Subdivision Modeling

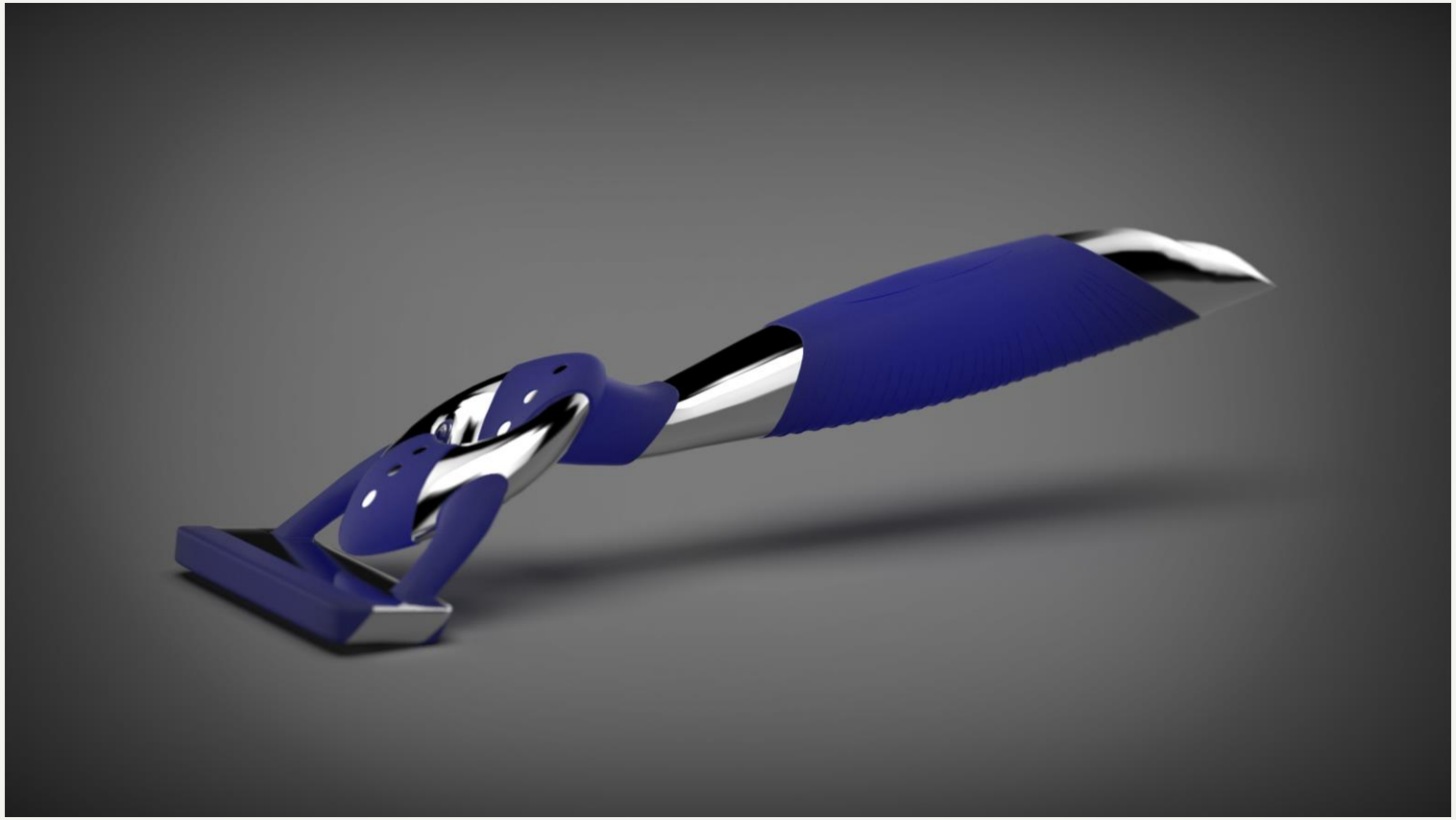
Ben Weisenberger, **Senior Application Engineer, Solid Edge Global Technical Enablement - Siemens Digital Industries Software**

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Agenda

- Subdivision Modeling – What is it?
- Environment and UI
- Cage Primitives
- Selection and Priority Filtering
- Move
  - Tip
  - Lift
  - QuickMove
- Blend
- Show Blend Values
- Split Cage Faces
- Copy/Paste Subdivision Features
- Scale Cage Elements
- Symmetry Mode
- Delete and Fill Cages



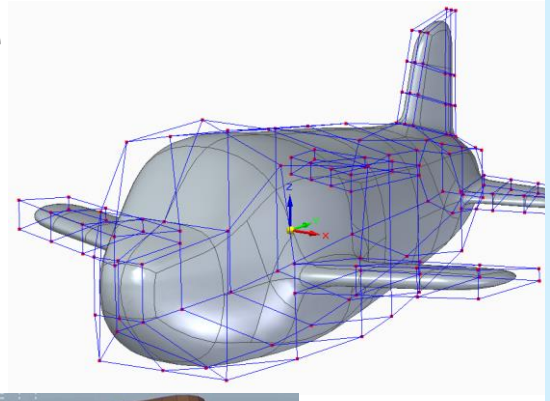
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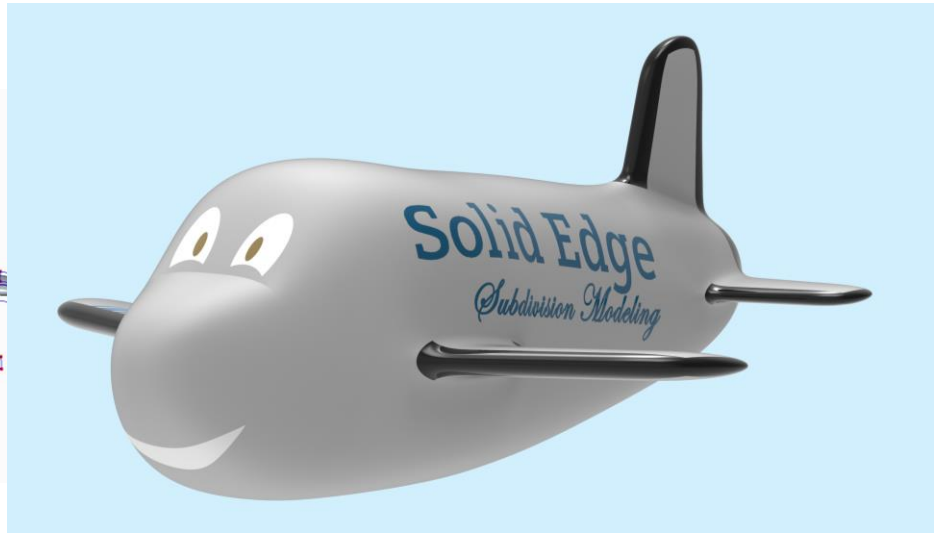
Subdivision Modeling
What is it?



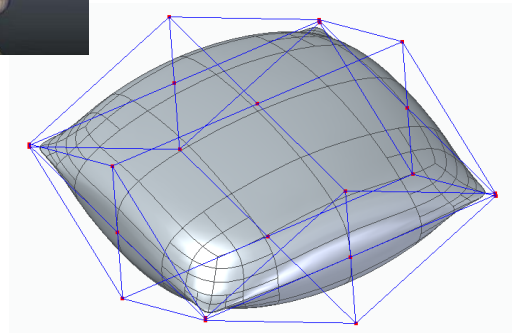
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Ingenuity for life

- A modeling technique that generates a stylized body using a polygonal cage to control its shape
- The body is generated through a set of rules that is repeatedly applied to each polygonal face/edge/vertex to generate the next level polygons' vertices and their connectivity
- Most common implementation is through Pixar's Open Source Surface Subdivision platform











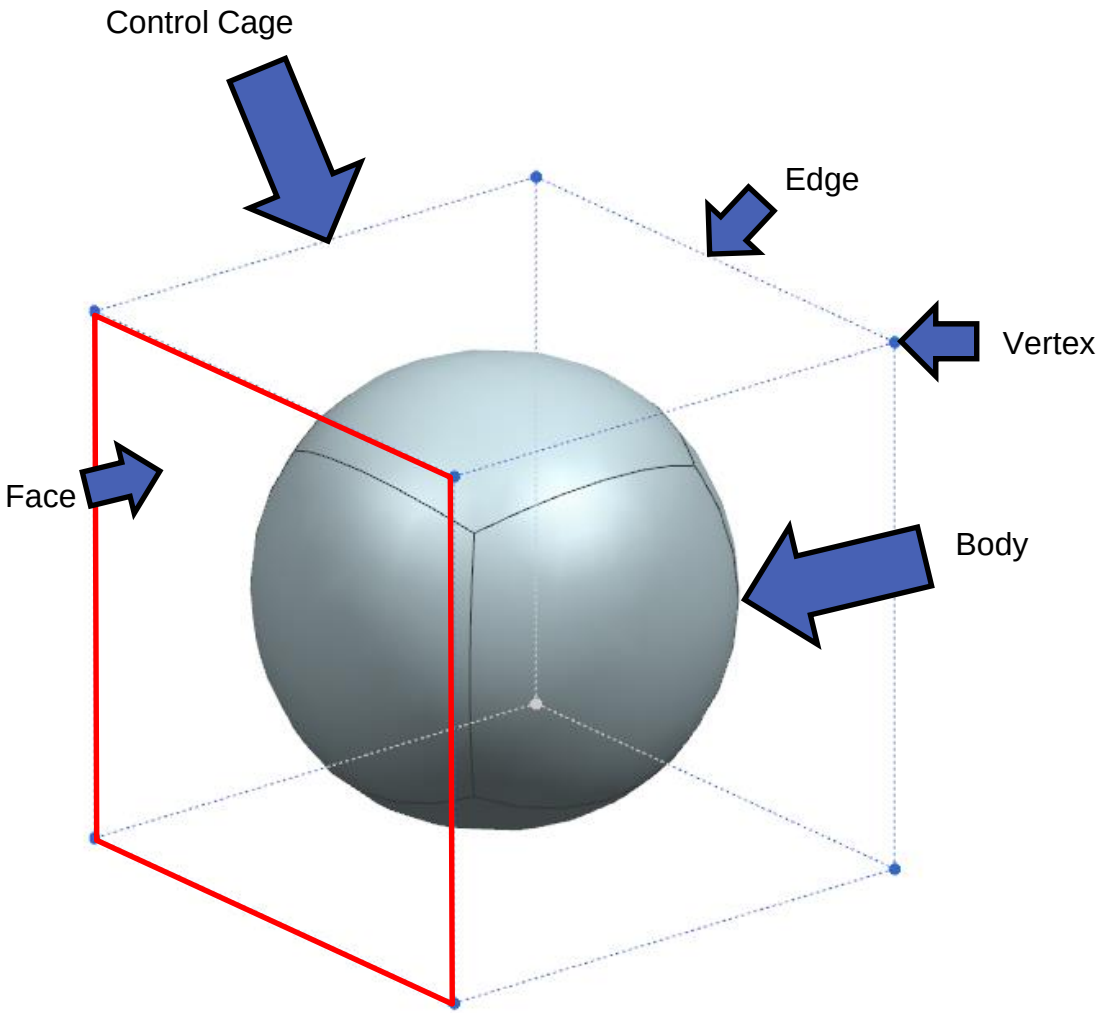
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Subdivision Modeling Framework



