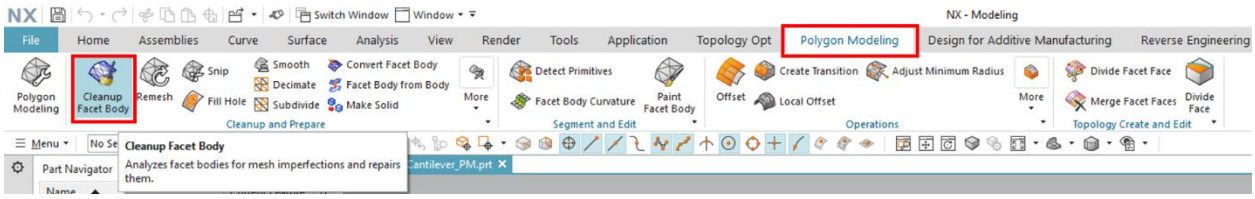
POLYGON MODELING

This tutorial demonstrates processing a part file into a cleaner result for ease of operations downstream in the Additive Manufacturing application. In this tutorial, we use Polygon Modeling on a topologically optimized part. Polygon Modeling is an environment which uses the concept of **Convergent Modeling**. A convergent model represents both CAD geometry (B-rep) and mesh geometry (STL) simultaneously.

CLEANUP FACET BODY

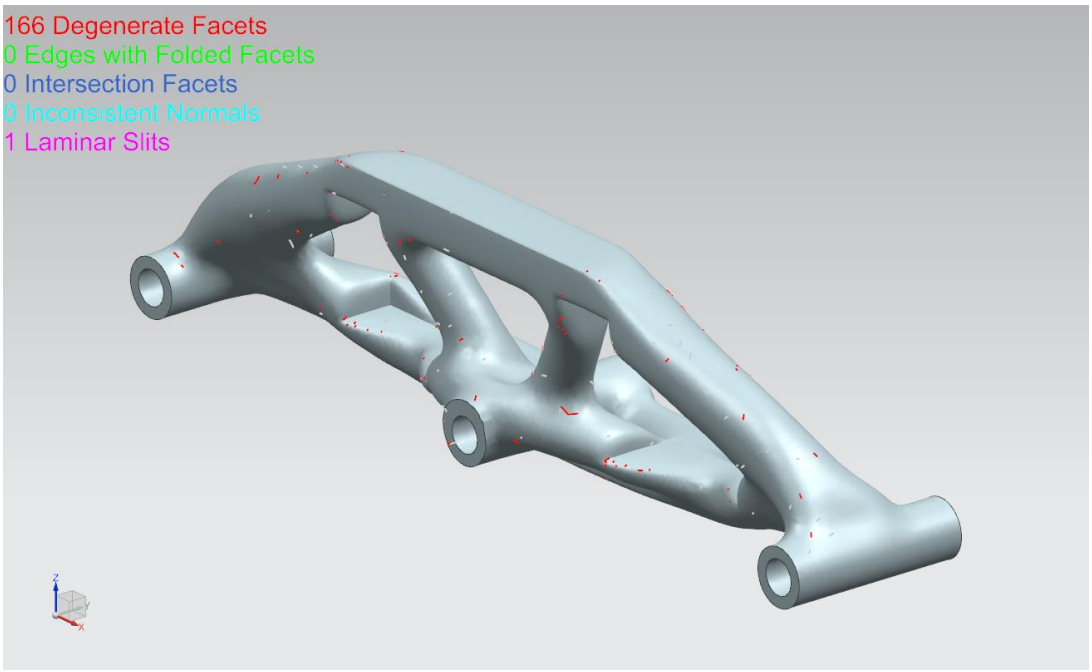
Cleanup Facet Body is used to analyze, display and repair defective facet (mesh) geometry. In this example we first analyze whether the geometry requires any repair at all.

1. Open the part "**Simple_Cantilever_PM"**
2. On the **Ribbon bar,** in **Polygon Modeling**, click **Cleanup Facet Body**



3. In **Cleanup Facet Body** dialog box, click on body from the graphics window to select facet body
4. In the **Checks** group, select the tab **All to Analyze**
5. In the **Thresholds** group, keep the default values
   Minimum Angle Folded Faces 10.0000
   Minimum Facet Number 102
   NOTE: These values can be changed depending on the part mesh density
6. In the **Results Display** group, keep the box **Show Information Window** unchecked
7. In the **Settings** group, keep the default value
   Distance Tolerance = 0.0371
8. Click on **Show Result**

