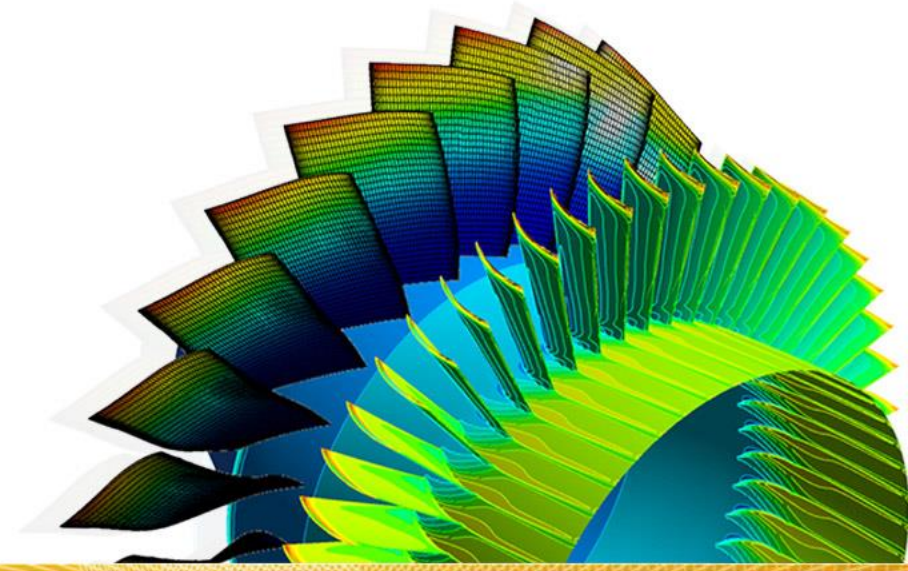
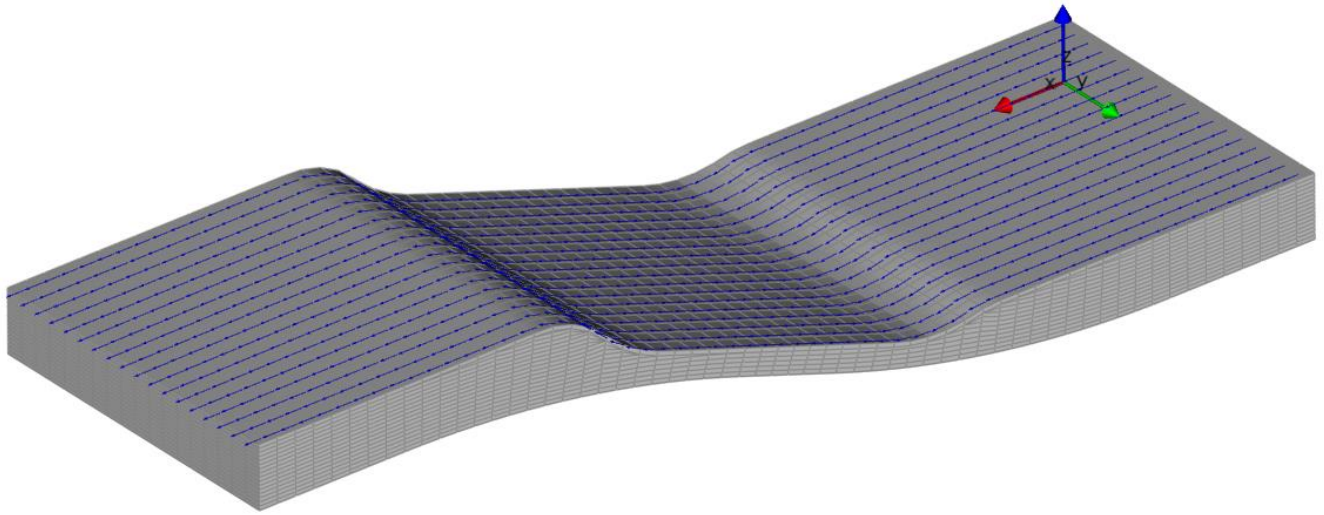
ANSYS Composite PrepPost 19.0

Workshop 07.2 – Solid Modeling and Ply Drop Offs



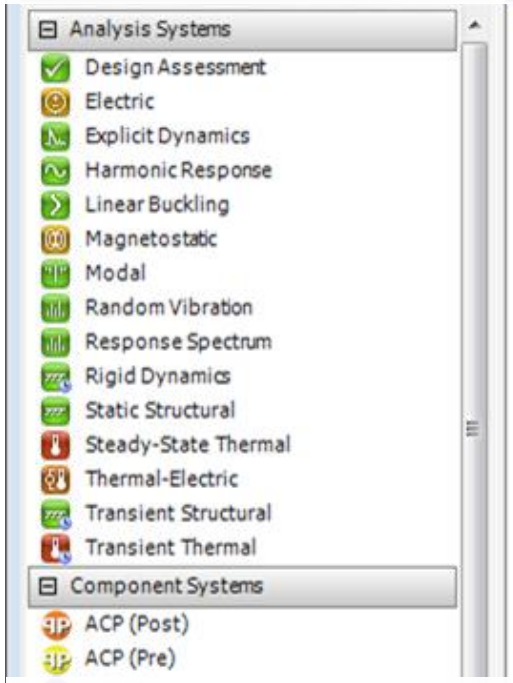
8. Workshop Solid Modeling and Ply Drop Offs

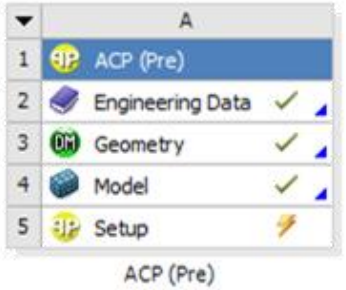
- The second workshop in solid modeling will cover ply drop offs and how to use cut-off rules to model complex solid composite designs.



8. Workshop Solid Modeling and Ply Drop Offs

Start ANSYS Workbench and Restore Archive

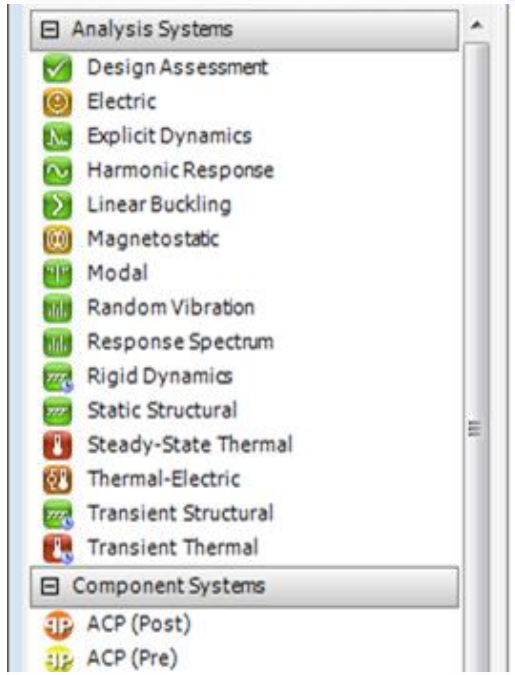


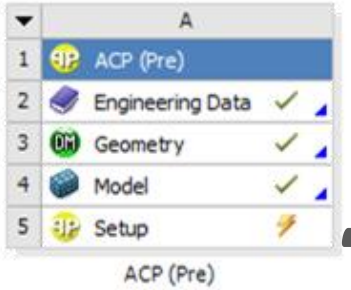


1. Start ANSYS Workbench and restore Archive "*Solid Model and Ply Drop Offs FROM_START_19.0.wbpz*"
2. Save the Workbench project