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Ingenuity for life

- This technique is also known as cage modeling
- Control cages contain vertices, edges and faces, which control the body
- We support Face/Edge/Vertex topology so cage edits can be done
- User has control over the body shape by adding topology to the cage or changing blend values applied to elements of the cage



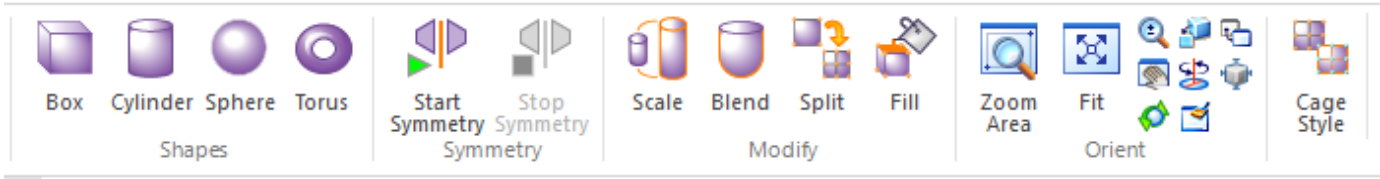
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Subdivision Modeling Environment and UI

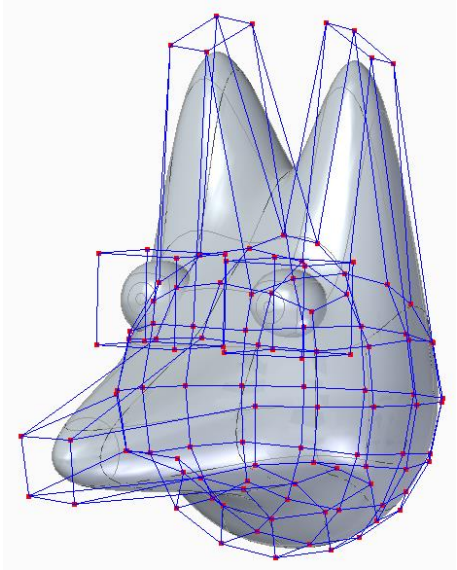


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Ingenuity for life

- It has its own environment and UI
- Available in both Synchronous and Ordered modeling
- When created in Synchronous, the result is a body which cannot be modified by other features, but will edit back into Subdivision environment
- Editing the body can be done in Ordered environment with a hybrid workflow









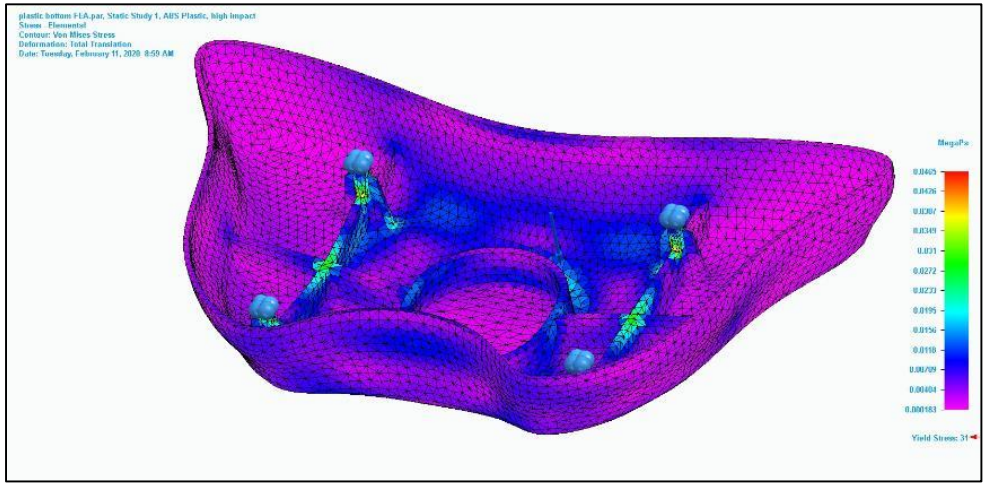
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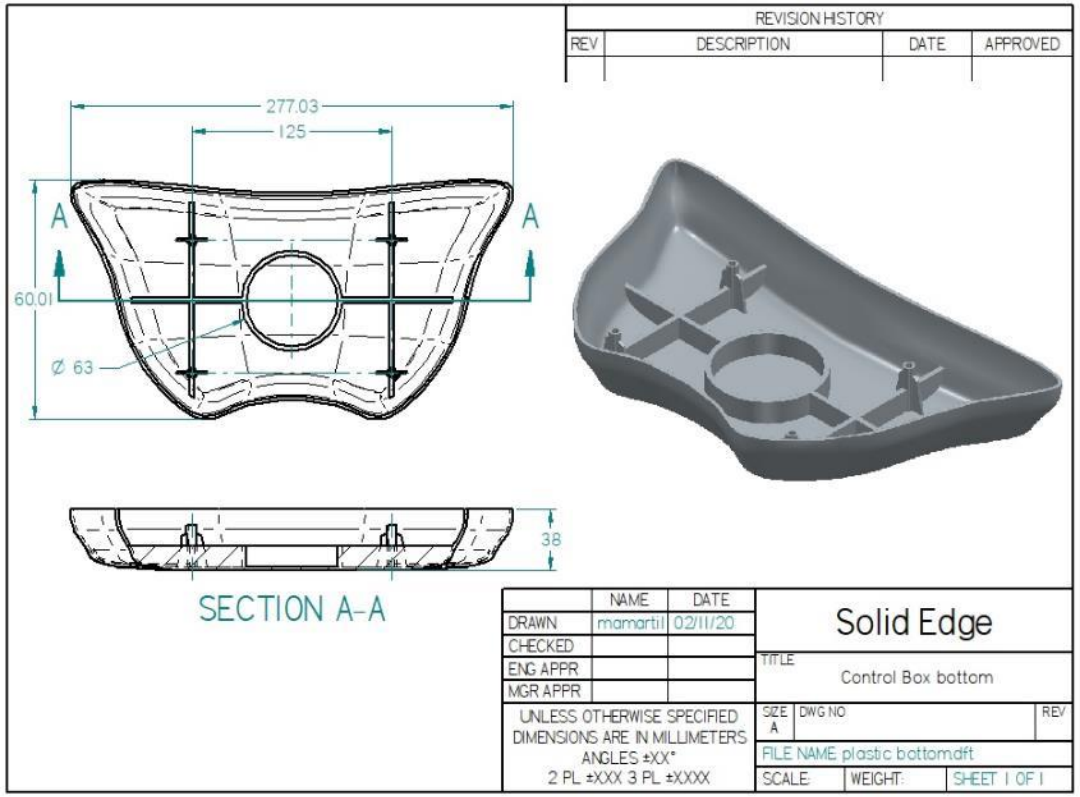
Subdivision Modeling Environment and UI

Subdivision Modeling

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Ingenuity for life

- Subdivision bodies are created using spline surface patches, so they can be placed in drawings, with some limitations.
- Resulting bodies are available for downstream applications that support spline faces and bodies.





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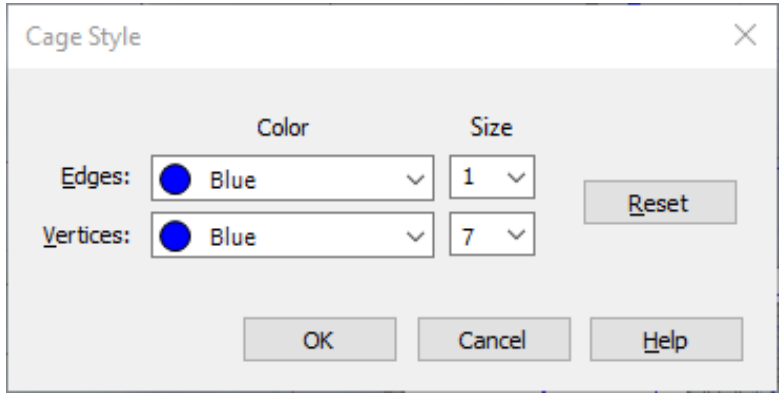
Subdivision Modeling Environment and UI

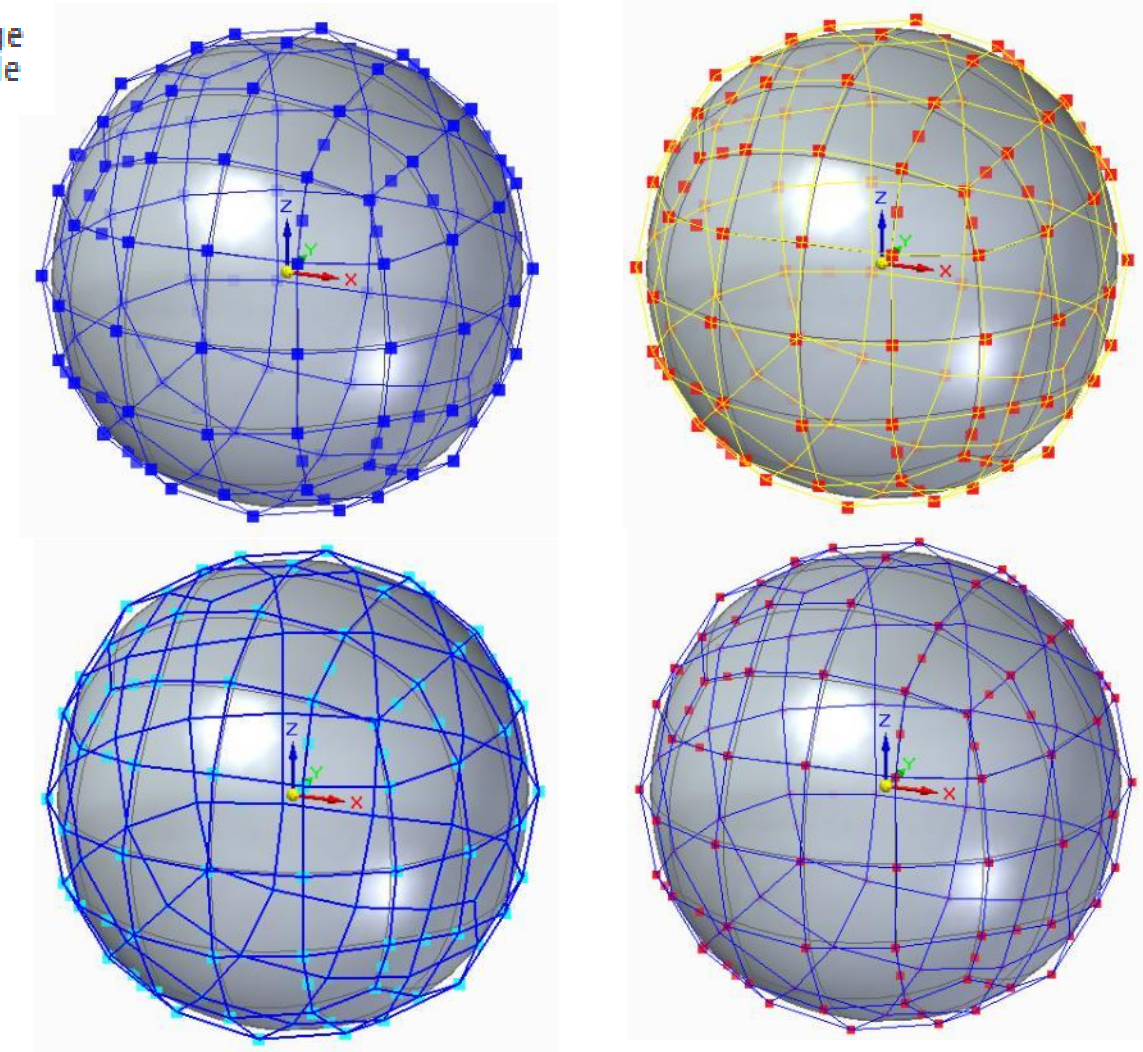


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Ingenuity for life



- The Cage Style command allows the user to control how vertices and edges display on cages
- Users can change color and size of edge and vertices
- The style values are stored as a user preference