Notice the results in the graphics window



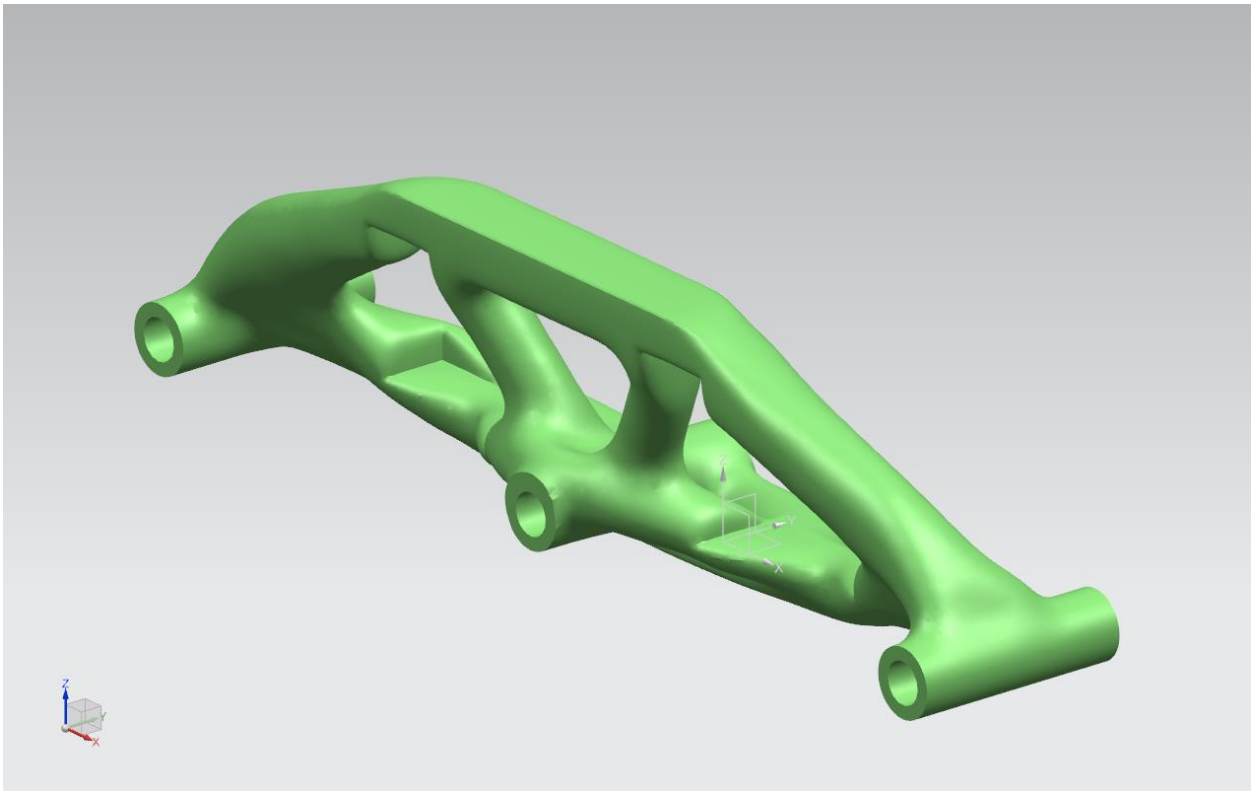
9. Click **OK** to close the **Cleanup Facet Body** dialog box

EXAMINE GEOMETRY

Note that the **Cleanup Facet Body** results show some degenerate facets and laminar slits. To check whether the mesh needs repair, we perform another test called **Examine Geometry**. If the results of this test fail, then we **repair** geometry using **Cleanup Facet Body**

1. On the **Ribbon bar**, in the **Analysis** tab, in the **Relation** group click on **More → Examine Geometry**
2. In the **Examine Geometry** dialog box, in the **Objects to Examine** group, click on the part in the graphics window to select object
3. In the **Checks to Perform/Results to Highlight** group, click **Set All**
   Notice the box checked on each criteria. The part will be examined for every criteria in the dialog box
4. In the **Check Criteria** group, keep default values
   Distance = 0.0100
   Angle = 0.5000
5. In the **Actions** group, click **Examine Geometry**

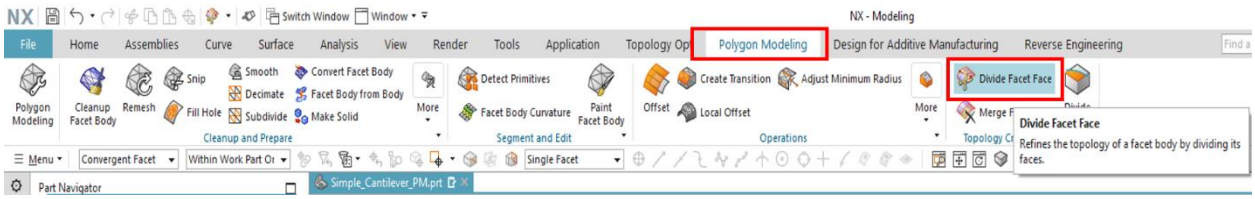
6. **Notice** the part has passed every check. This implies that the mesh geometry does not need repair. Click **Close**



DIVIDE FACET FACE

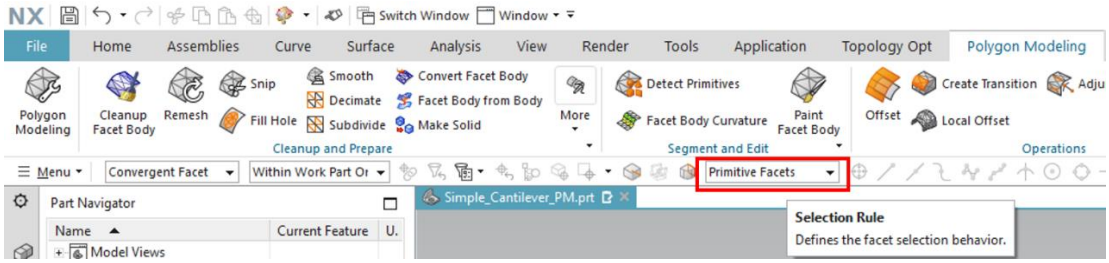
A topology optimized part is usually represented as a single face (single mesh) even though the part appears to have several faces to the eye. **Divide Facet Face** is used to re-topologize a part into as many faces as desired

1. On the **Ribbon bar,** in **Polygon Modeling**, click **Divide Facet Face**



2. In the **Divide Facet Face** dialog box, confirm that the selection method is **By Region**

3. On the **Top Border Bar** of the **Ribbon bar**, from the drop-down menu of **Selection Rule**, select **Primitive Facets**