8. Workshop Solid Modeling and Ply Drop Offs

Start ANSYS Workbench and Restore Archive



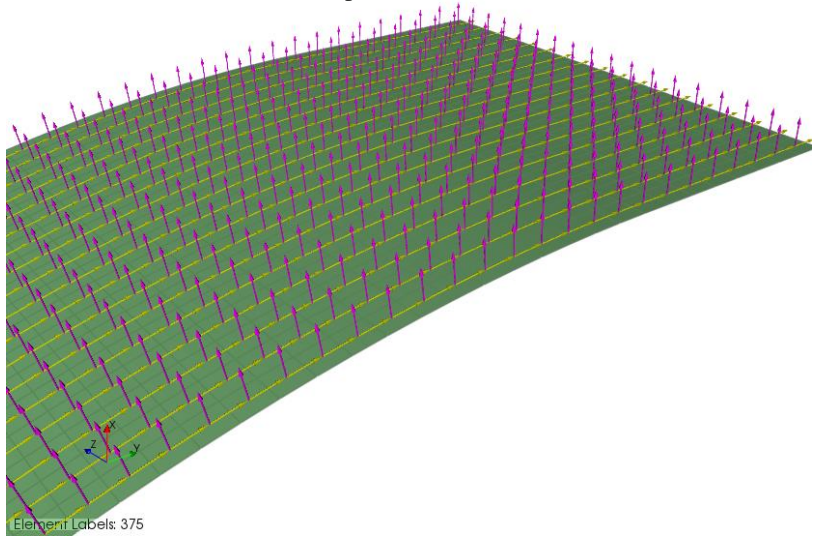


1

1. Open ANSYS Composite PrepPost. Mesh and materials are already defined

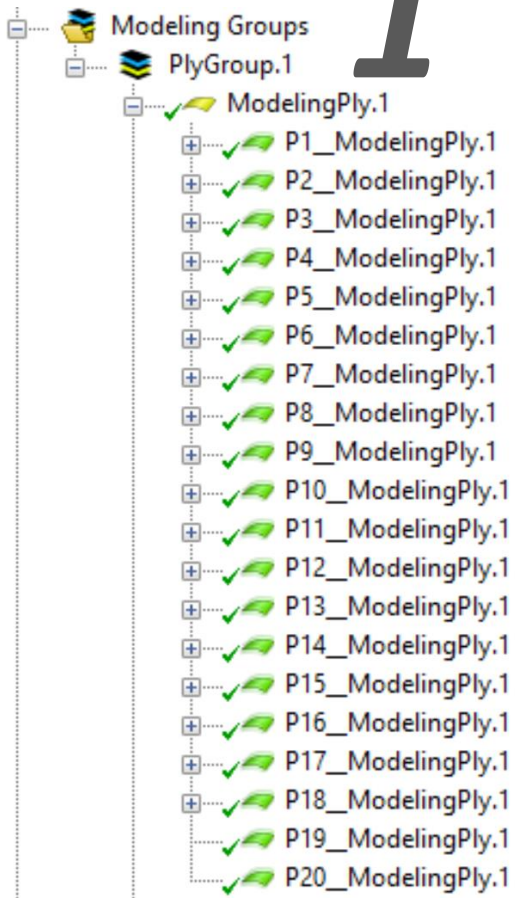
8. Workshop Solid Modeling and Ply Drop Offs

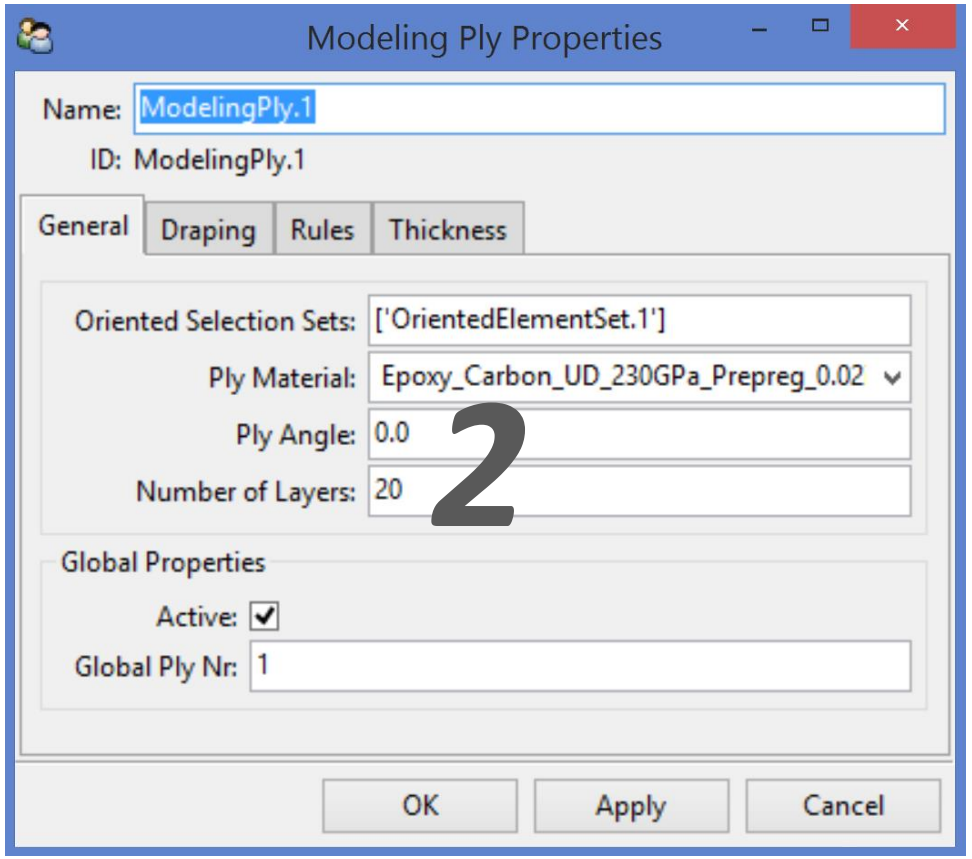
- A fabric with a thickness of 0.02 inch is already defined.
- Two materials, Epoxy_Carbon_UD_230GPa_Prepreg and Resin_Polylite_413, are used. The resin material will be used as global drop off material.
- Rosette and Oriented Element Set are already defined.



8. Workshop Solid Modeling and Ply Drop Offs

Create Plies

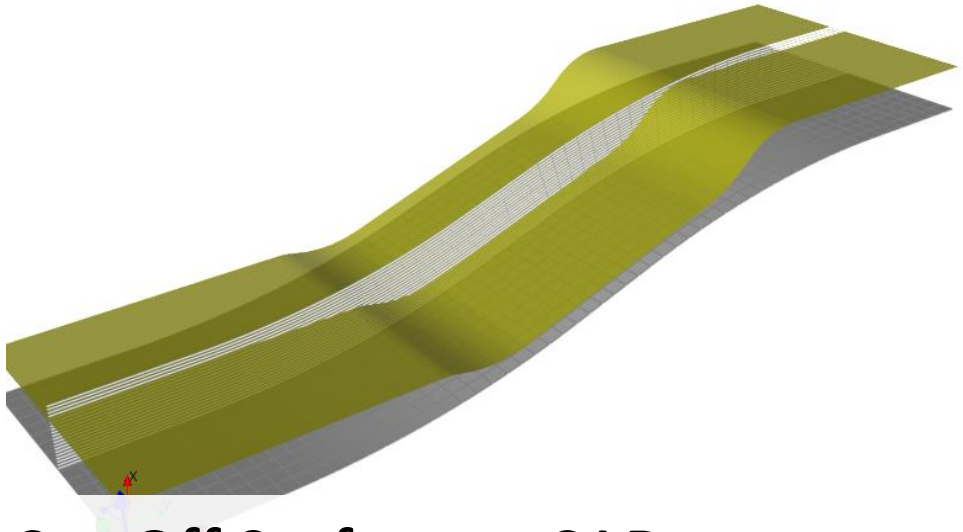




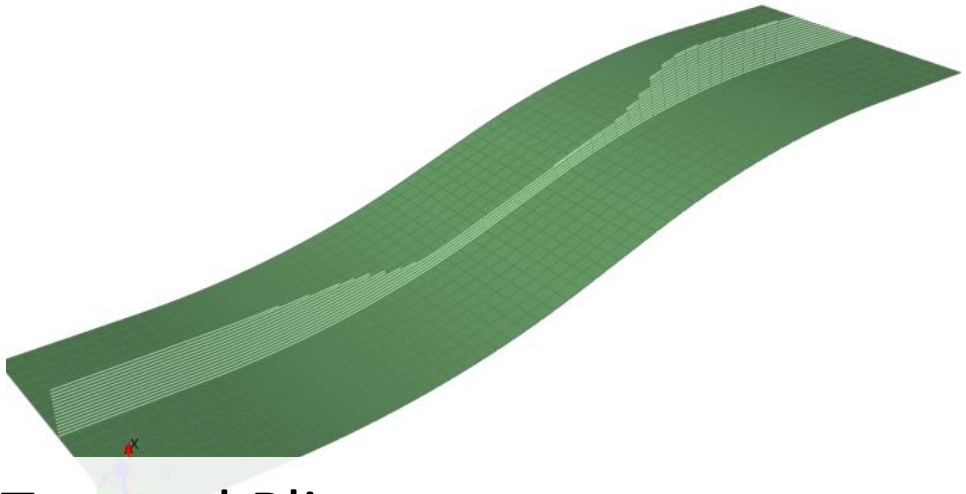
1. Create a new ply group
2. Create 20 new layers (all 0° plies)

8. Workshop Solid Modeling and Ply Drop Offs

- In the next step we will use a cut-off rule to taper the plies. The cut-off rule uses a CAD surface to taper plies where they are cut by the surface.