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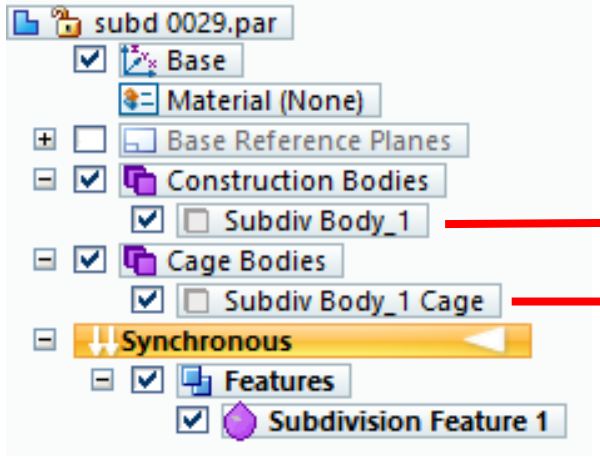
Subdivision Modeling Environment and UI

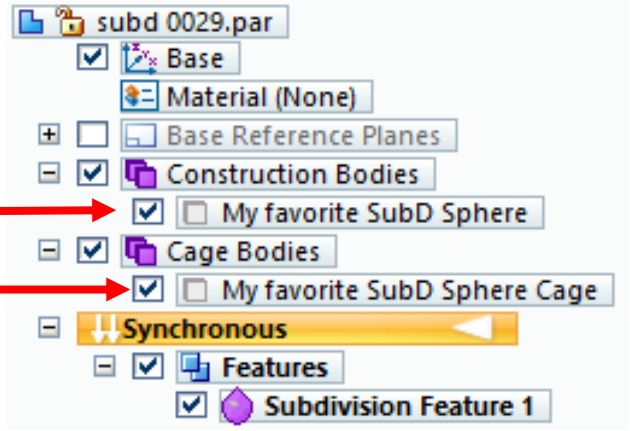


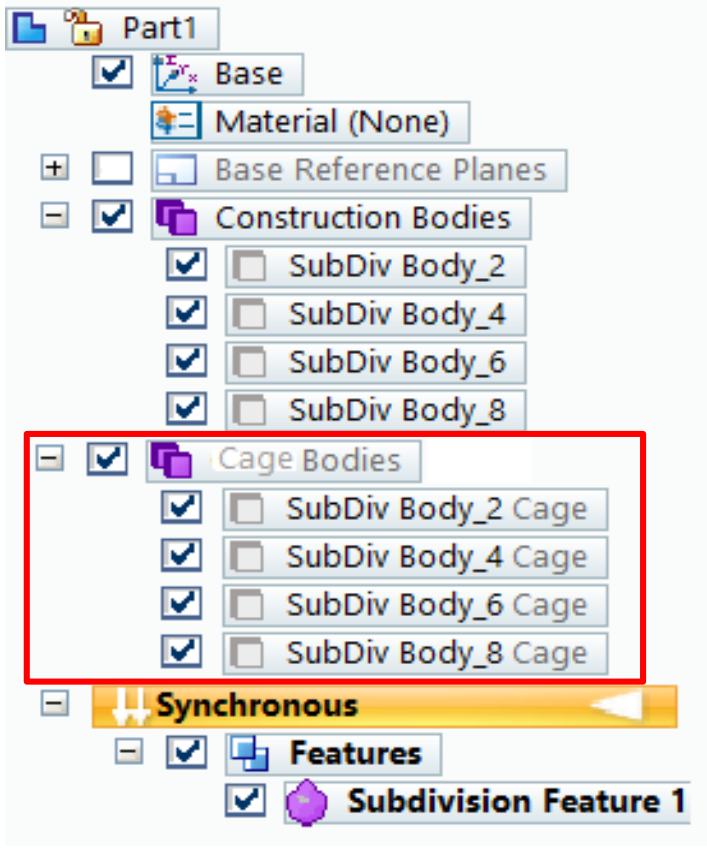
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Ingenuity for life

- Subdivision features can contain multiple cages, so we added a Cage Bodies collector within the Subdivision environment

- Cage and Subdivision bodies names are synced. If one changes, the other also does







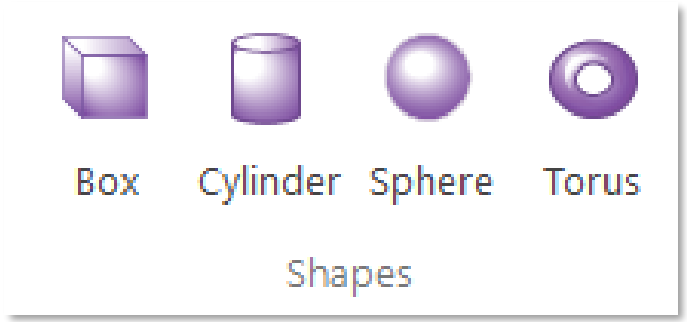
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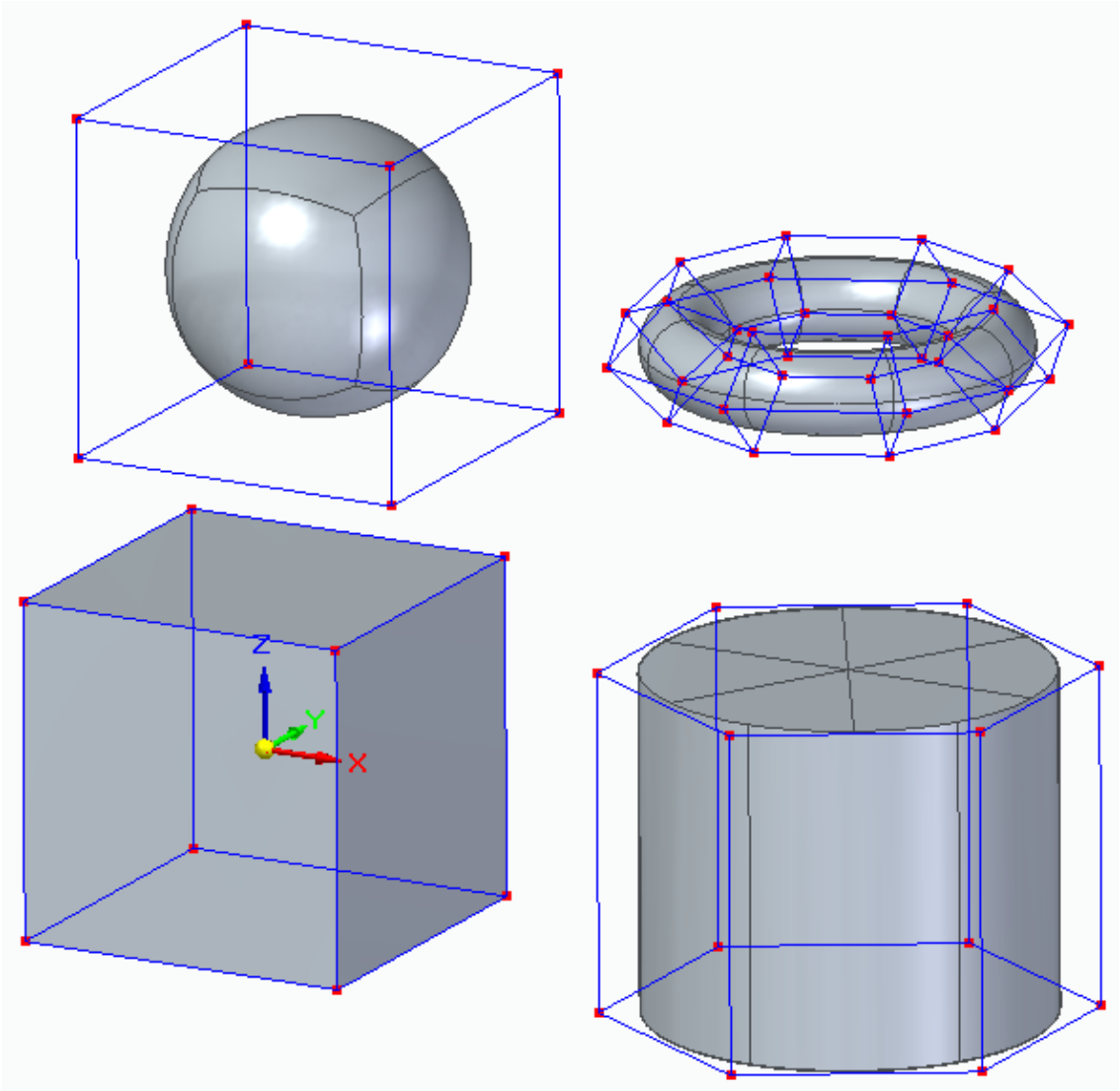
Subdivision Modeling Cage Primitives



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Ingenuity for life

- Cage creation is done using primitives. We plan to allow protruding, revolving and other methods later
- Default creation method for all primitives is to place them at the origin with smooth edges option turned on





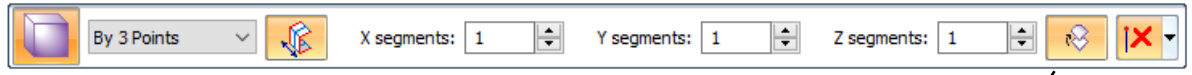
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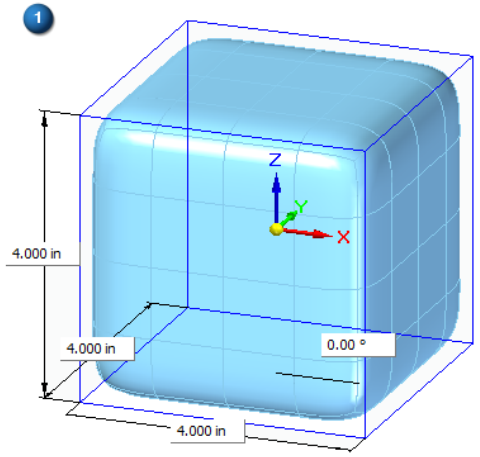
Subdivision Modeling
Box command