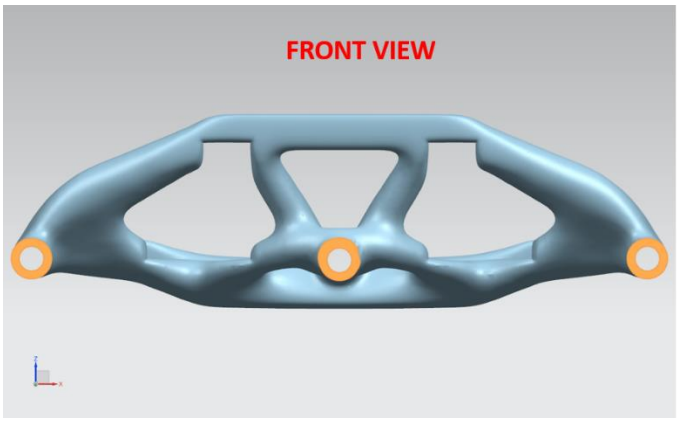


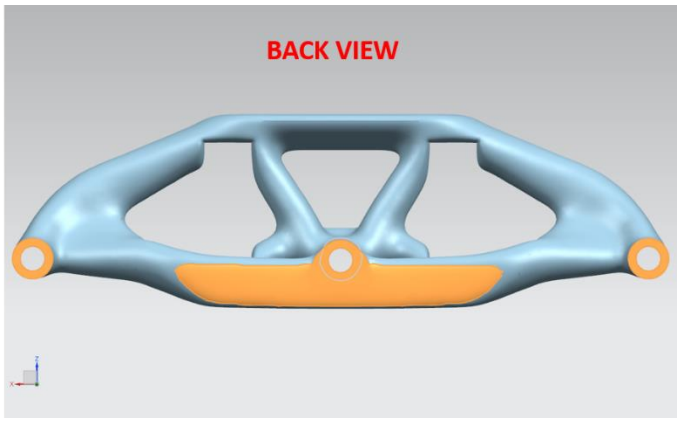
NOTE: Primitive facet selection rule automatically identifies primitive faces like circles, cylinders, planes, etc.

TIP: Experiment with each selection rule from the list to view result

4. In the **Region** group, select all planar-circular facet regions from the graphics window

   NOTE: Once the selection rule is set, facets are selected by clicking in the general area of desired face. **Divide Facet Face** automatically identifies and highlights the face in the graphics window. To increase or decrease the tolerance for selection click on − + symbols in the **Divide Facet Face** dialog box





5. In the **Continuity** group, check the box **Smooth Edge**

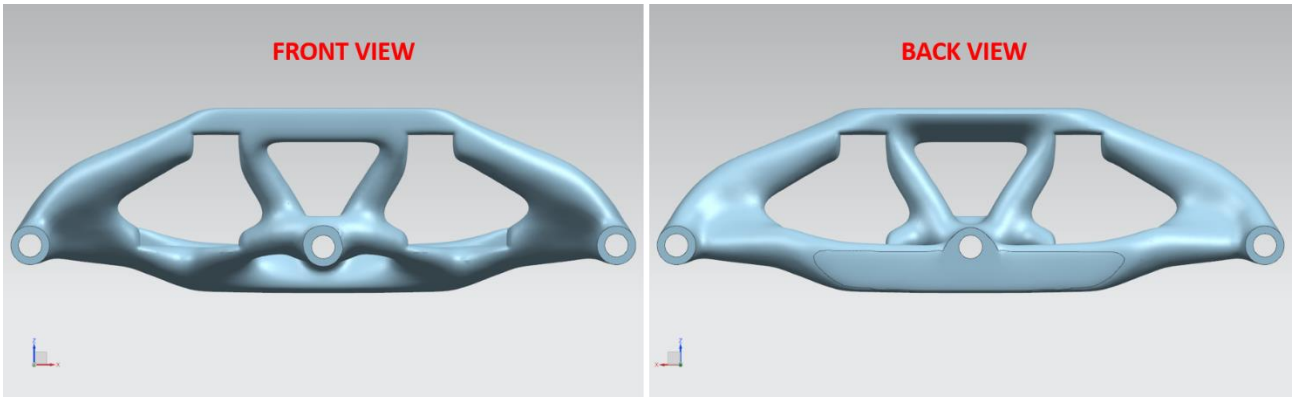
   NOTE: Smooth Edge selection ensures that the facets do not have jagged edges

6. In the **Settings** group, **uncheck** the box **Edit a Copy**

   NOTE: Edit a Copy selection creates a new body in the Model History in the **Part Navigator** group. If this is not selected, the current body is modified and the history of operations is not saved.