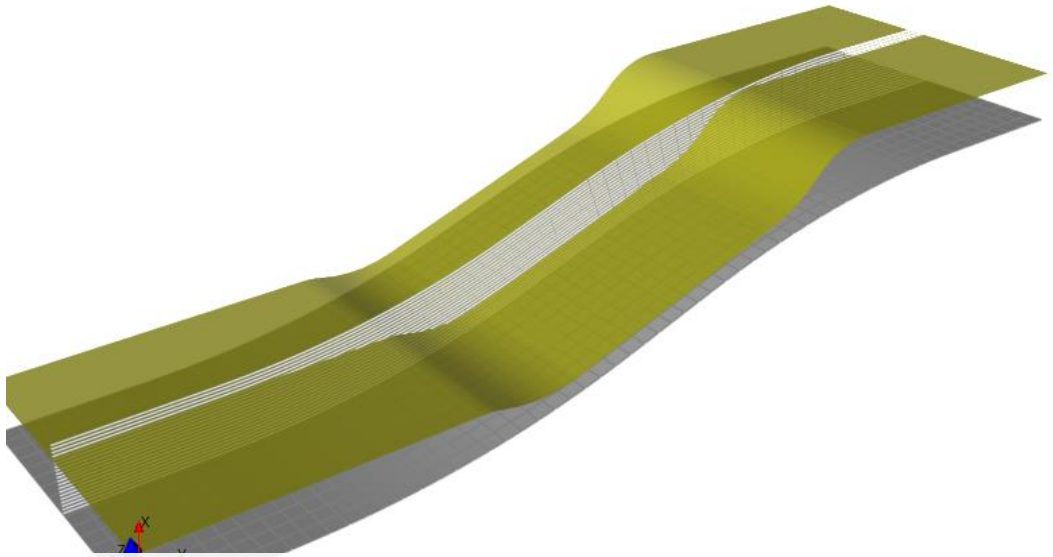
Cut-Off Surface as CAD geometry



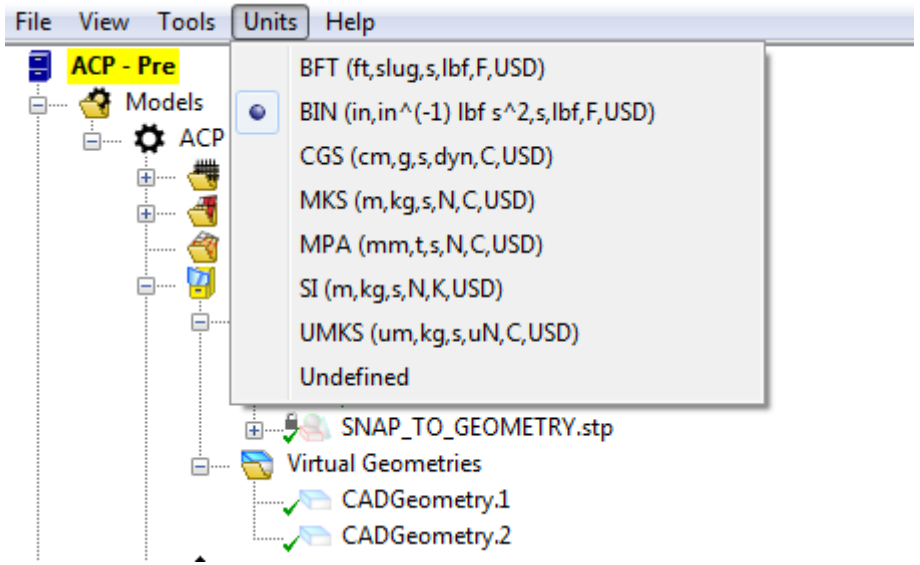
Tapered Plies

8. Workshop Solid Modeling and Ply Drop Offs

- The unit system of the step file imported for the CAD rule is US Customary (inch), please change the unit system of ACP (Pre)

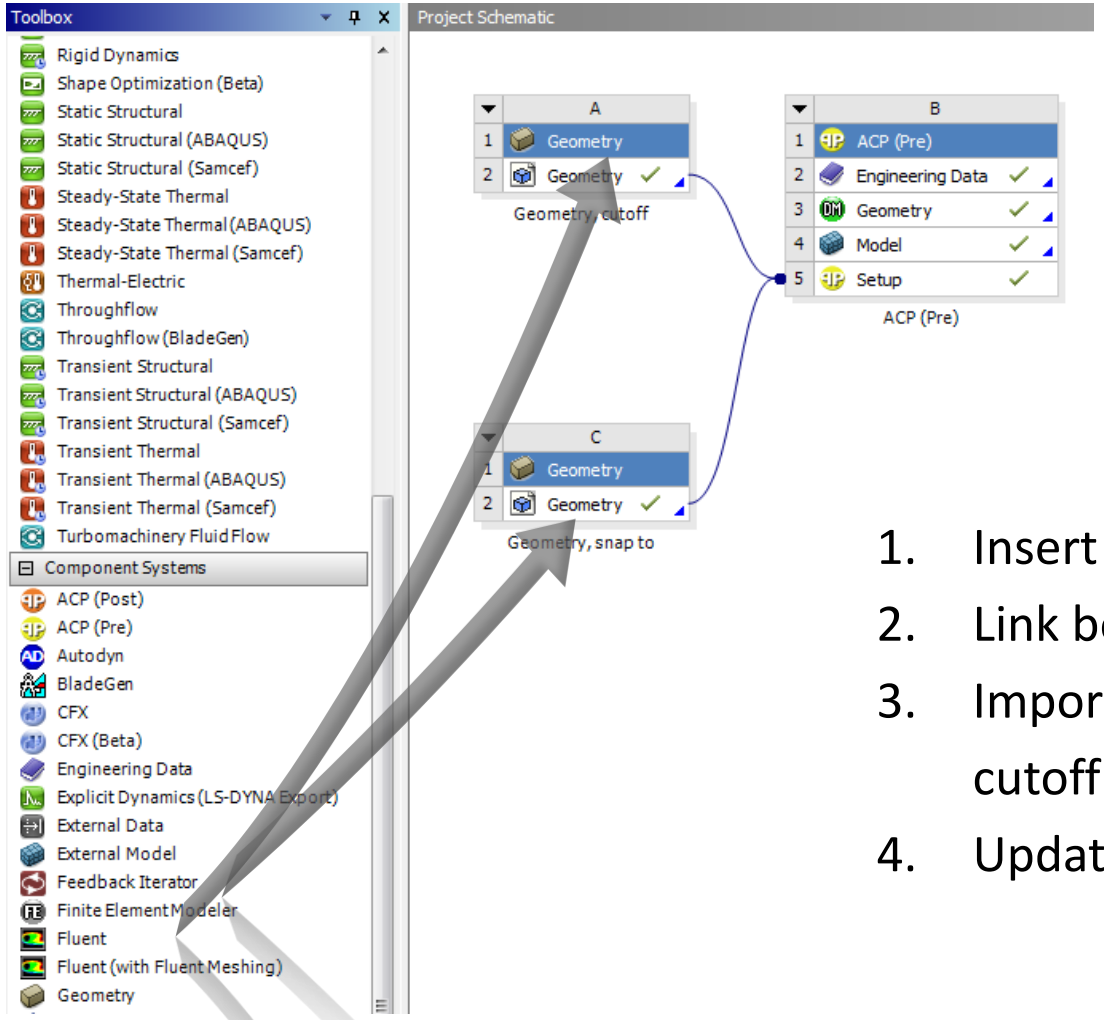


Cut-Off Surface as CAD geometry



8. Workshop Solid Modeling and Ply Drop Offs

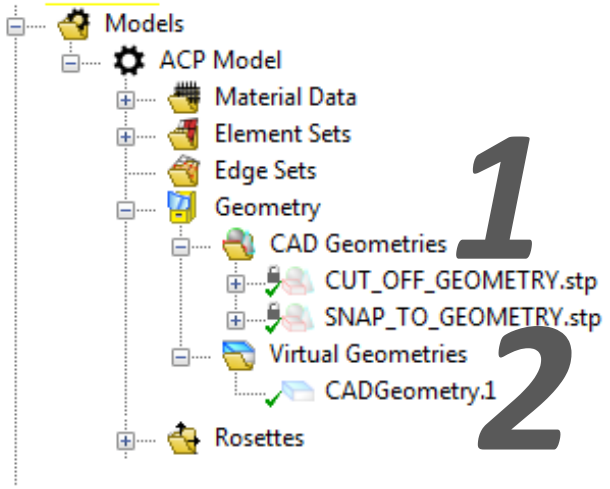
Import Geometry

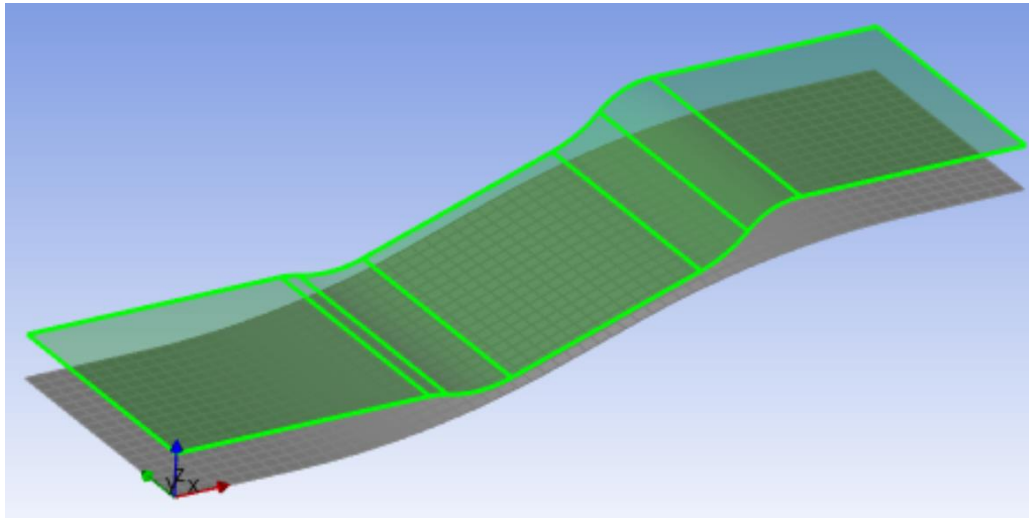


1. Insert two new *Geometry* components from the Component Systems
2. Link both *Geometry* to *Setup* of ACP (Pre)
3. Import the cad files CUT_OFF_GEOMETRY.stp from “Geometry, cutoff” and SNAP_TO_GEOMETRY.stp from “Geometry, snap to”
4. Update ACP (Pre) setup and return to ACP (Pre)