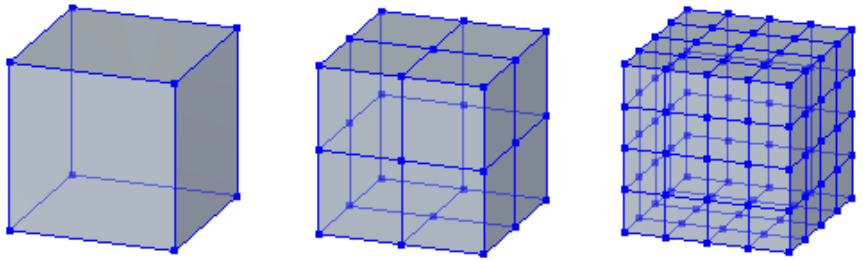
Subdivision Modeling

SIEMENS
Ingenuity for life

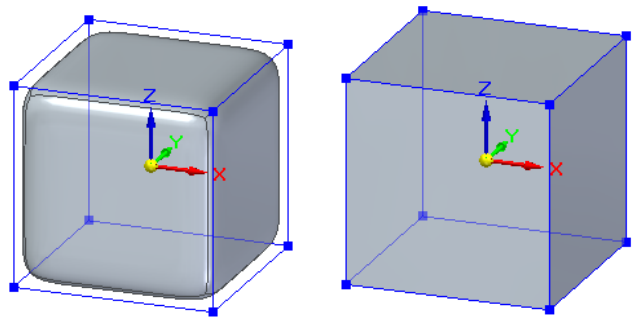
- Default creation method as **At Origin** but can be changed to **By Center, By 2 Points,** or **By 3 Points**
- Number of cage segments in X,Y,Z directions can be controlled independently







Segments: XYZ=1 XYZ=2 XYZ=3



Smooth Edges: ON OFF

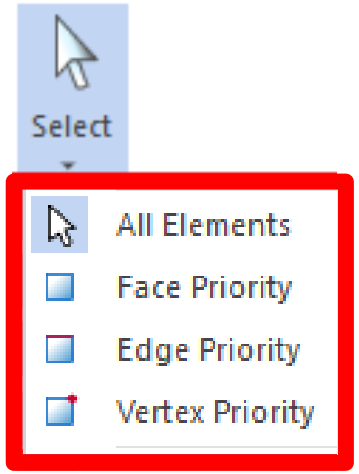
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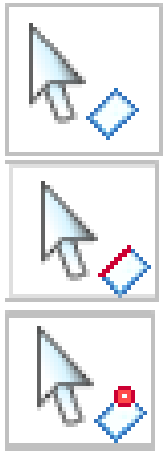
Subdivision Modeling
Selection Priority and Filtering

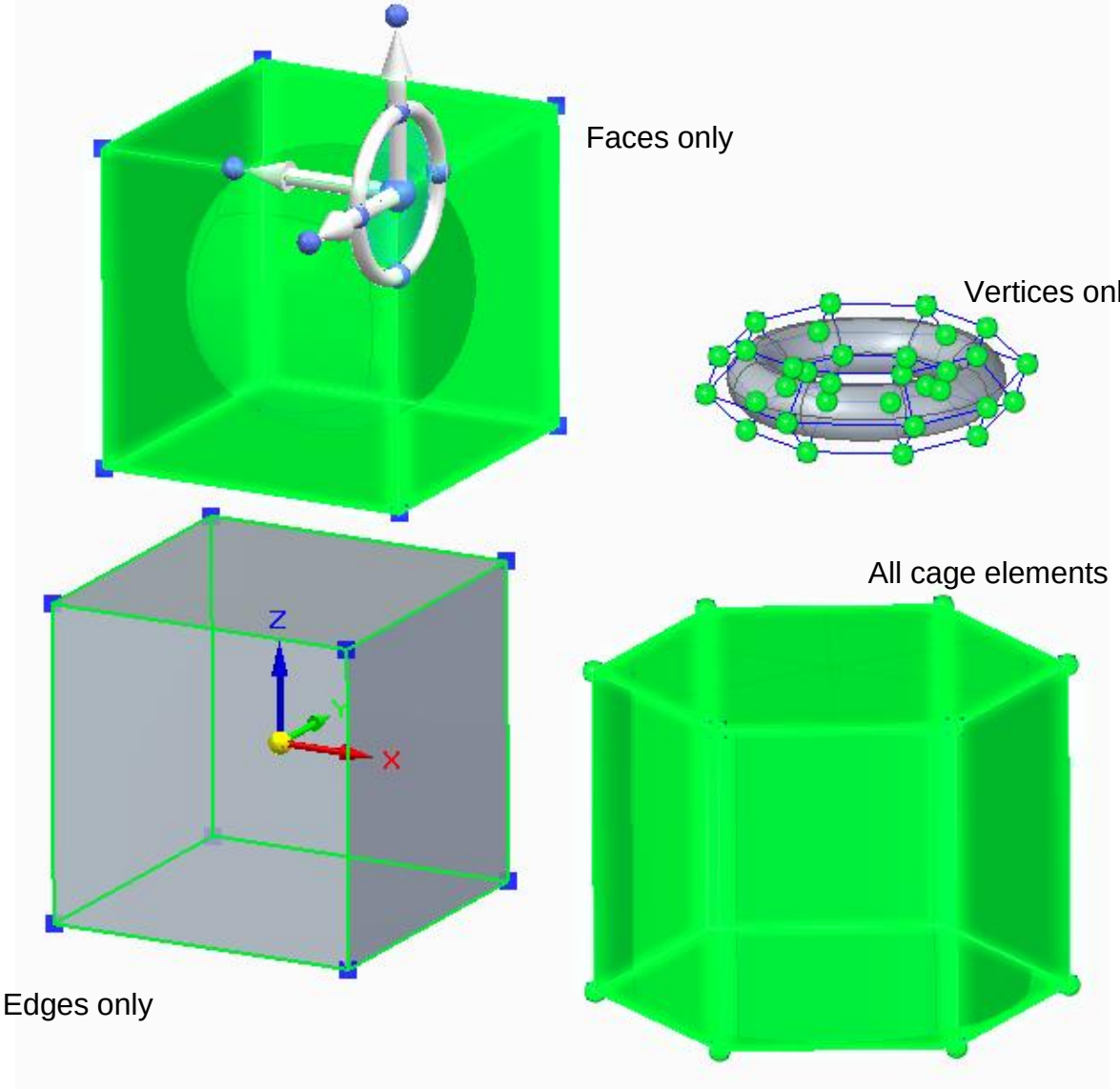
Subdivision Modeling

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Ingenuity for life

- Selection filters allow priority selection of faces, edges or vertices
- QuickPick can also be used to select individual planar faces, vertices, and edges
- Controlled via shortcut: CTRL+Spacebar







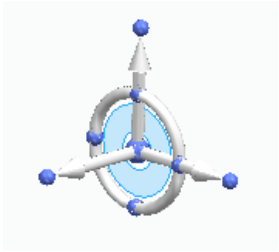
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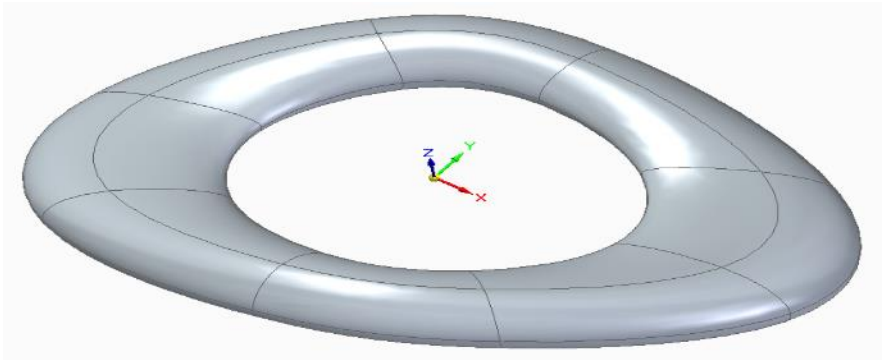
Subdivision Modeling
Move - Tip

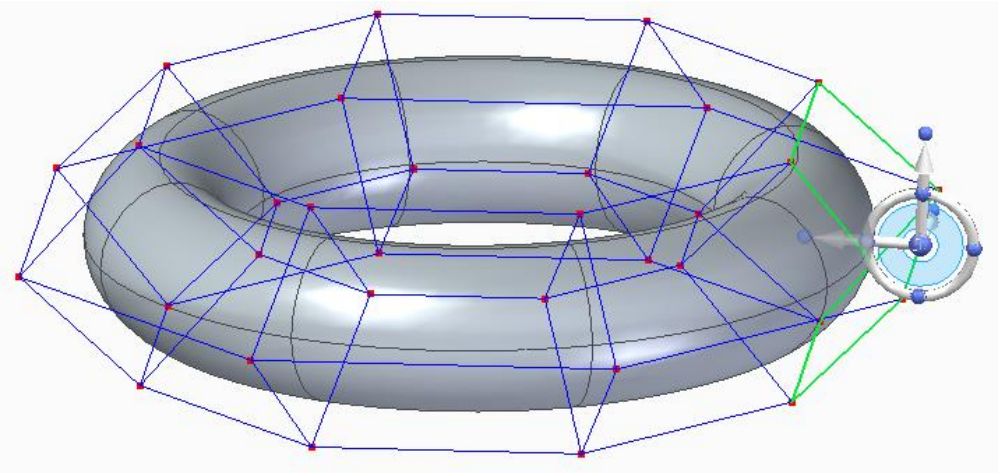
Subdivision Modeling

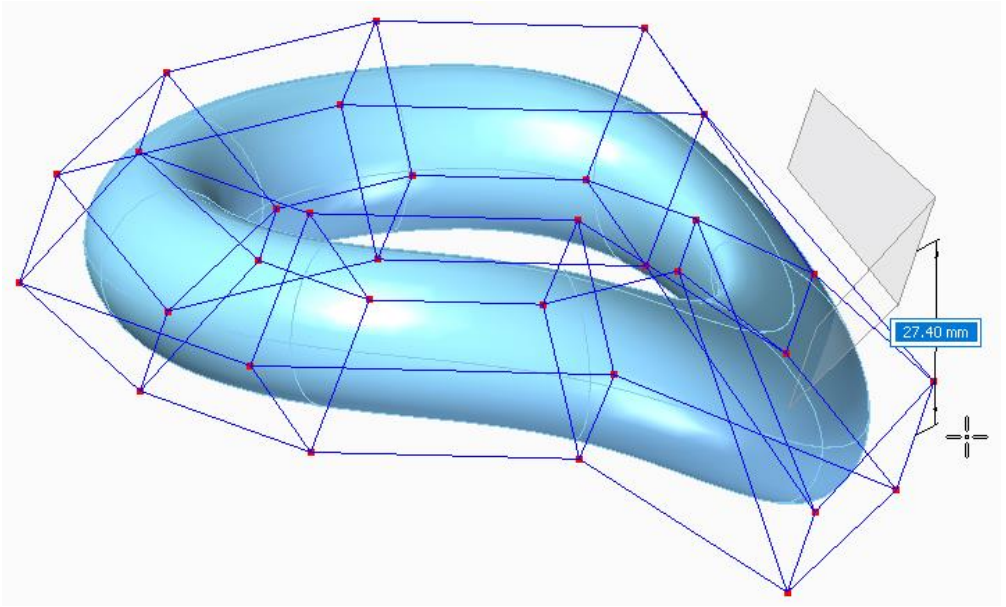
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Ingenuity for life

- Move and Rotate operations are done using the Steering Wheel.
- Tip mode is the default behaviour
- No new faces are created in Tip mode
- Tip trims, extends, or changes the current orientation of faces connected to the elements in the select set