7. Click **OK** to close the **Divide Facet Face** dialog box and view results in the graphics window

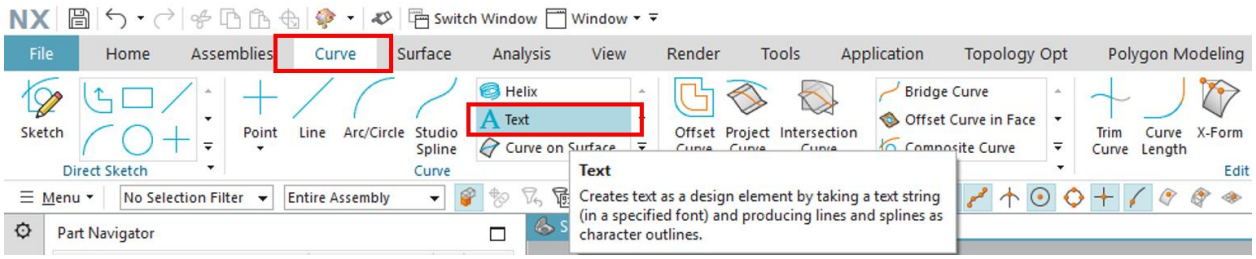
Notice the divided facets on the part



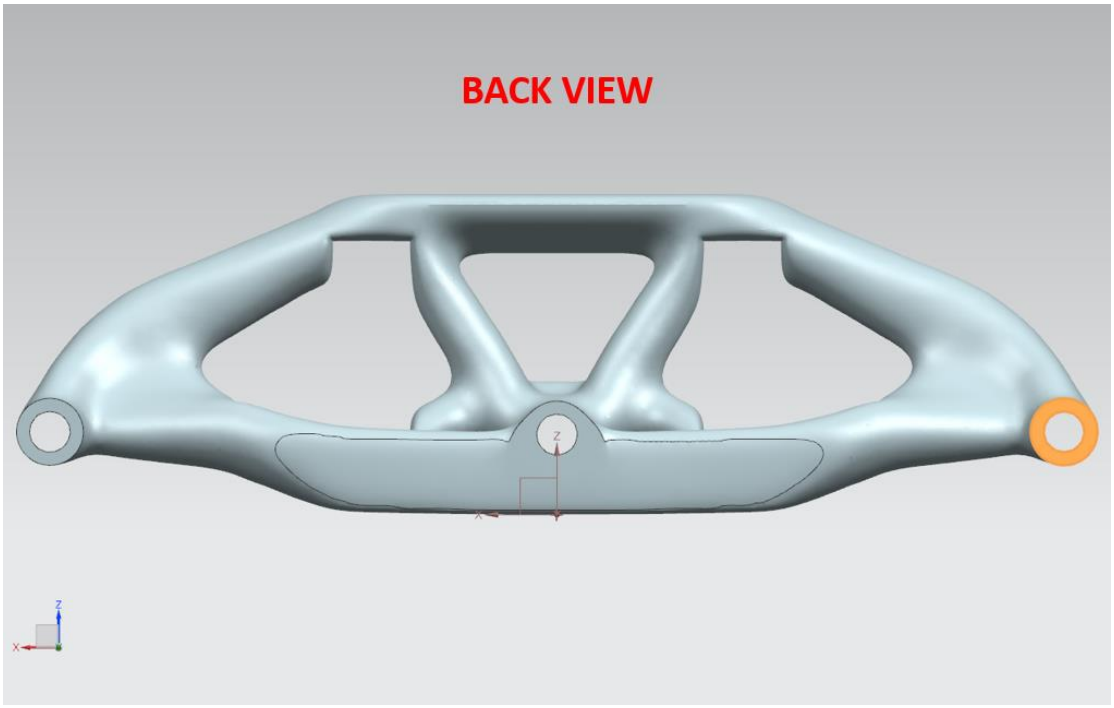
ADD TEXT TO CREATE MARK

Manufacturers want to print text (ex: name of company, part information) on the part. It is possible to insert text on a part using the **Text** command

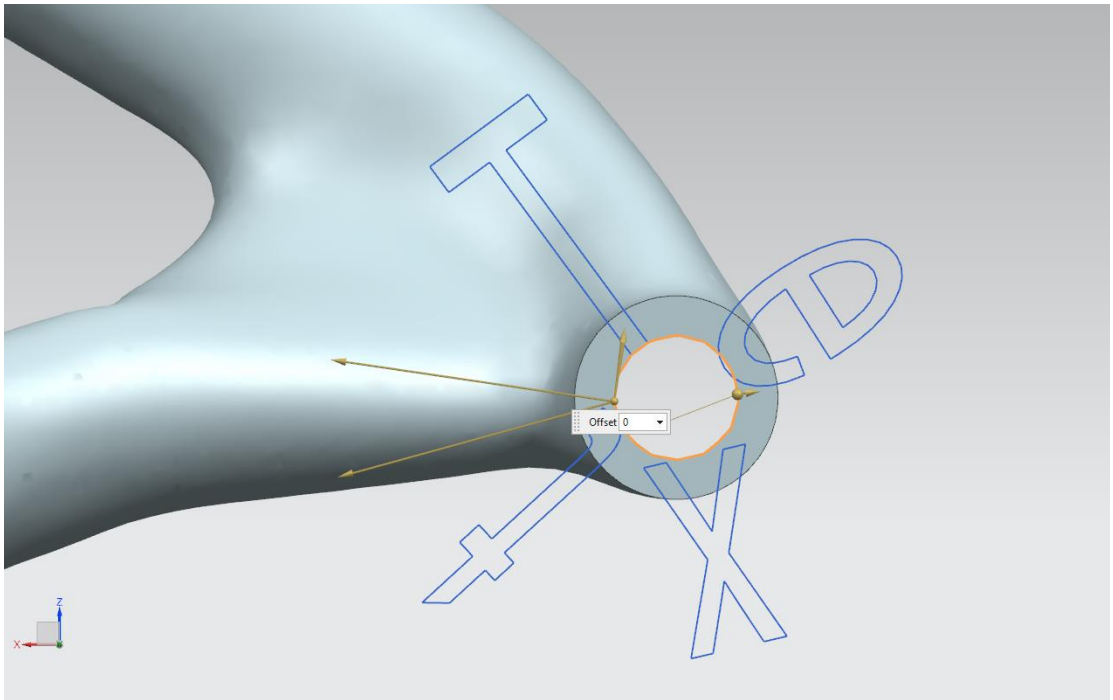
1. On the **Ribbon bar**, in the **Curve** group, click **Text**



2. In the **Text** dialog box, set the selection mode to **On Face**
3. In the **Text Placement Face** group, select circular face of the part from the graphics window as shown in the picture