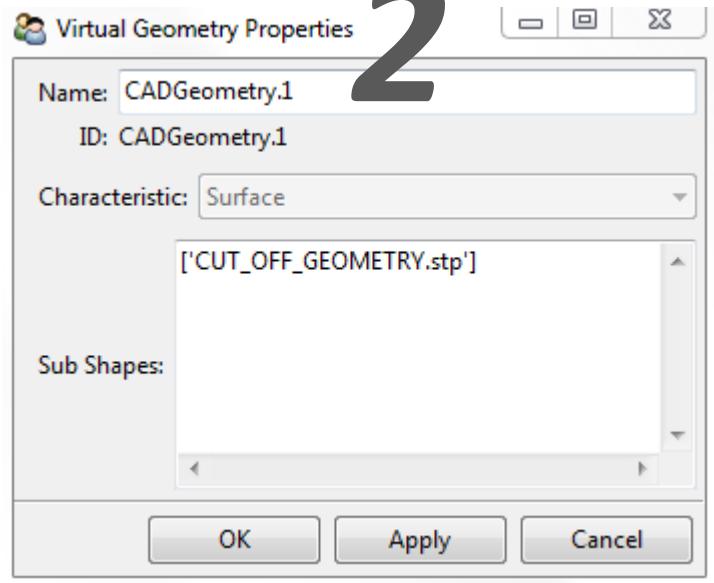
8. Workshop Solid Modeling and Ply Drop Offs

Import Geometry



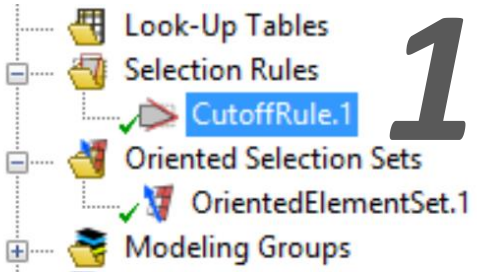


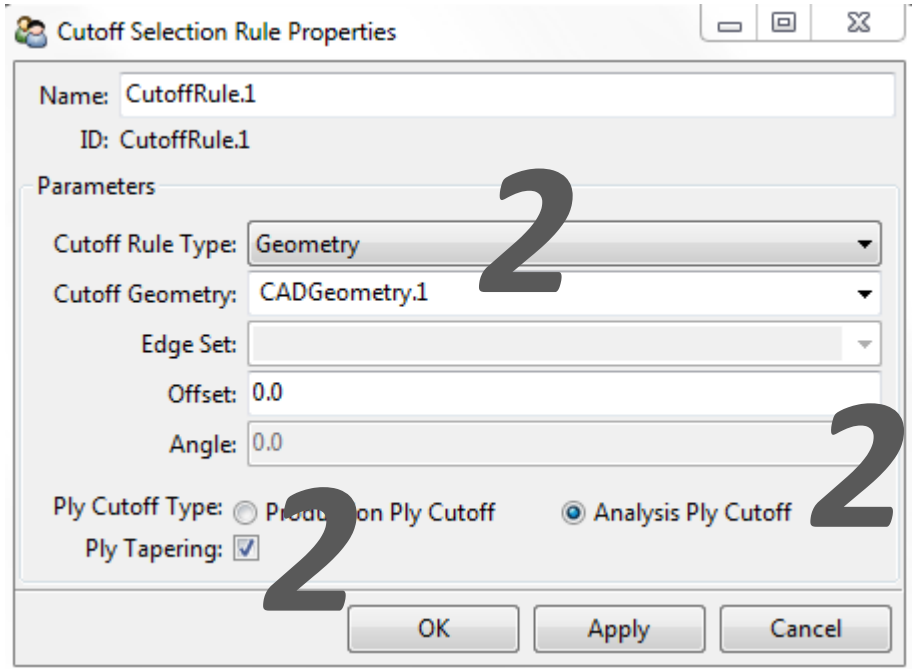
1. The CAD files imported at the previous step are loaded in ACP (Pre) in CAD Geometries
2. Create a new CAD virtual geometry