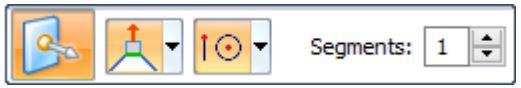
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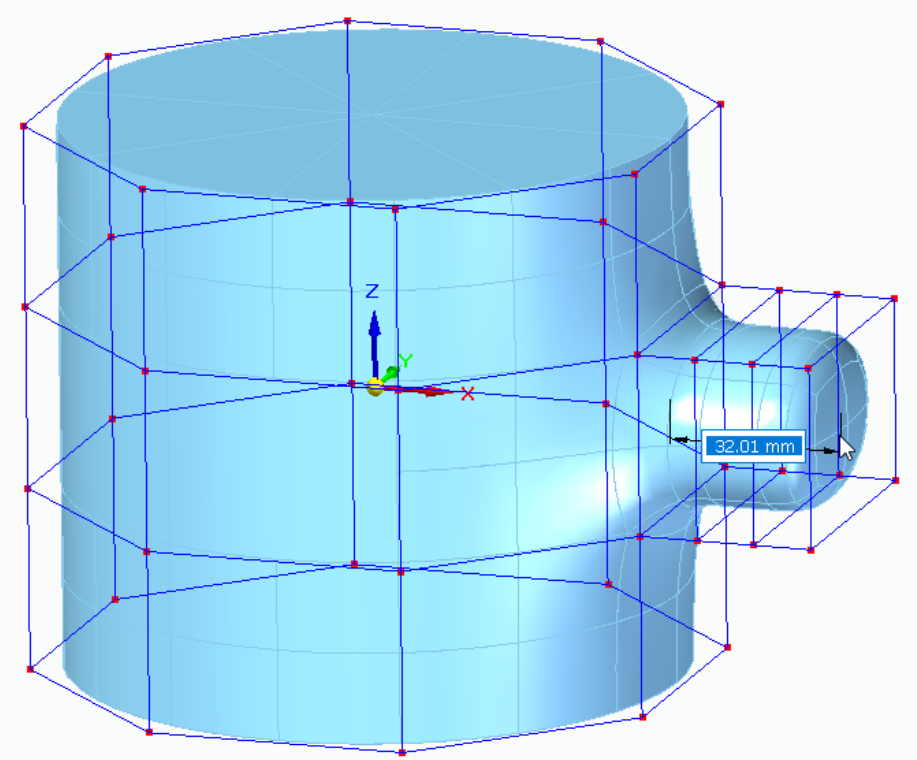
Subdivision Modeling
Move - Lift

Subdivision Modeling

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Ingenuity for life

- Lift adds faces to the model
- Existing faces are left in current positions and only selected elements are moved
- Lift can only be used when the select set contains faces
- We can define how many faces to add to model with the **Segments** box on command bar



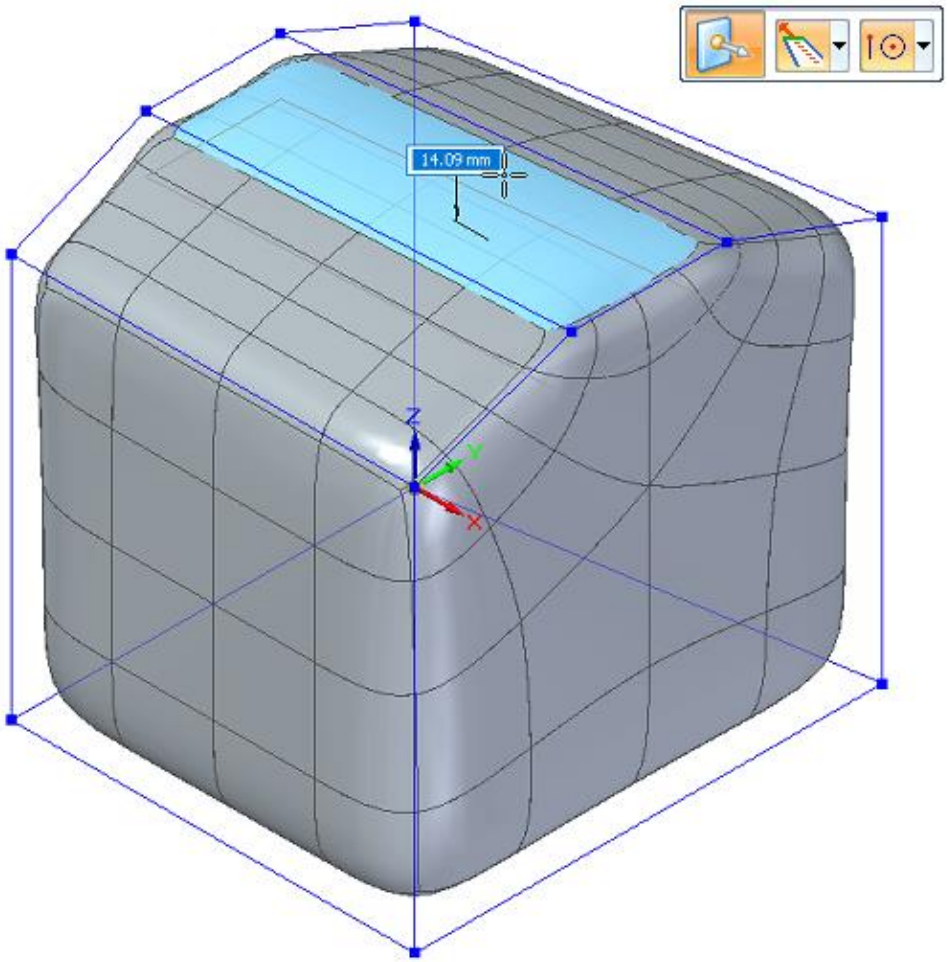


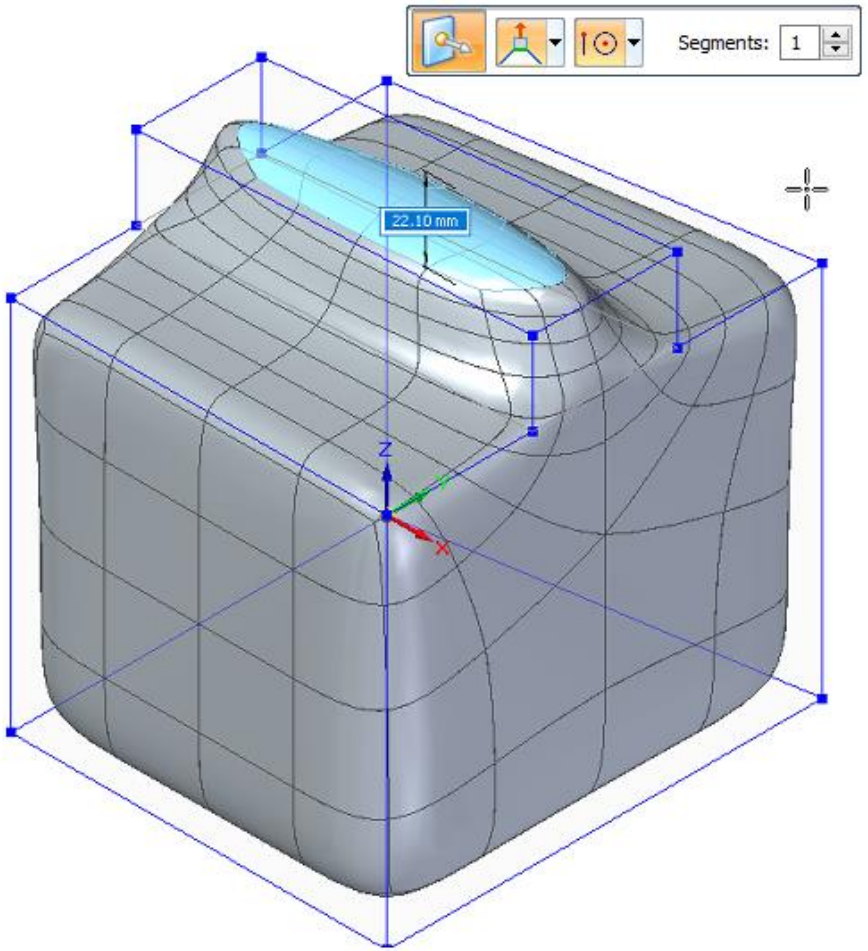
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Subdivision Modeling
Tip vs Lift

Subdivision Modeling

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Ingenuity for life





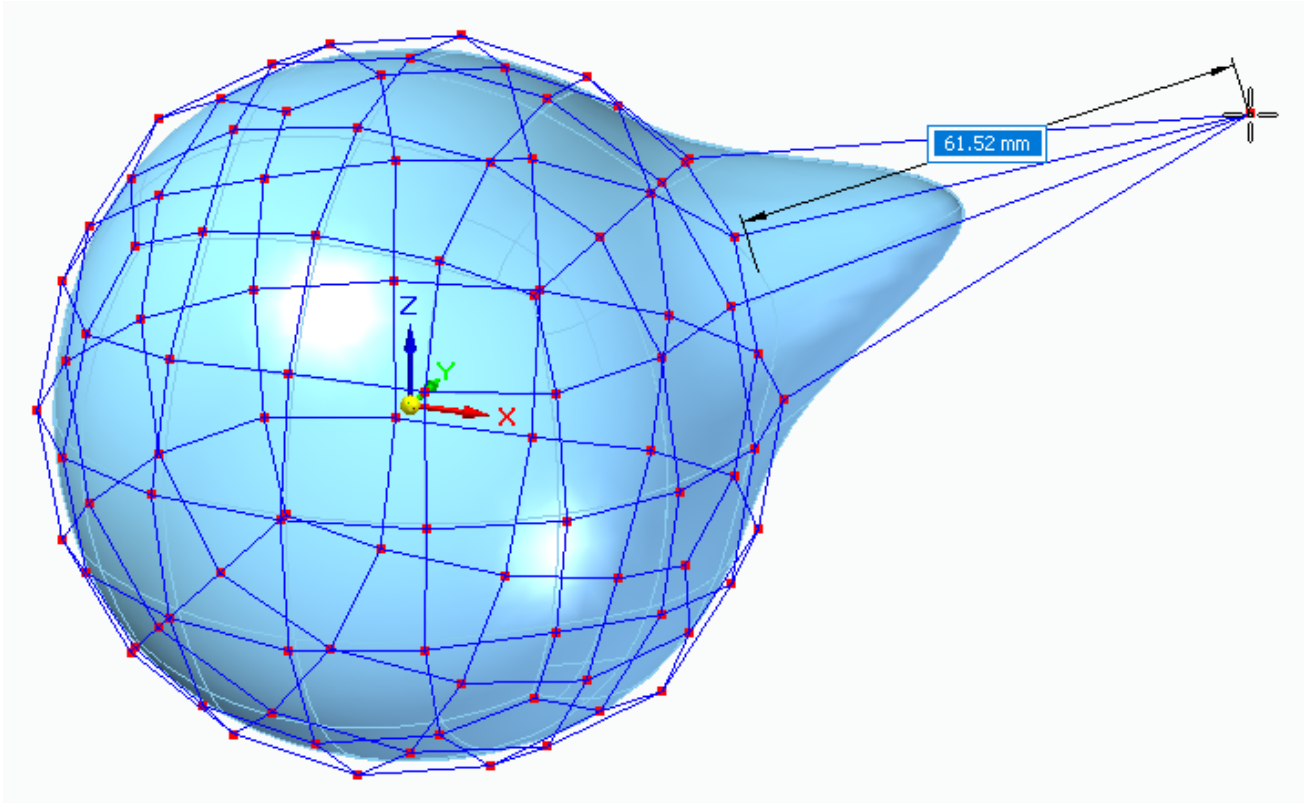
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Subdivision Modeling QuickMove