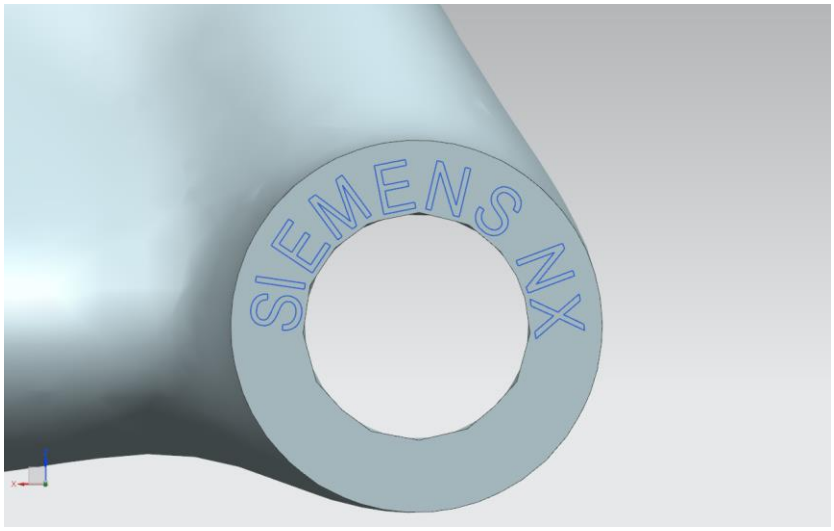


4. In the **Location on Face** group, select the **Placement Method** mode to **Curves on Faces**
5. Click on **Select Curve** in the dialog box and select the inner curve on the selected circular face



6. In the **Text Properties** group, insert desired text in the box. In this example, set the following-
   Text = SIEMENS NX
   Uncheck Reference Text
   Font = Arial
   Script = Western
   Font Style = Regular
   Check Use Kerning Spaces
7. In the **Text Frame** group, use the following settings-
   Anchor Location = Center
   %Parameter = 26.3721
   In the **Dimensions** group, use the following settings-
   Offset = 0.1 mm
   Length = 7.55 mm
   Height = 1 mm
   W Scale = 88.4313 mm
   NOTE: These values have to be adjusted to get the desired font size. The above values may vary
8. In the **Settings** group-
   Check Associative
   Check Join Curves
   Uncheck Project Curves
9. Click **OK** to close the **Text** dialog box

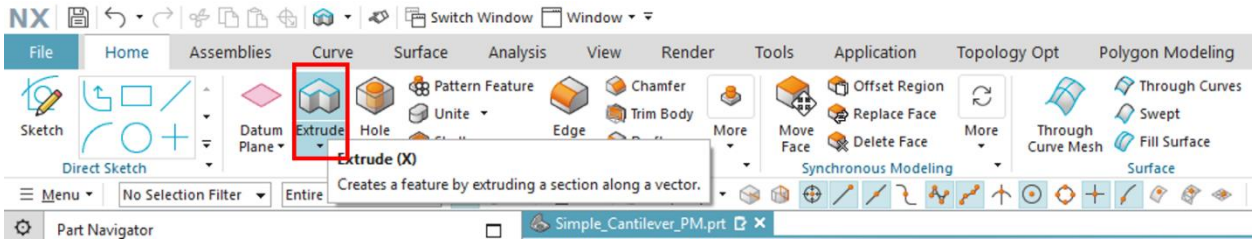
Notice the text appear on the face



EXTRUDE

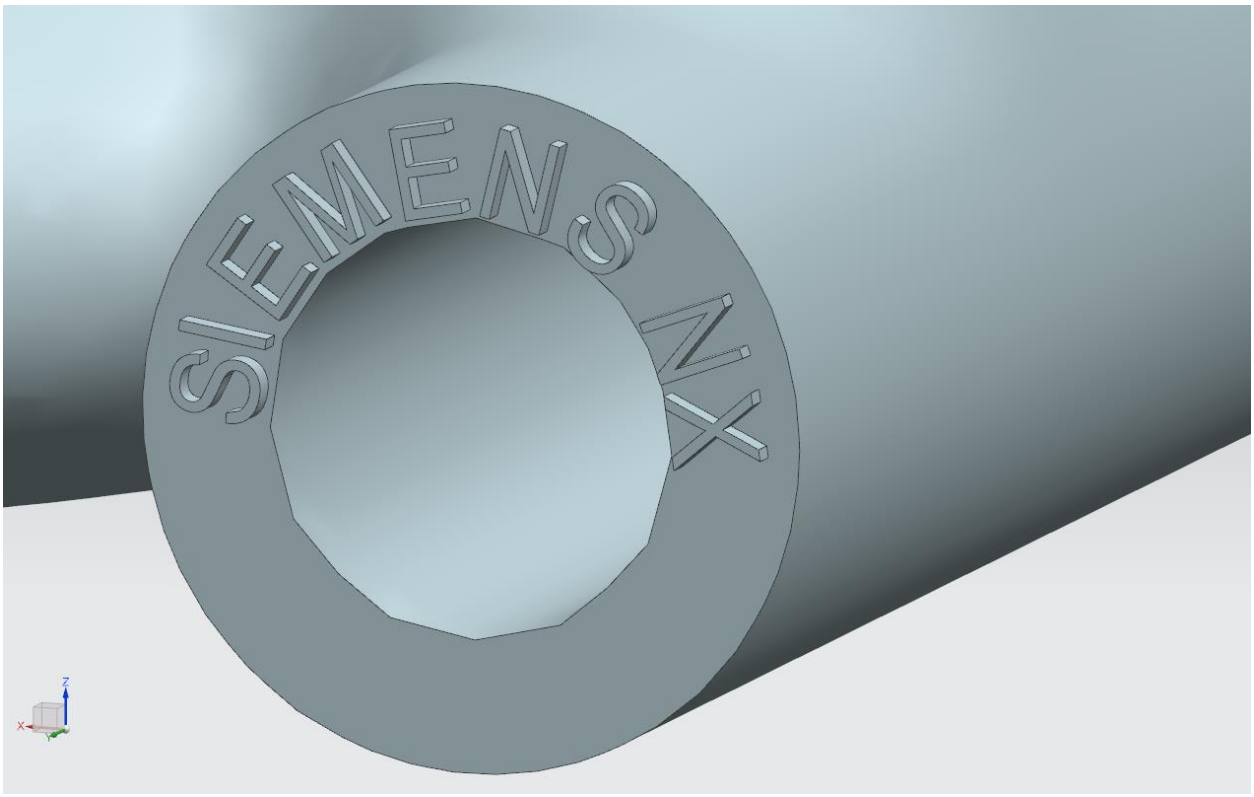
The created text has to be extruded to convert it into a solid body.