8. Workshop Solid Modeling and Ply Drop Offs

Create a new Cut-Off Rule

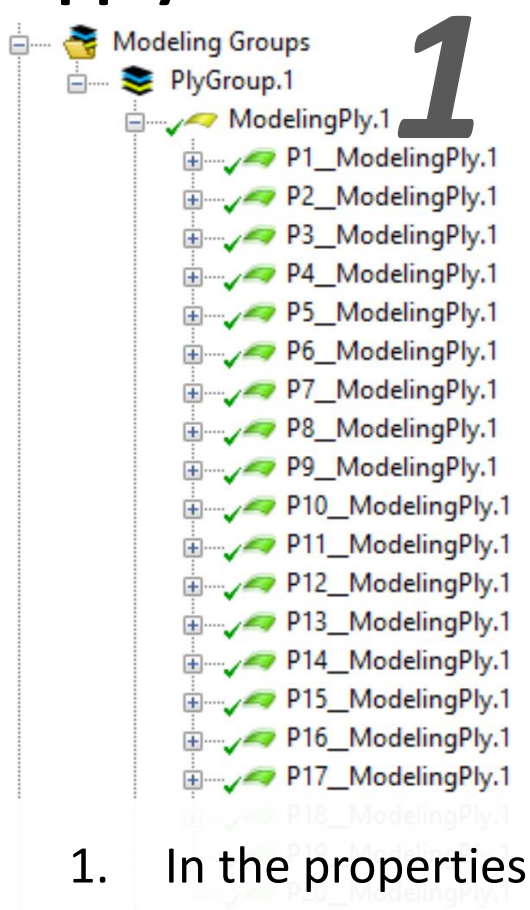


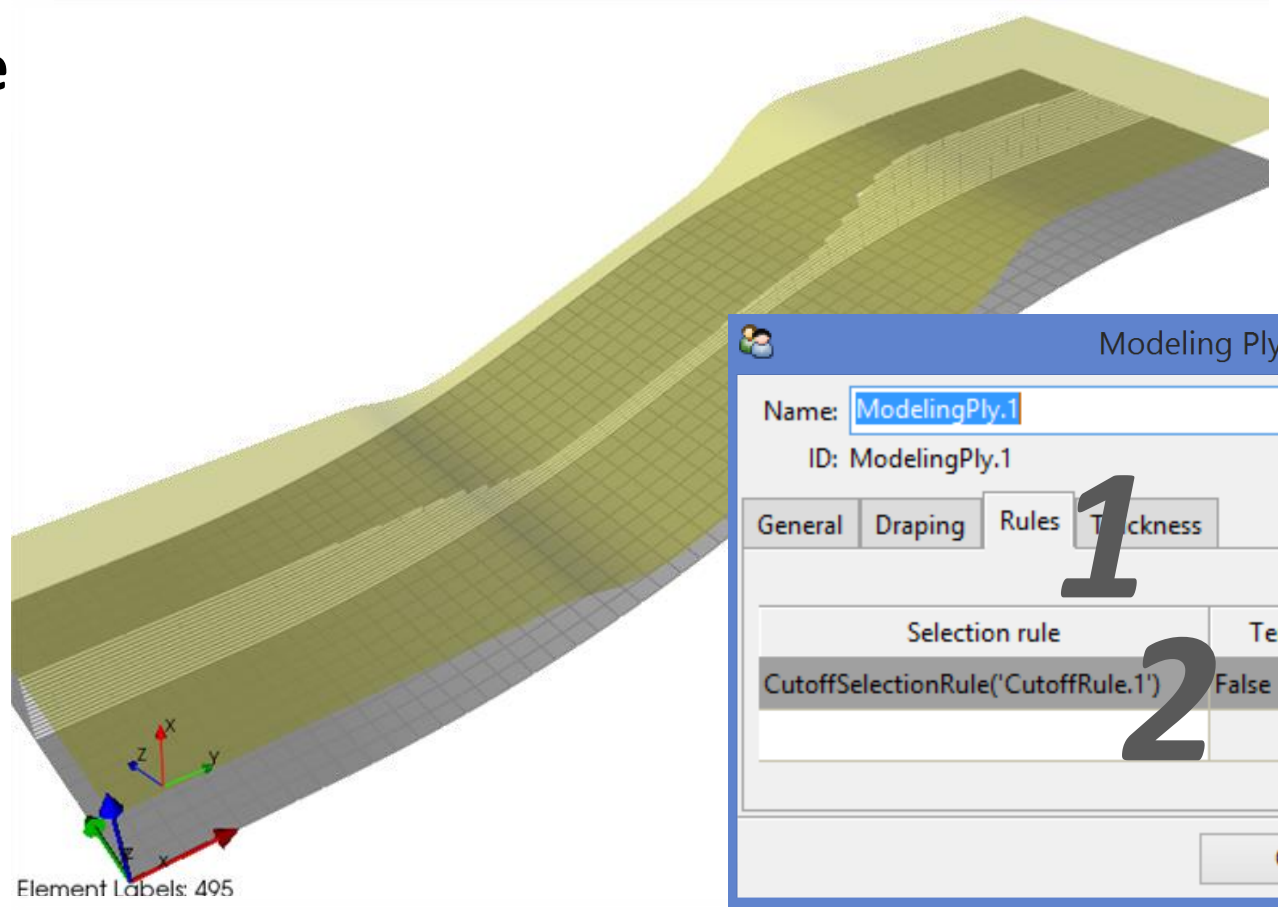


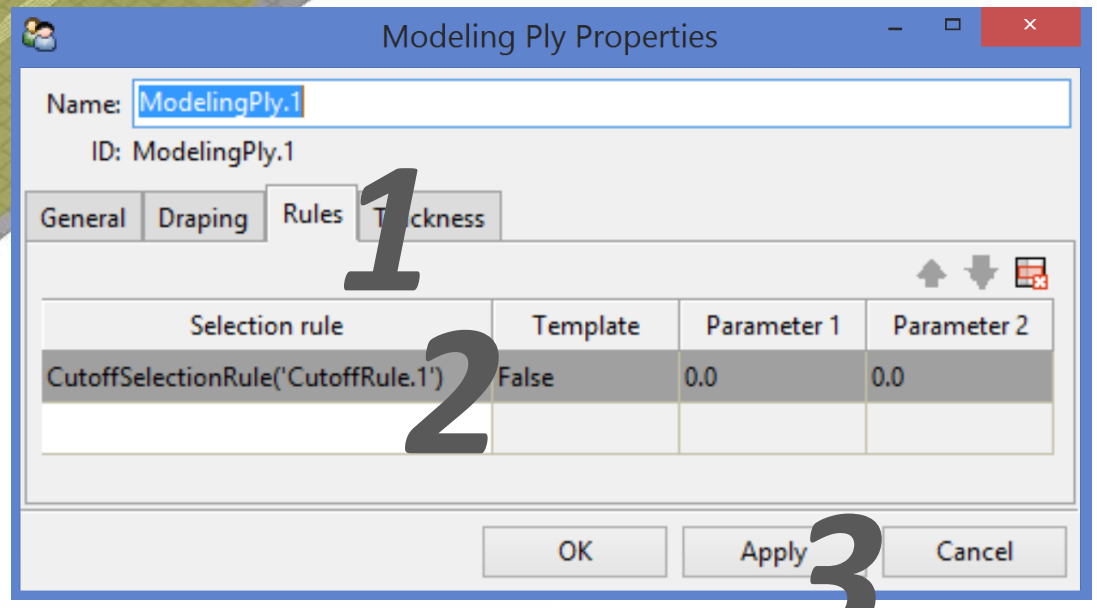
1. Create a new Cut-Off Rule (Right Mouse button on Selection Rules → Create Cutoff Rule)
2. Select the imported CAD geometry, Analysis Ply Cutoff, and Ply Tapering in the property window

8. Workshop Solid Modeling and Ply Drop Offs

Apply Cut-Off Rule



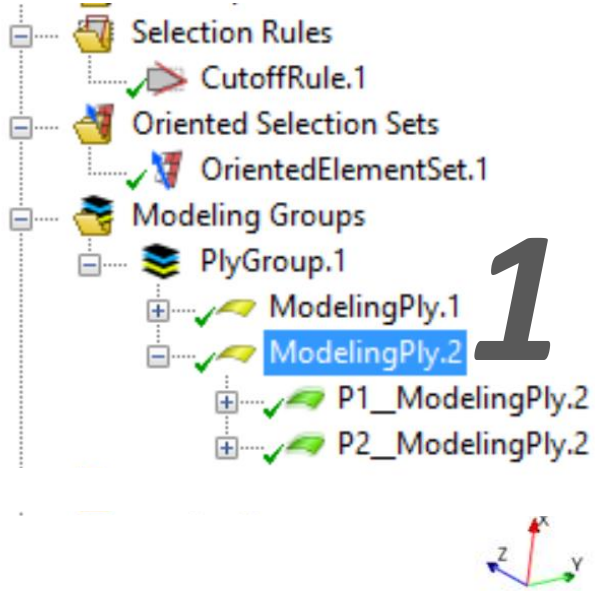


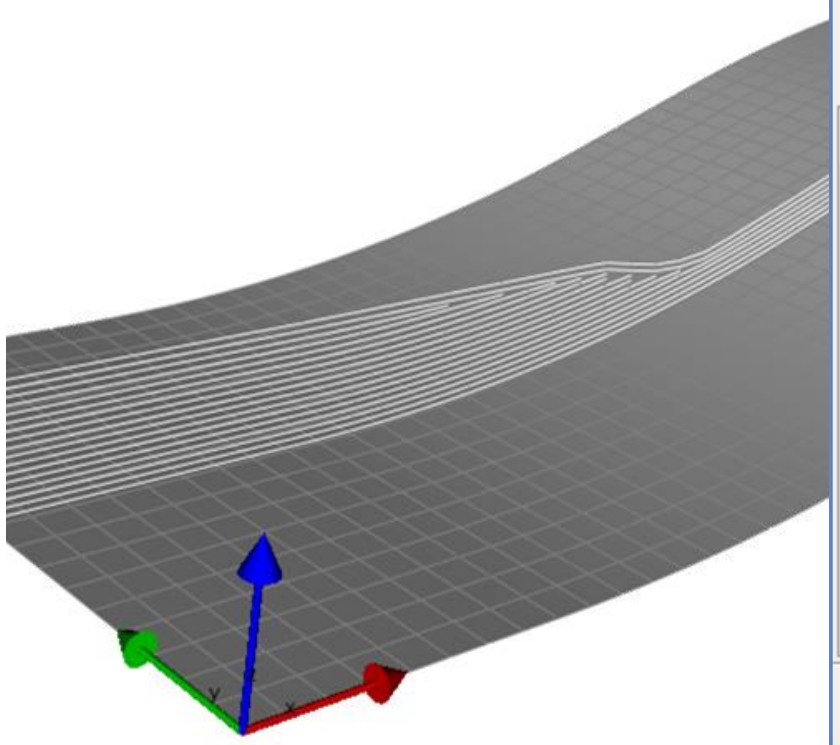


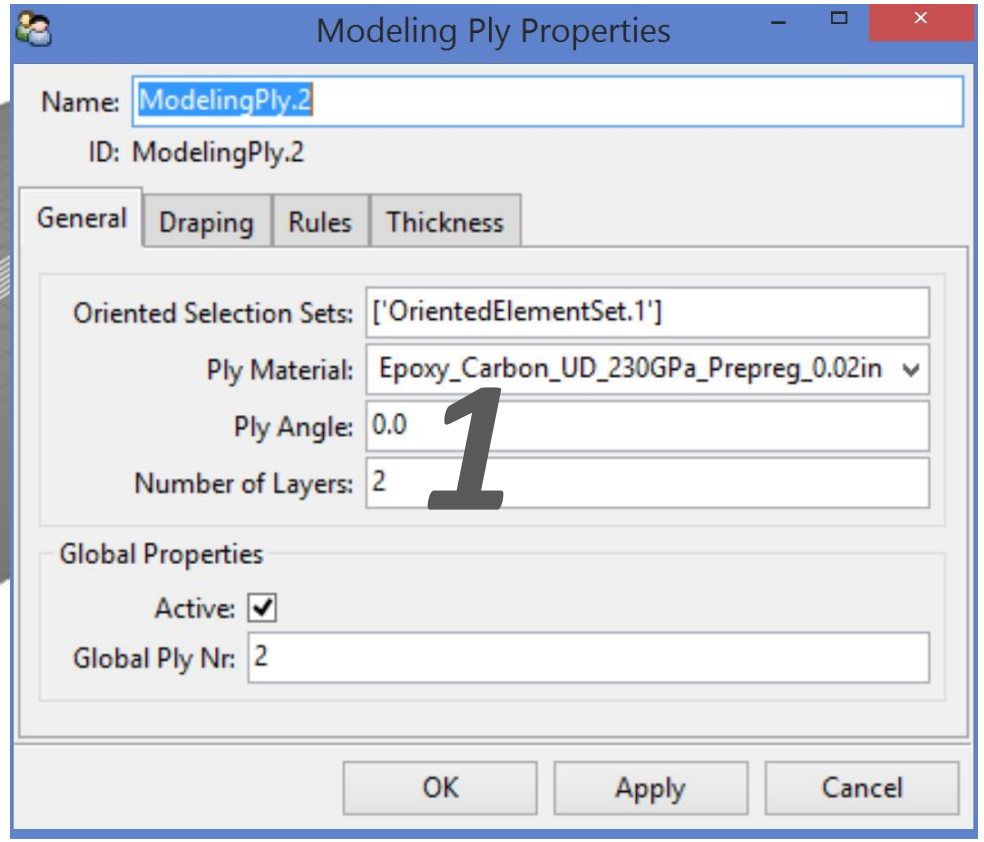
1. In the properties of the modeling ply, switch to the rules tab
2. Add Cut-Off rule by selecting the rule in the rule column
3. Click apply and update the model to see the ply tapering in the section cut

