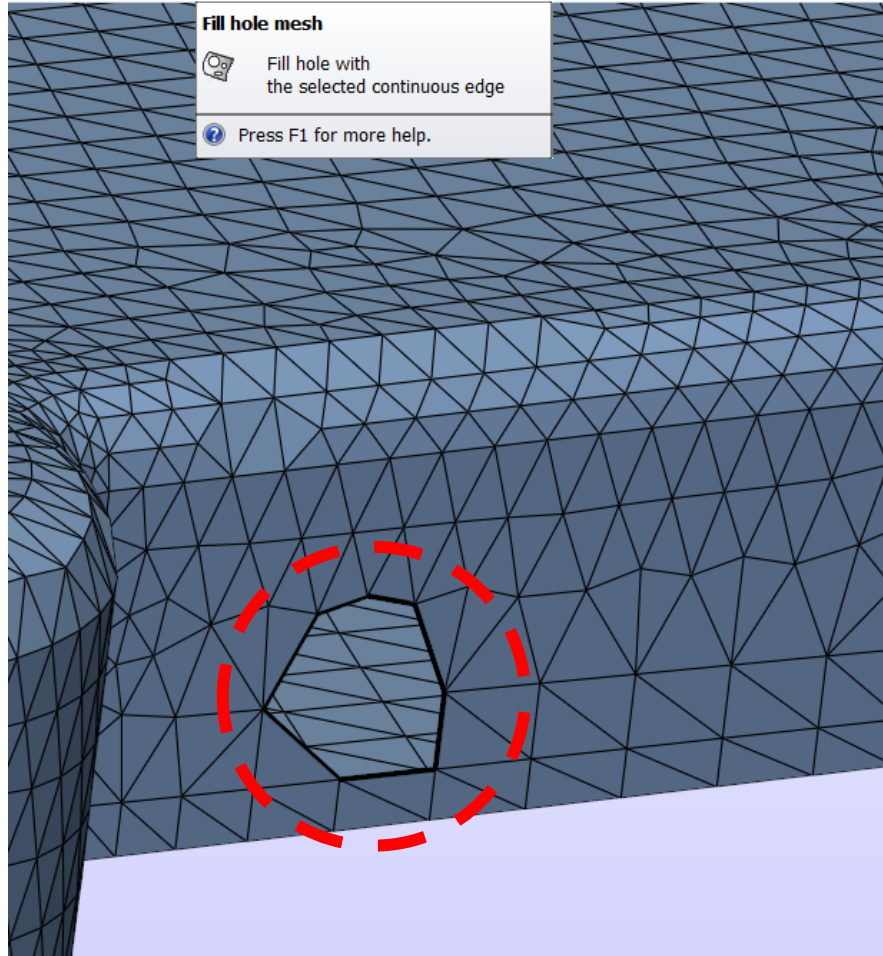
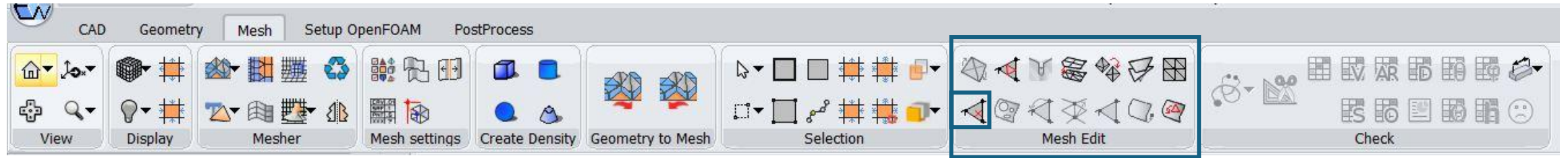
Mesh Edit : Quad to Tria



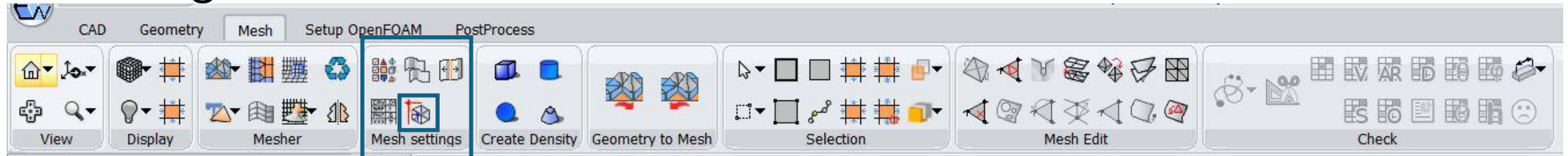
Mesh Edit : Delete elements



Mesh Edit : Fill hole



Mesh settings



Leak Detection Tool

Source (Dead) Point (Red)

X: 5652.67

Y: -51.7626

Z: -48.5612

Target (Live) Point (Red) 1

X: 5891.66

Y: 39.3488

Z: -55.6507

Number of Targets: 1

Compute Path Find Hole Cancel