1. On the **Ribbon bar**, in the **Home** tab, click **Extrude**



2. In the **Extrude** dialog box, in the **Section** group, select curve by clicking on the text in the graphics window
3. In the **Direction** group, specify vector as **Face/Plane Normal**
4. In the **Limits** group, use the following settings-
   Start = Value
   Distance = 0 mm
   End = Value
   Distance = 0.25 mm
   Uncheck Open Profile Smart Volume
5. In the **Boolean** group,
   Boolean = None
6. In the **Draft** group,
   Draft = None
7. In the **Offset** group,
   Offset = None
8. In the **Settings** group,
   Body Type = Solid
   Tolerance = 0.0100
9. **Check Preview**
   Click **OK** to close the **Extrude** dialog box

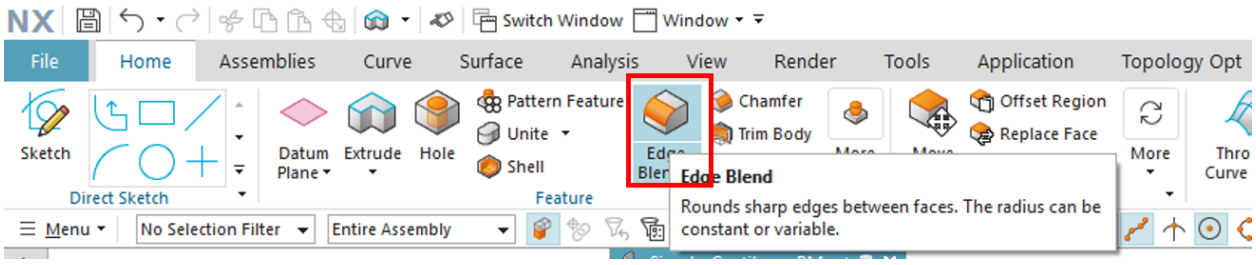
Notice the extrusion in the graphics window



EDGE BLEND

Edge Blend is used to round sharp edges between faces

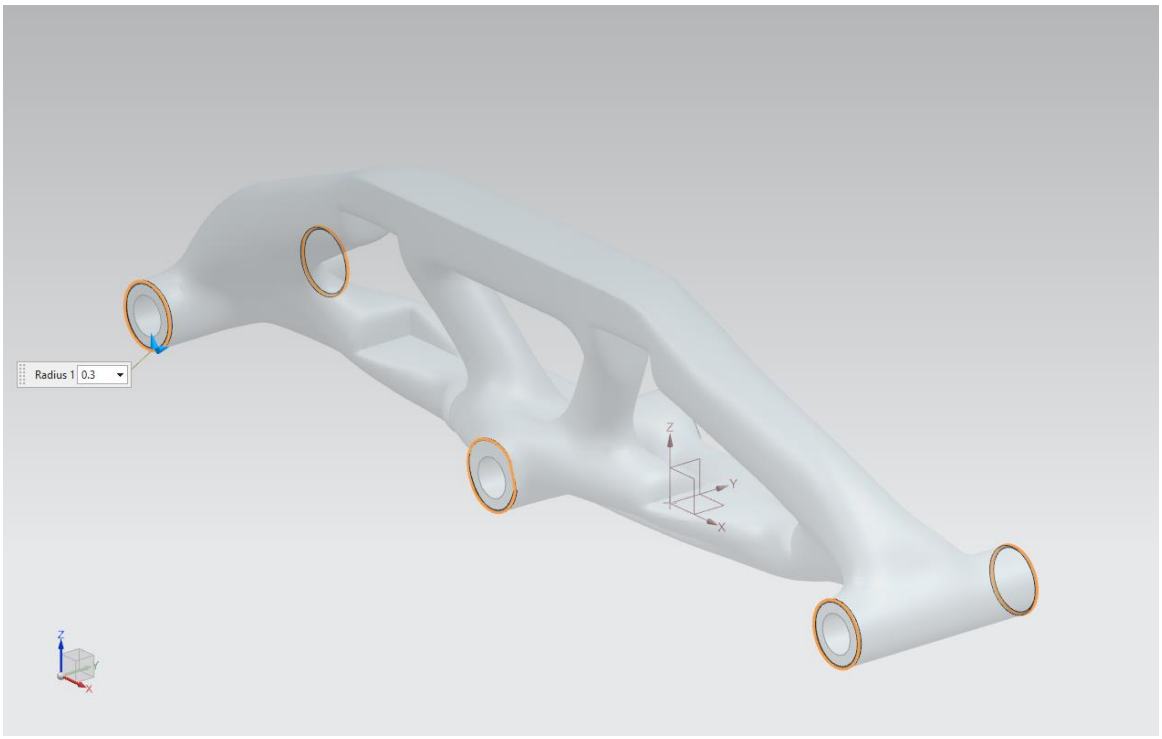
1. On the **Ribbon bar**, in the **Home** tab, click **Edge Blend**