8. Workshop Solid Modeling and Ply Drop Offs

Create a new Ply



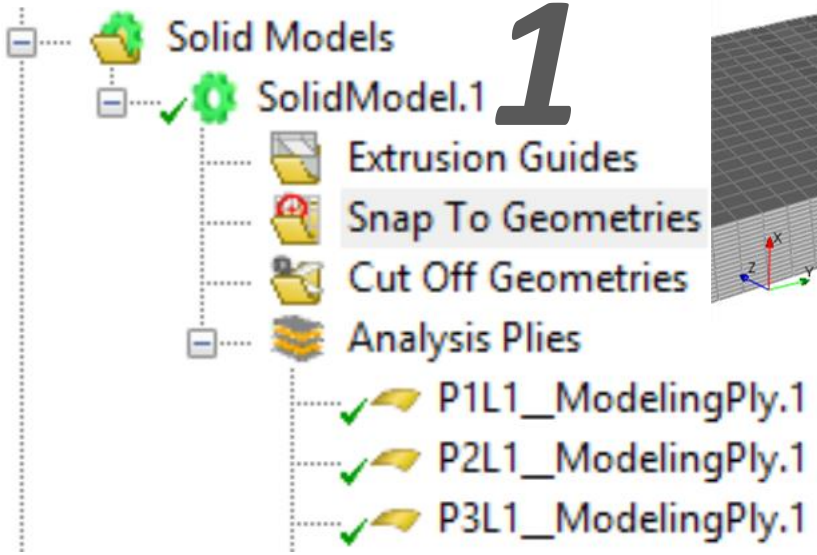


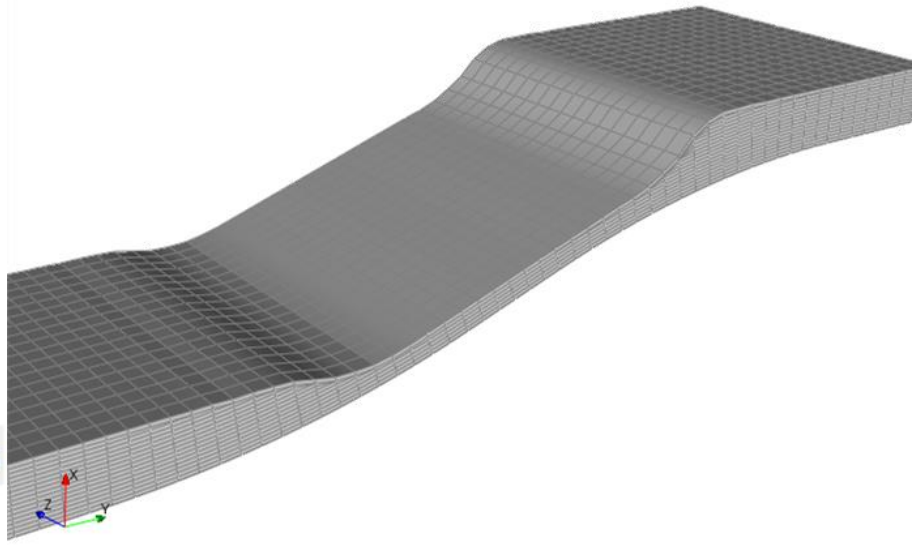


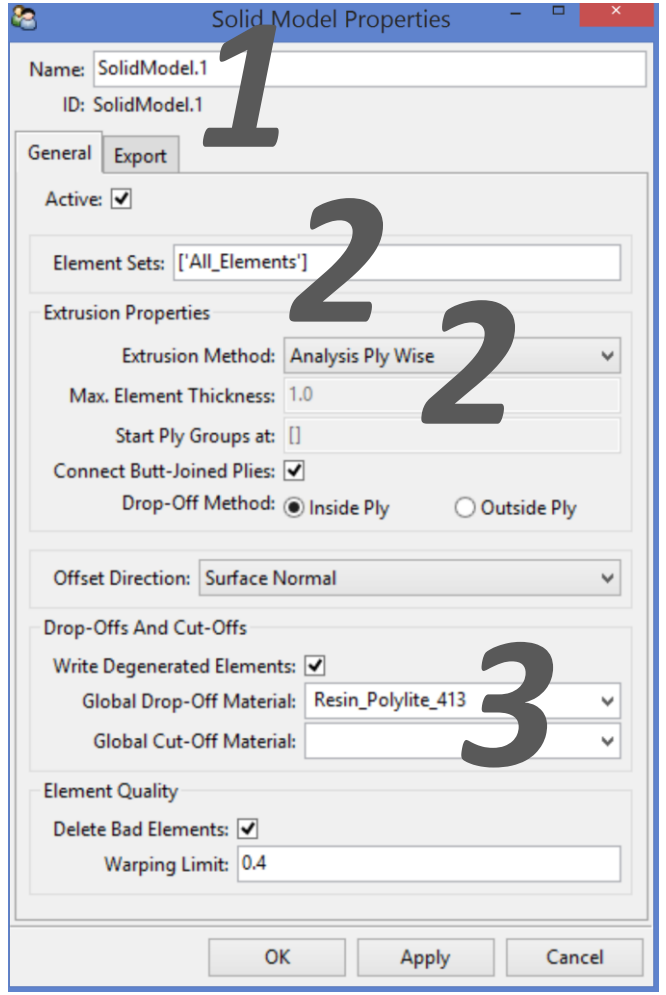
1. Create two new plies (0° plies) within the existing ply group. The new plies will be placed on top of the tapered layers

8. Workshop Solid Modeling and Ply Drop Offs

Create a Solid Model



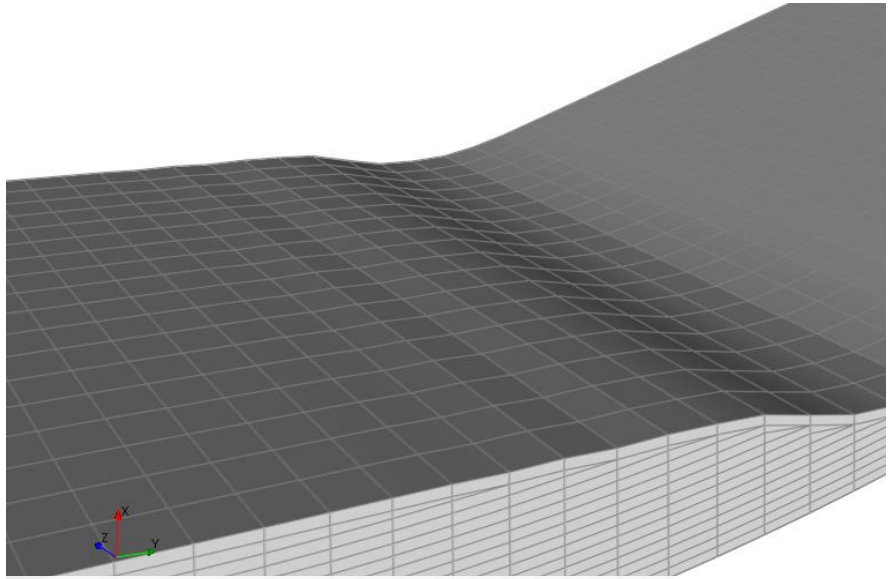




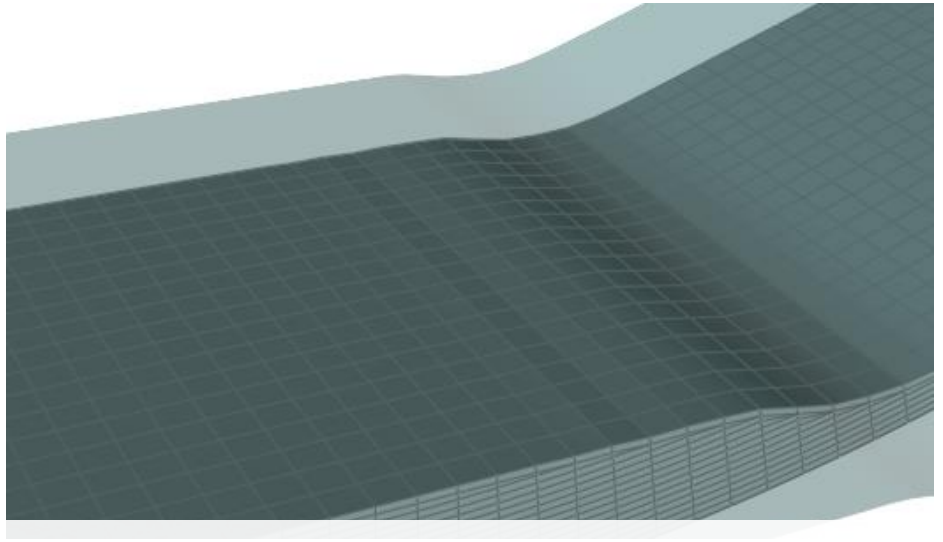
1. Create a new Solid Model (Right Mouse button on Solid Models → Create Solid Model)
2. Select All Elements in element sets and extrusion method Analysis Ply Wise
3. Select to use homogeneous drop-off elements and Resin_Polylite_413 as drop-off material.

8. Workshop Solid Modeling and Ply Drop Offs

- Although the solid model is not bad, ANSYS Composite PrepPost allows creating a smoother outer surface of the solid model.
- With the snap-to-geometry feature, the extruded surface is smoothed using a CAD surface.