Subdivision Modeling

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Ingenuity for life

- QuickMove moves a vertex without the use of the steering wheel
- Ideal for quickly fine tuning shapes and locations
- A plane parallel to the screen, through the vertex, is locked and used for the move
- Left-click and hold when the vertex is highlighted to activate QuickMove



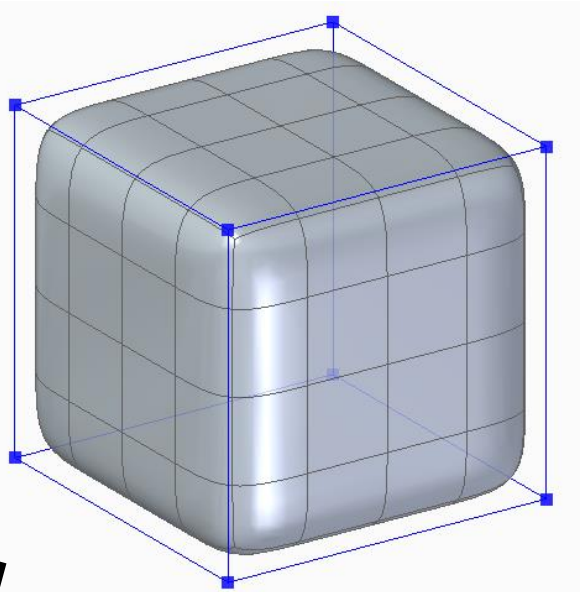
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Subdivision Modeling
Blend Edges and Vertices

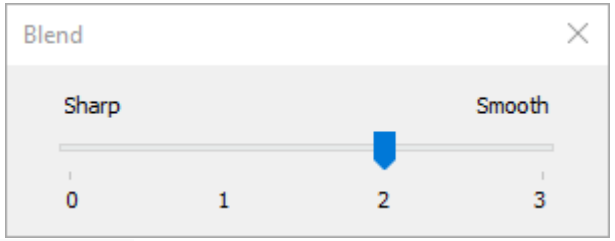
Subdivision Modeling

SIEMENS
Ingenuity for life

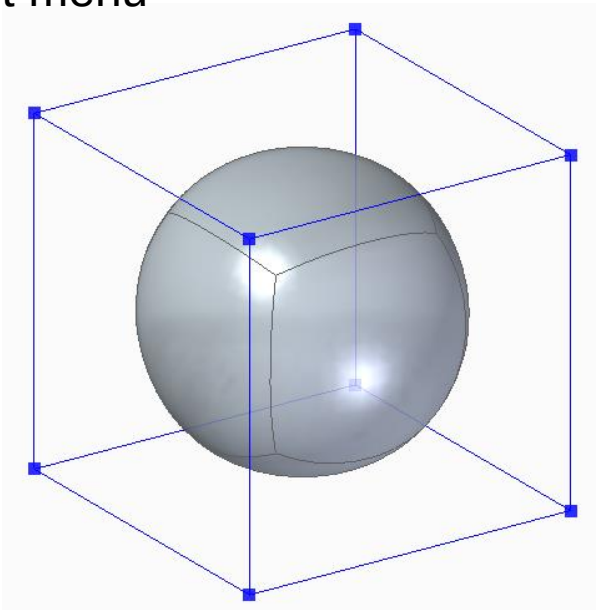
- The Blend command allows user to set blend values to edges and vertices to better control body shape
- Blend values vary from 0 to 3. Zero is a sharp edge and three is a smooth blend
- Command is located on the Ribbon and shortcut menu



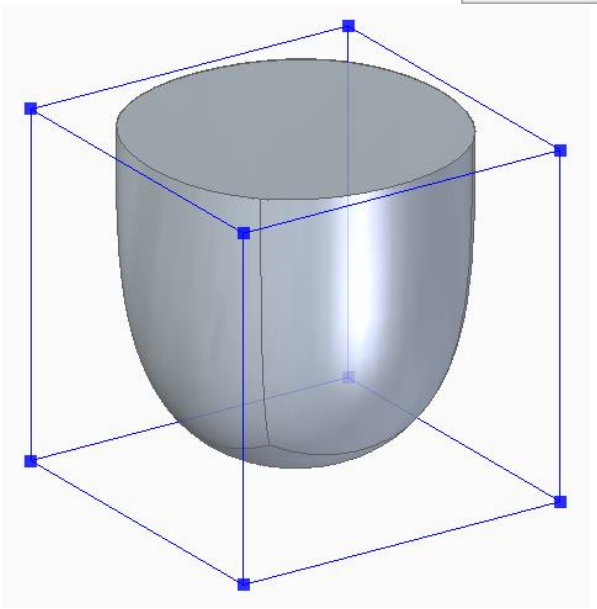
Blend value changed to 2 on all edges and vertices



Blend Value is 3 on all elements



Primitive - Sphere



Blend Value is 3 on all elements but the four top edges, which are set to 0

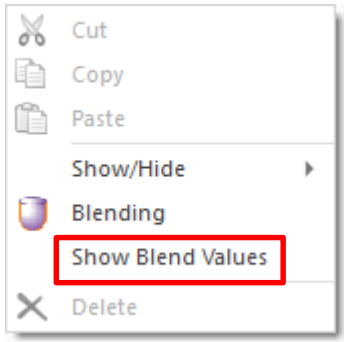
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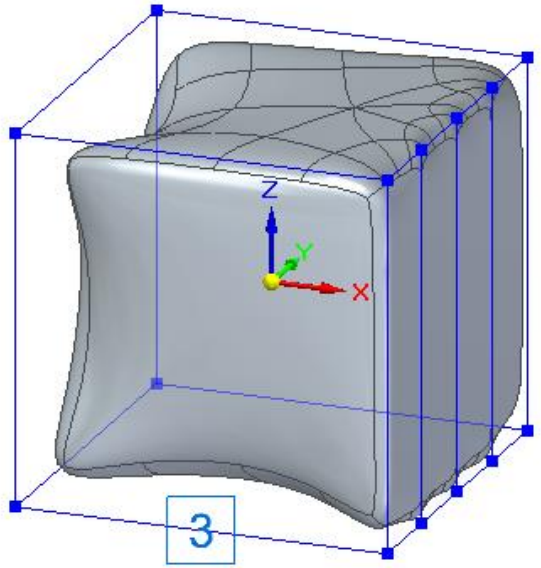
Subdivision Modeling
Show Blend Values

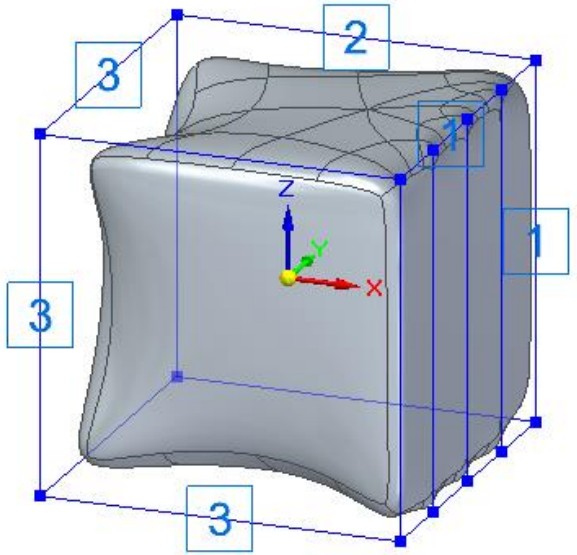


SIEMENS
Ingenuity for life

- Show Blend Values displays the Blend values for edges and vertices of the model
- By default, it shows only modified values to avoid clutter
- If elements are selected before activating the command (object-action), all blend values will be shown for the elements







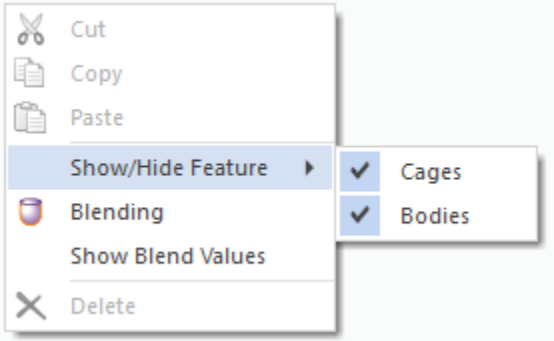
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Subdivision Modeling
Show/Hide All