2. Select the edges on the part from the graphics window as shown in picture below-
3. In the **Edge Blend** dialog box, in the **Edge** group, use the following settings-
   Continuity = G1 (Tangent)
   Shape = Circular

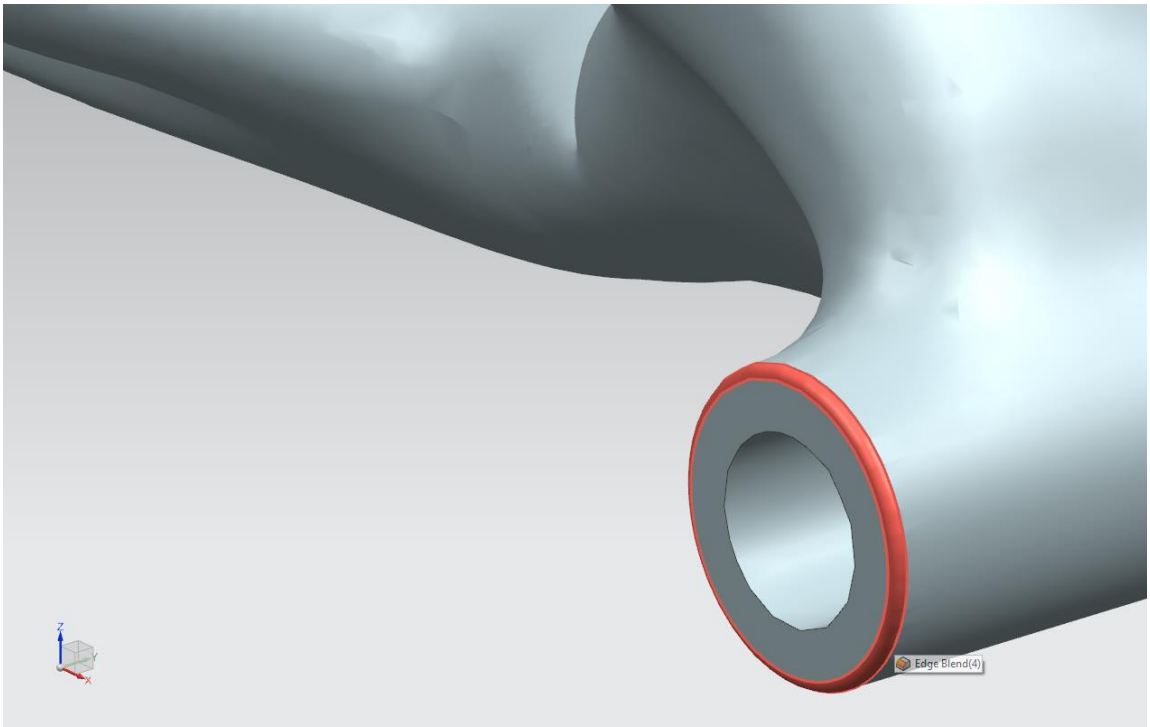
Radius 1 = 0.3 mm

Keep rest of the parameter settings as its default values in the dialog box



4. Click **OK** to close the **Edge Blend** dialog box

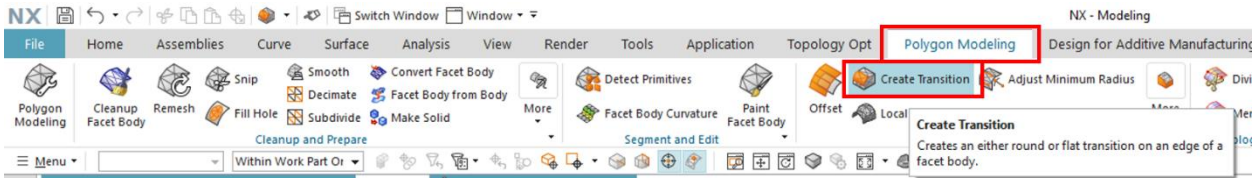
   Notice the rounded edges on the face edges in the graphics window