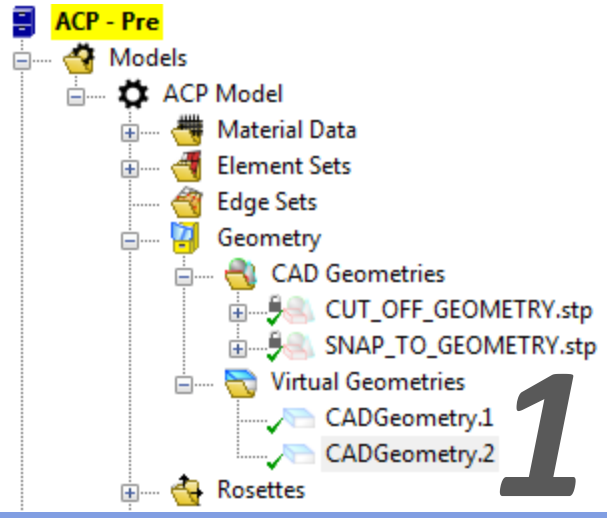
Solid Model Extrusion

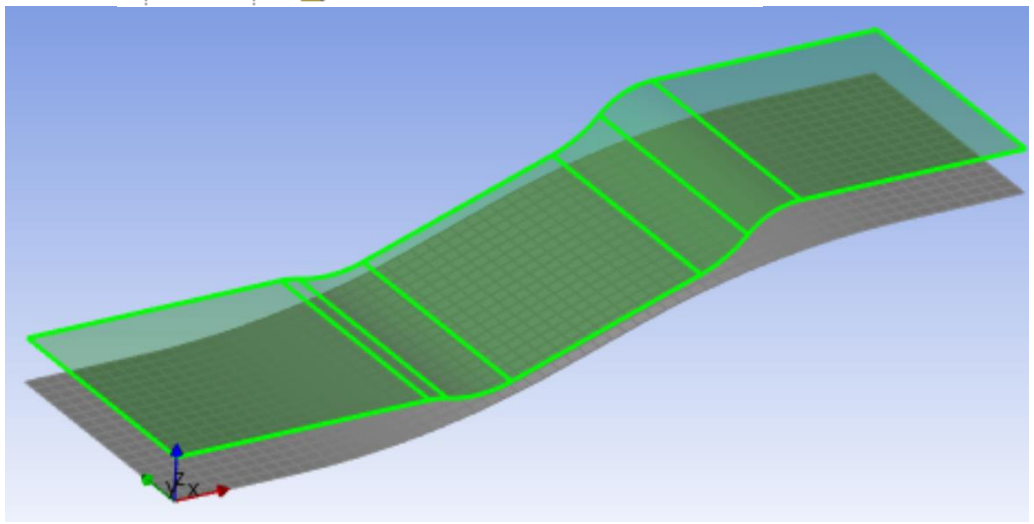


Outer surface used to smooth the extruded surface

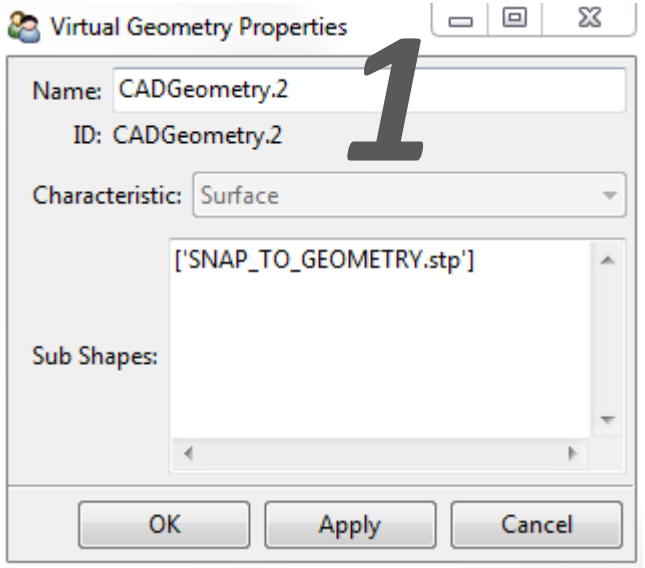
8. Workshop Solid Modeling and Ply Drop Offs