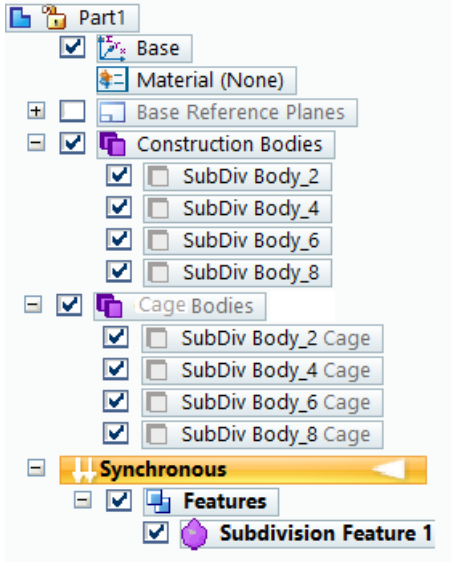


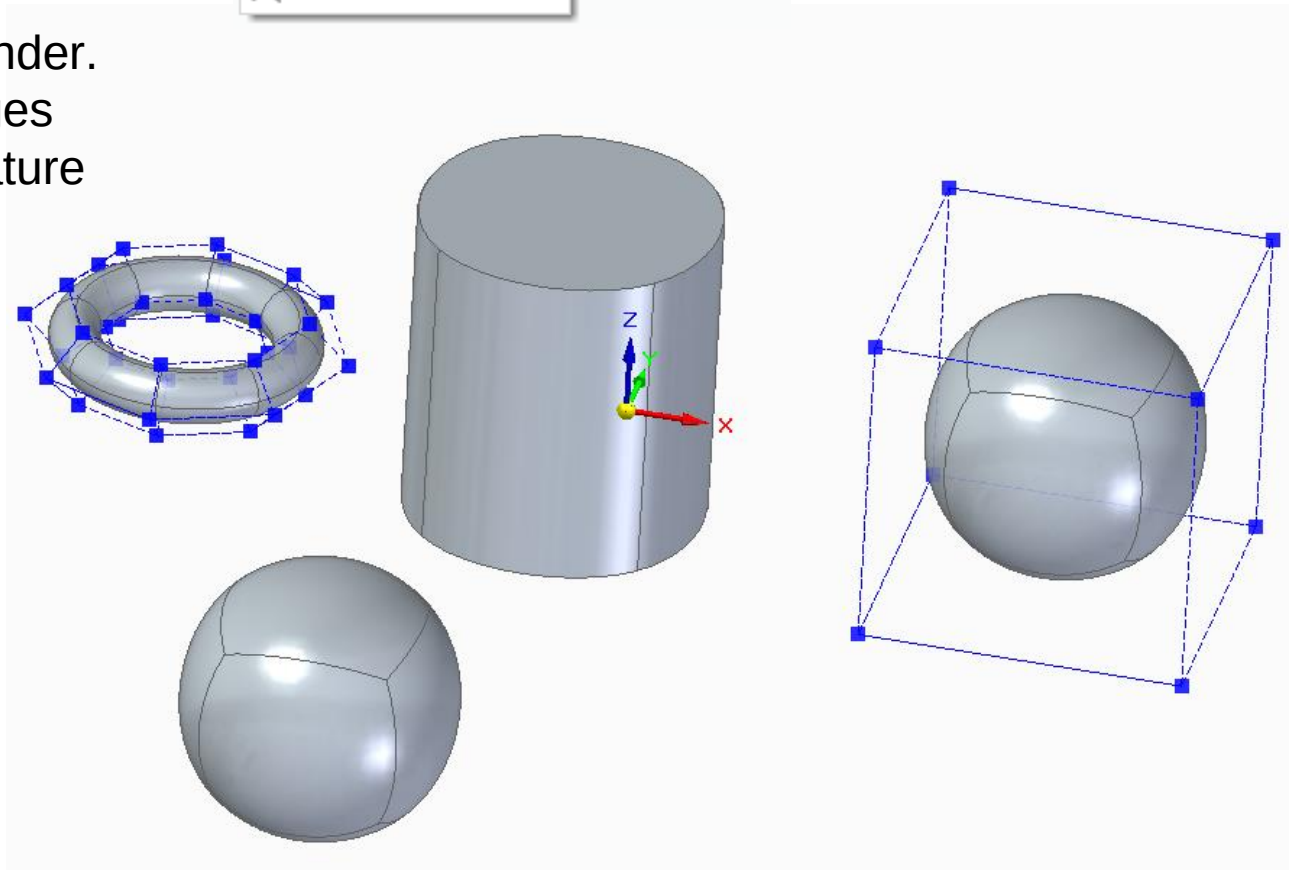
SIEMENS
Ingenuity for life

- Show/Hide Feature allows the user to show or hide all the bodies or cages in the Subdivision feature being created or edited



- Finer control is available through Pathfinder. Users can turn on and off individual cages and bodies or the entire Subdivision feature





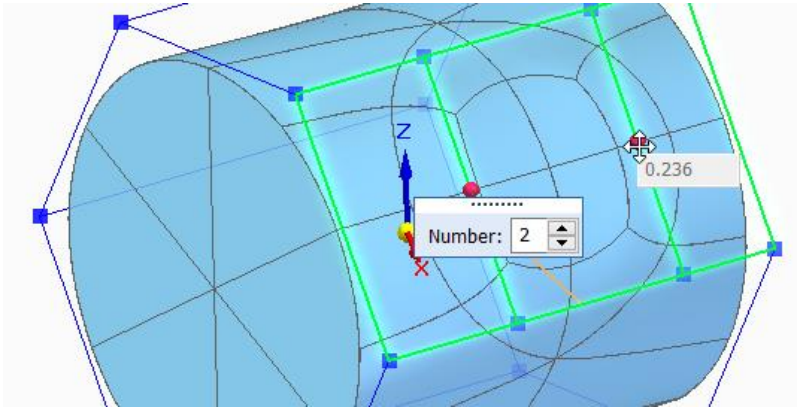
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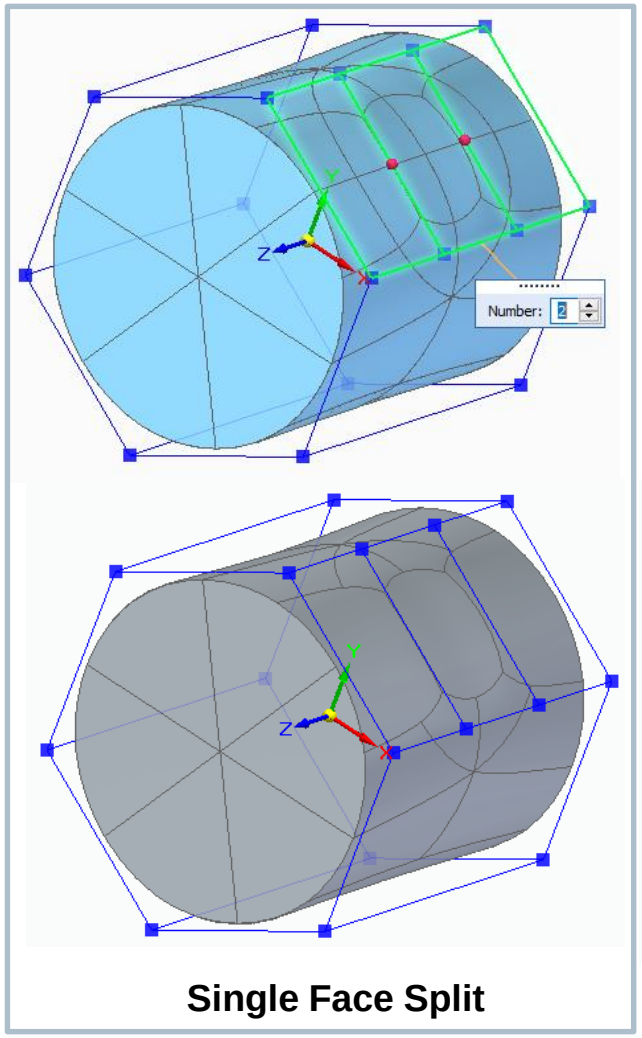
Subdivision Modeling
Split Cage Faces

Subdivision Modeling

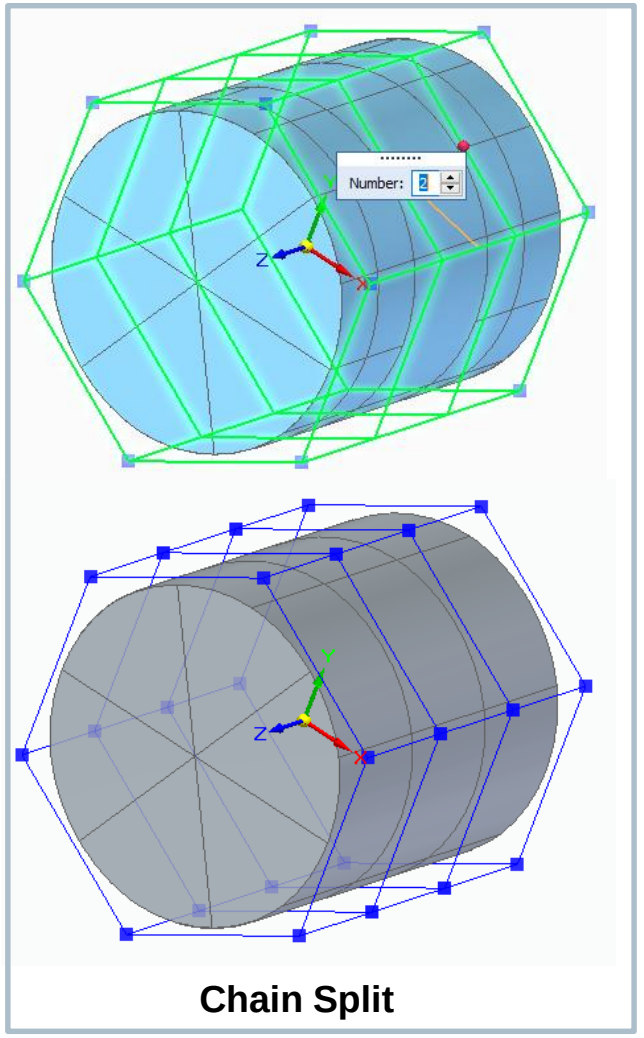
SIEMENS
Ingenuity for life

- The Split command allows users to split cage faces to add detail to the cage and body
- Single and Chain options are available. Chain allows selection of multiple faces and loops in the cage
- User controls split direction, number of splits and can move the split handles to control the location of split lines





Single Face Split



Chain Split

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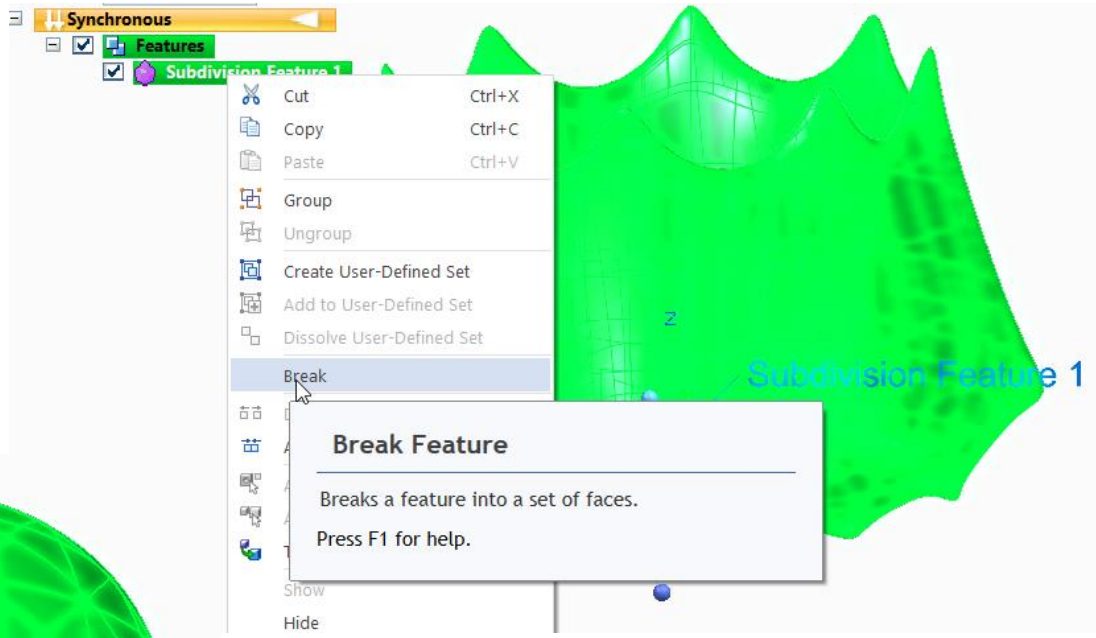
Subdivision Modeling
Drop Parents

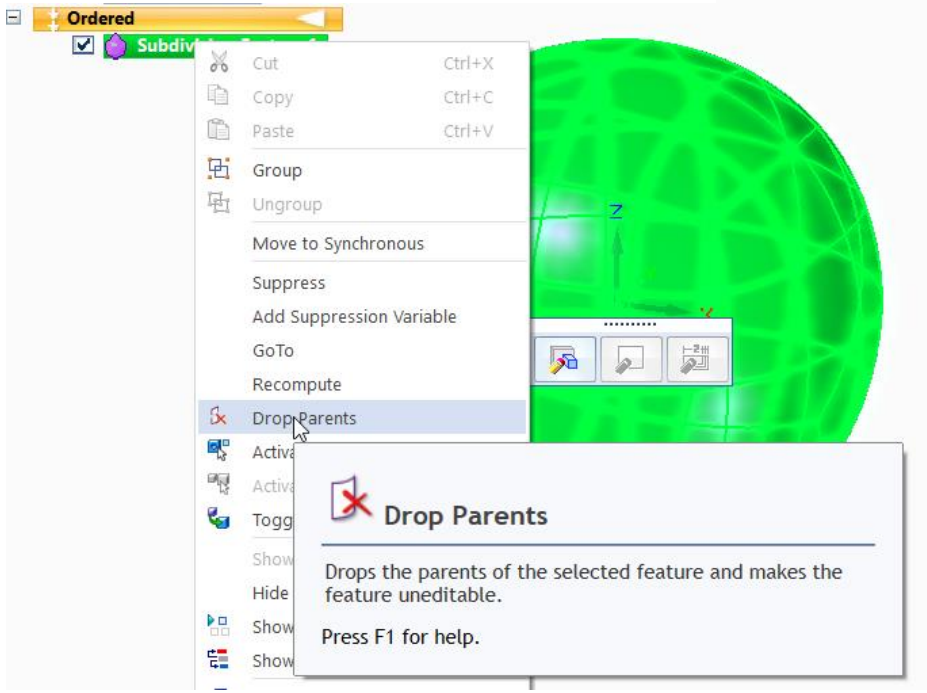
Subdivision Modeling

SIEMENS
Ingenuity for life

- Users can disconnect the Subdivision feature from its parent cage so it cannot be edited as a Subdivision feature anymore.