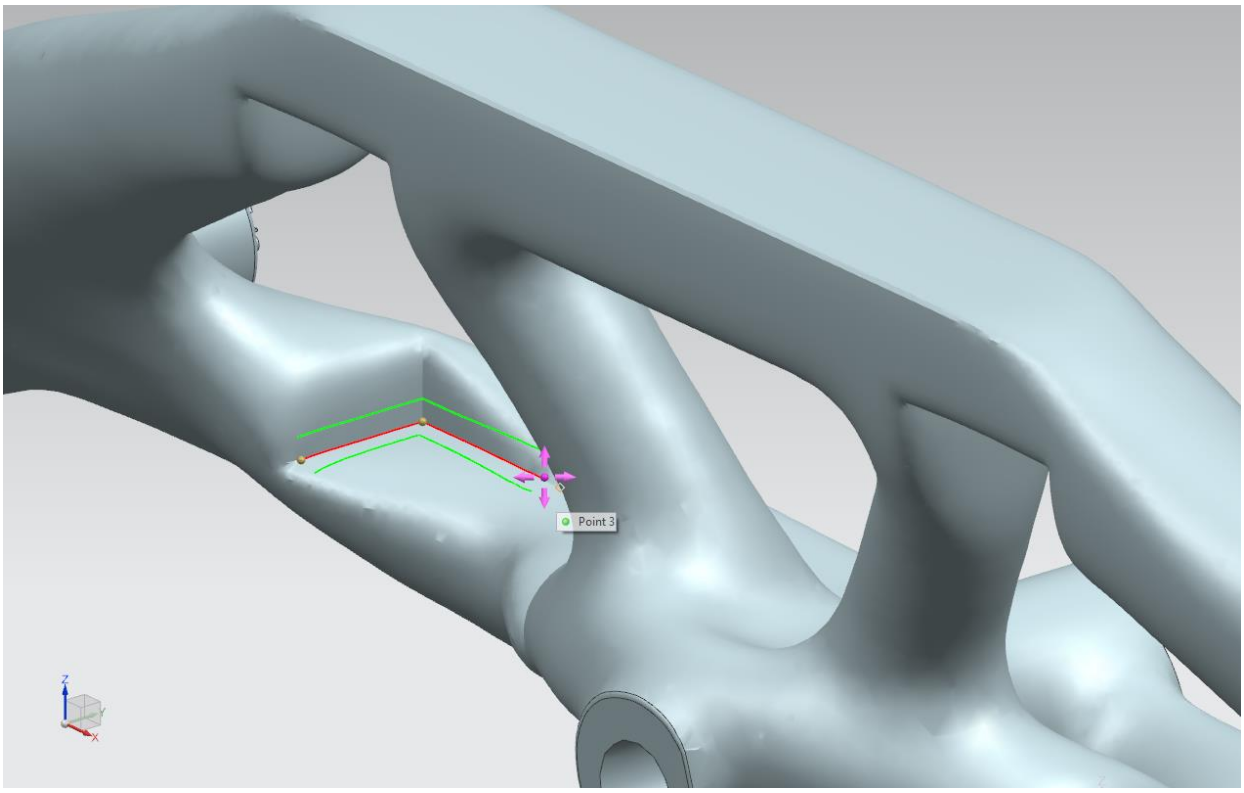
CREATE TRANSITION

Topology Optimized parts often result in parts with non-primitive faces. The geometry of such parts may contain sharp transitions which need to be smoothened. The **Edge Blend** feature can be used on face edges only. For a geometry containing the face itself with sharp features, the **Create Transition** feature can be used.

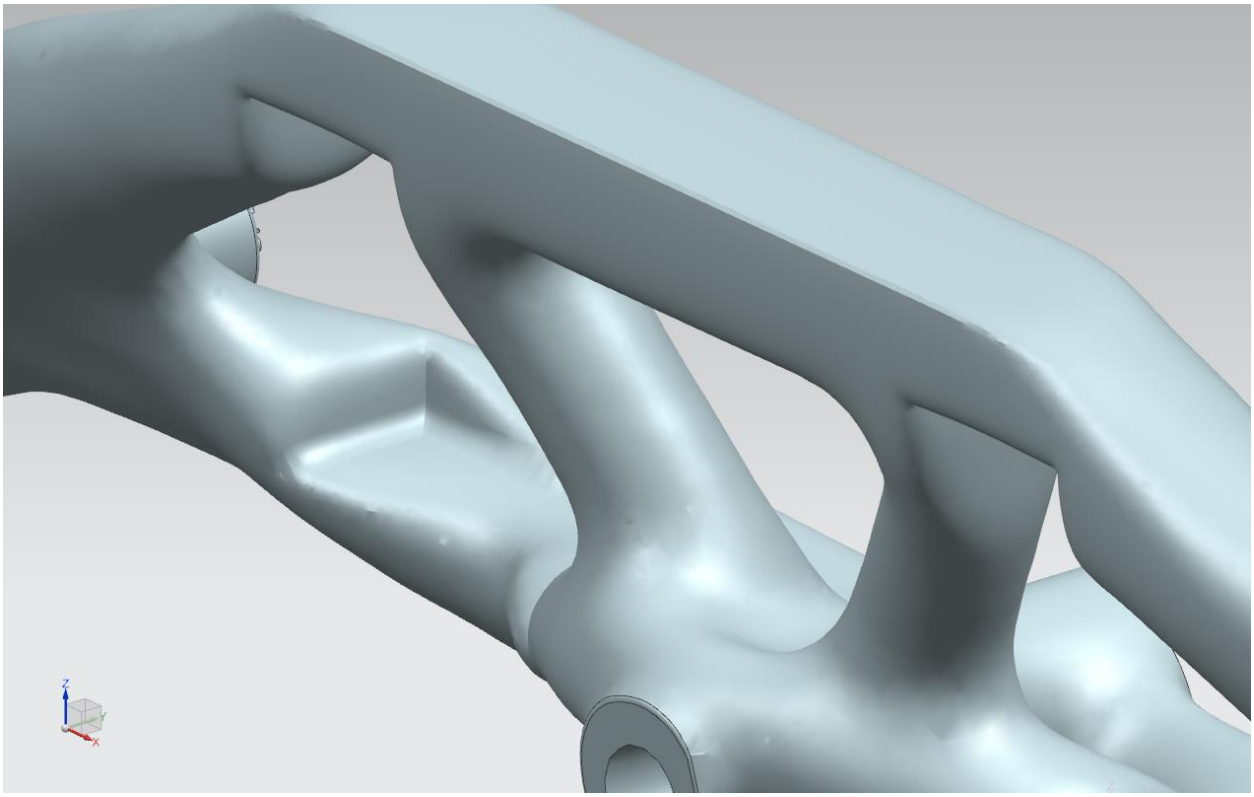
1. On the **Ribbon bar**, in **Polygon Modeling**, click **Create Transition**



2. In the **Create Transition** dialog box, set the selection mode to **Round**
3. In the **Edge** group, specify points on the part as shown in the picture below
4. In the **Dimension** group, enter-
   Radius = 1 mm



5. In the **Settings** group, **check** the box **Edit a Copy**
6. Click **Show Result**
   Notice the results in the graphics window



7. Click **Apply**
8. Continue operation on other areas of the part