Import Geometry



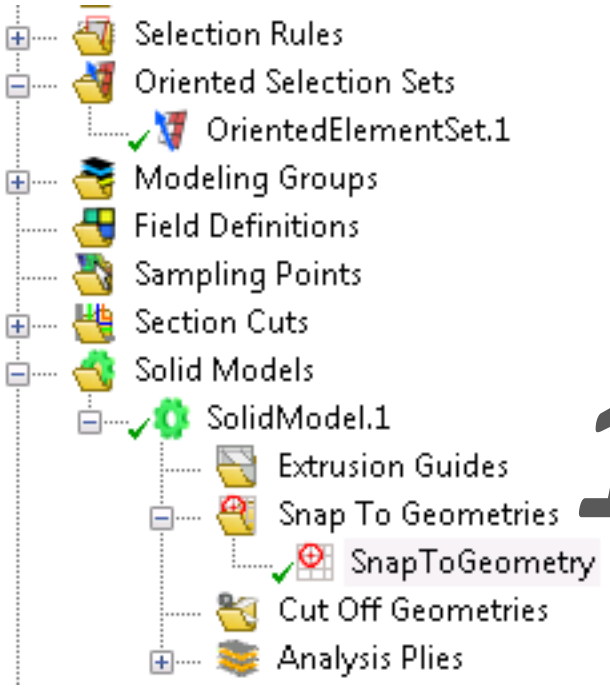


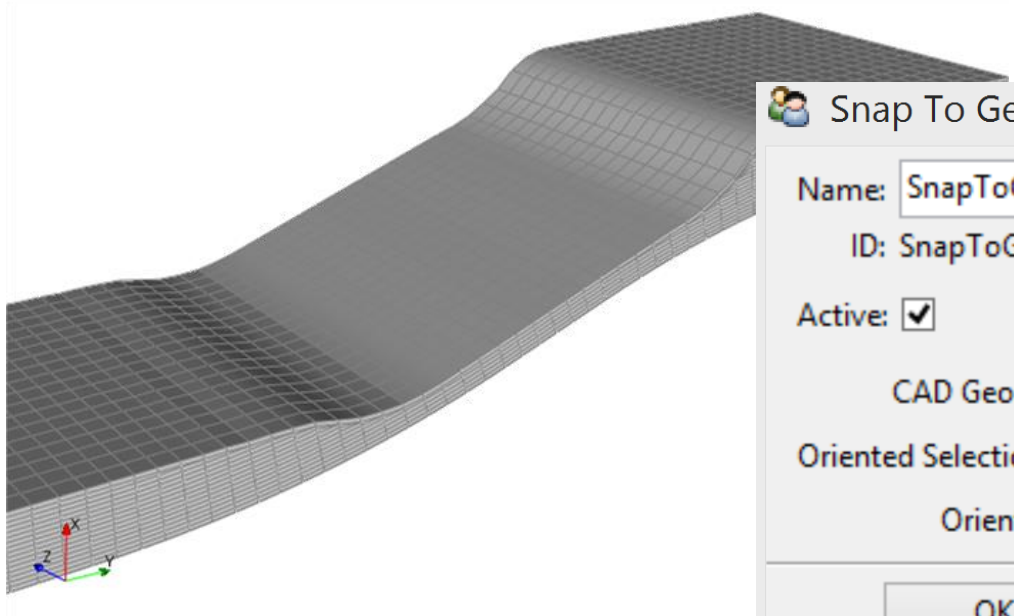
1. Create a new CAD virtual geometry

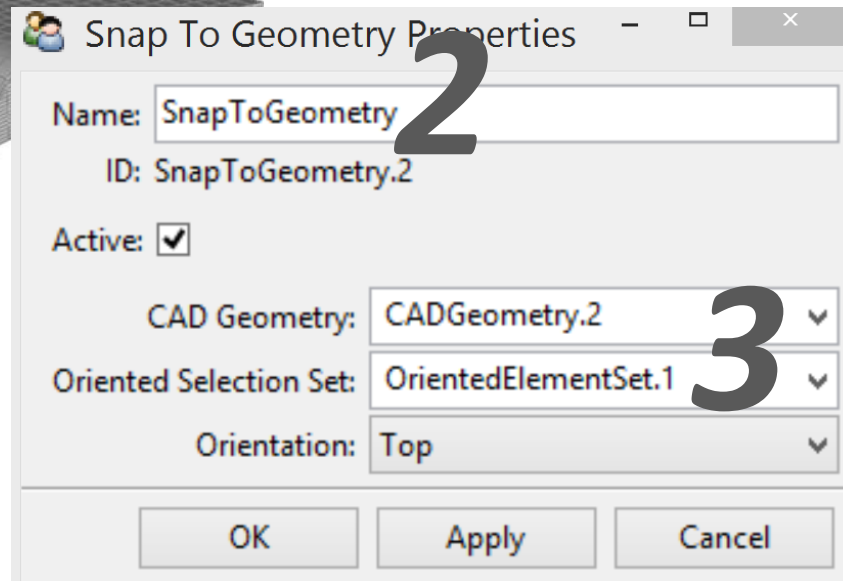


8. Workshop Solid Modeling and Ply Drop Offs

Use Snap-to-Geometry Feature



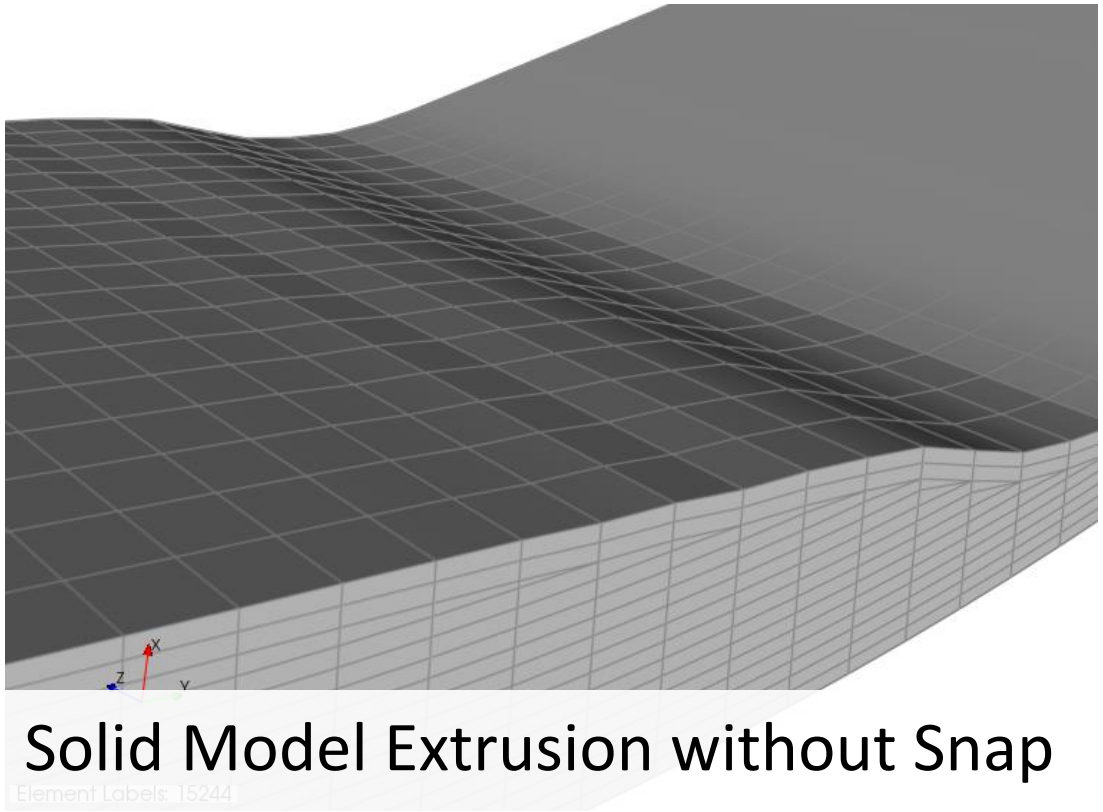




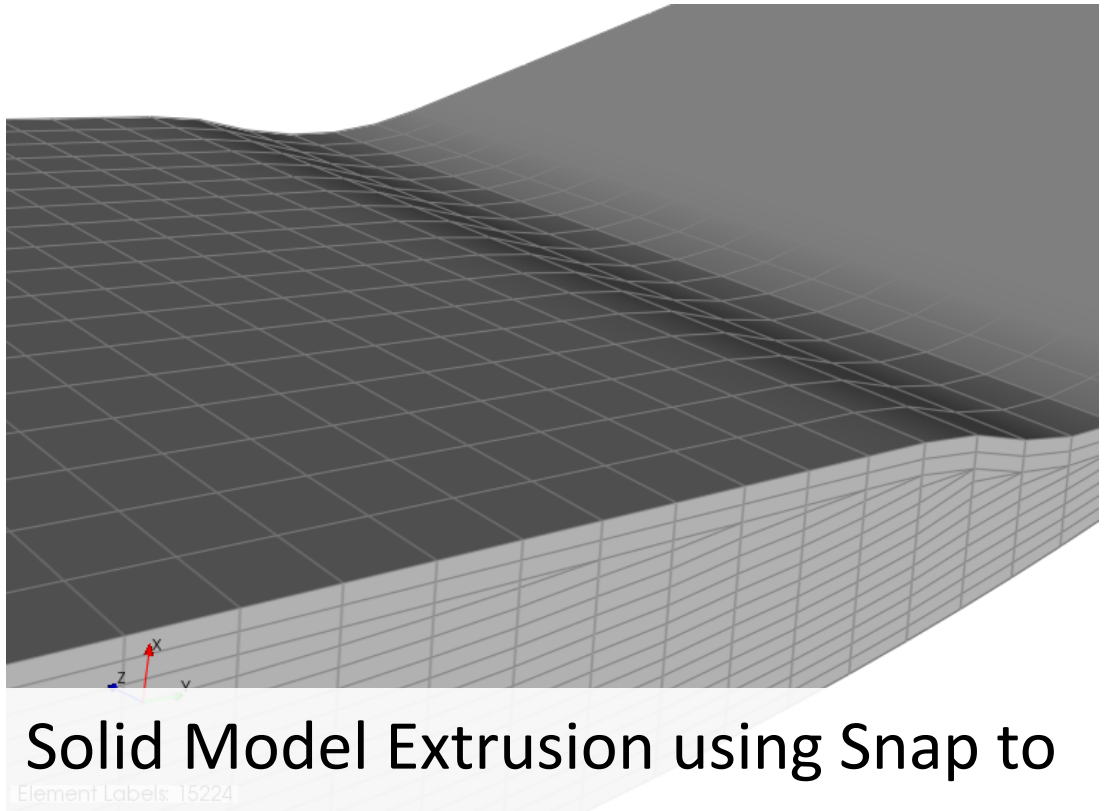
1. In the properties of the solid model switch to tab Snap to Geometry
2. Create a new item *SnapToGeometry*
3. Select the imported CAD surface for the snap to geometry feature and the oriented selection set of the modeling plies

8. Workshop Solid Modeling and Ply Drop Offs

- Updating the model will show a smoother outer surface of the solid composite model



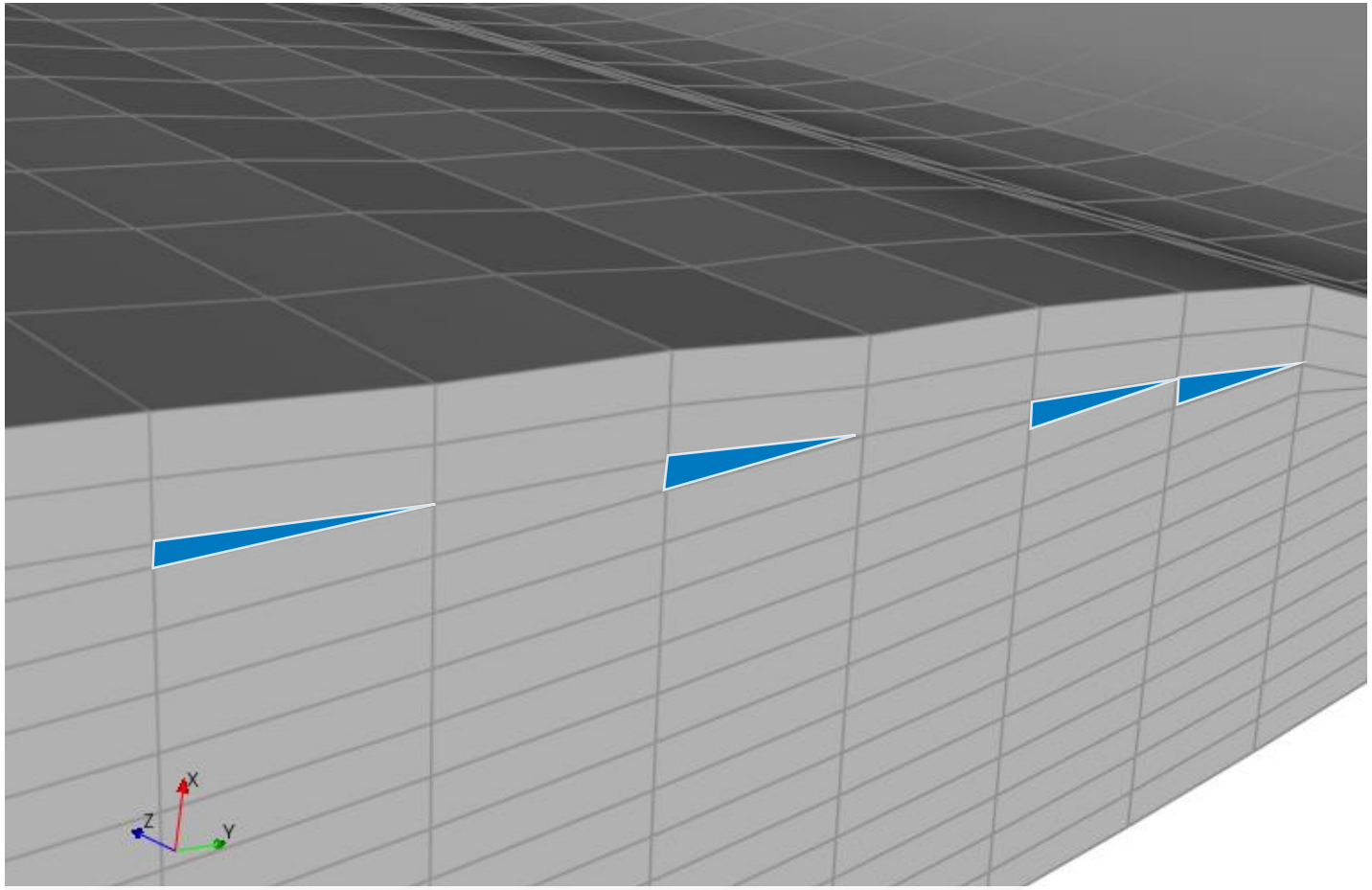
Solid Model Extrusion without Snap to Geometry Feature



Solid Model Extrusion using Snap to Geometry Feature

8. Workshop Solid Modeling and Ply Drop Offs

- The ply drop off elements will use the homogenous resin material



Ply drop off areas