- The command is in the shortcut menu and is called Break in Synchronous and Drop Parents in Ordered





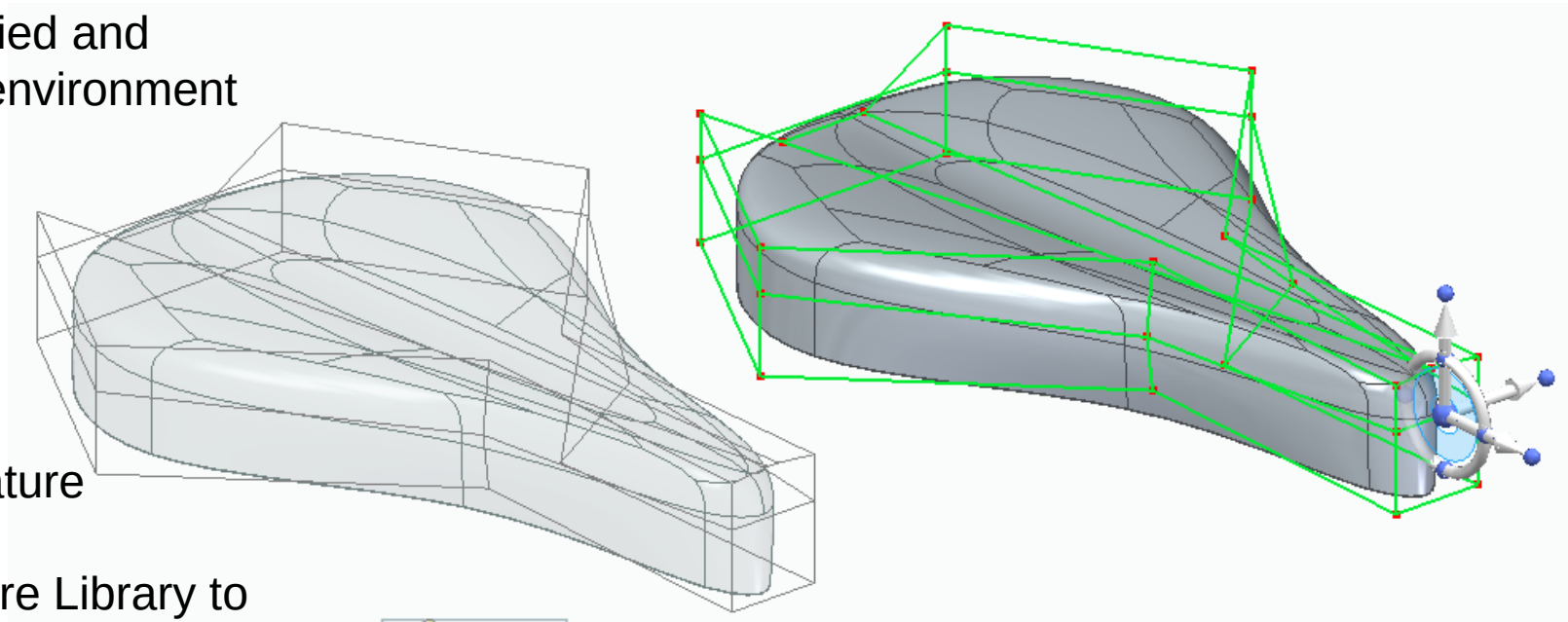
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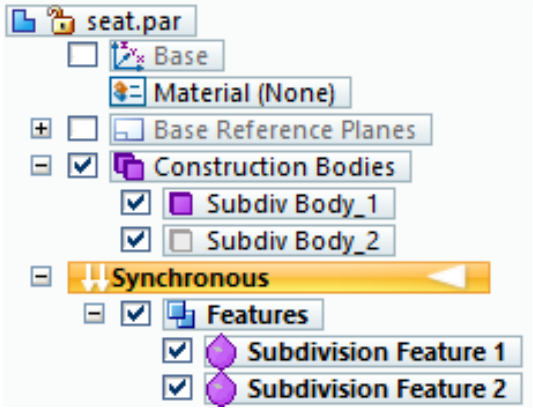
Subdivision Modeling
Copy and Paste Subdivision Feature

Subdivision Modeling

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- Subdivision features can be copied and pasted outside the Subdivision environment
- Copy and Paste works in both Ordered and Synchronous environments
- The entire feature is copied and pasted as a new Subdivision feature
- Features can be added to Feature Library to store common used Subdivision shapes.
- Location can be defined in Synchronous but the feature is placed in the original location automatically in Ordered





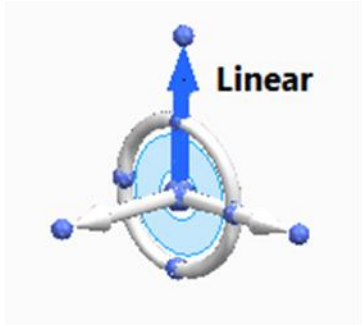
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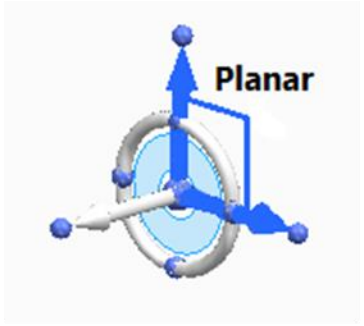
Subdivision Modeling
Scale Cage Elements

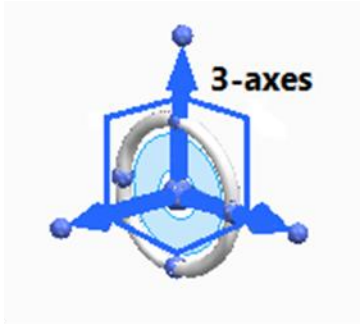
Subdivision Modeling

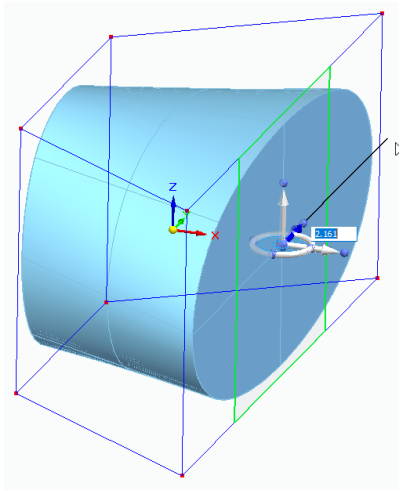
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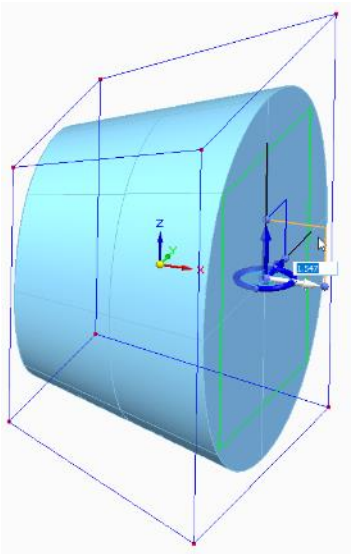
- The Scale operates on any elements of the cage: faces, edges or vertices
- Users can choose linear, planar or 3-axes scaling. Planar and 3-axes can be uniform or non-uniform
- Steering wheel determines origin of scale and is placed at the geometric center of selected vertices
- Center of Volume keypoint is available to move the steering wheel to the center of the cage

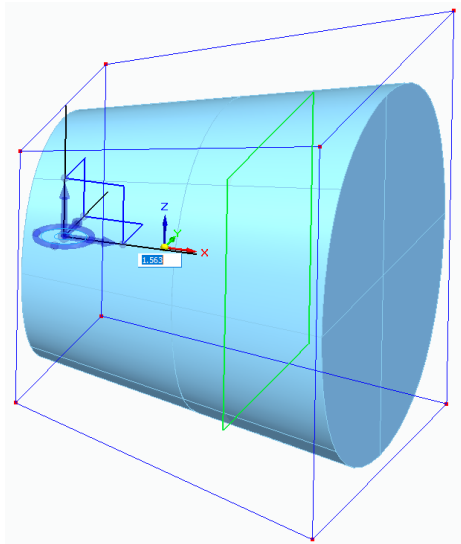












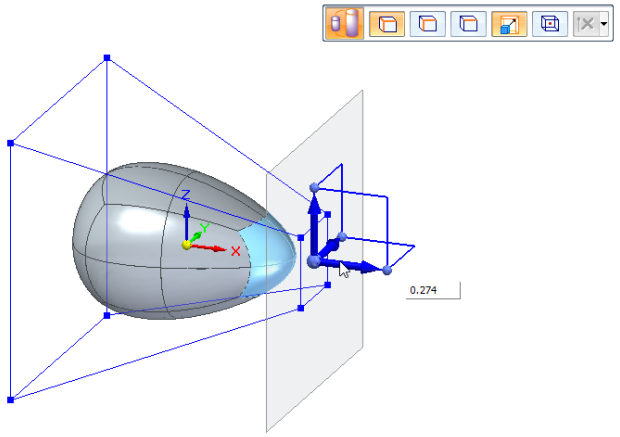
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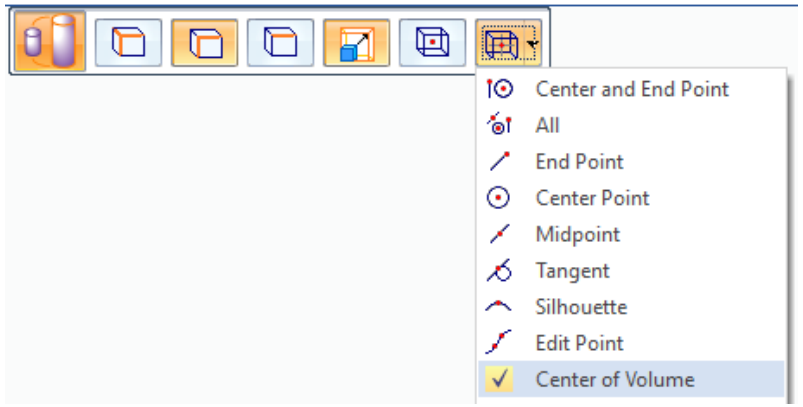
Subdivision Modeling
Scale Cage Elements

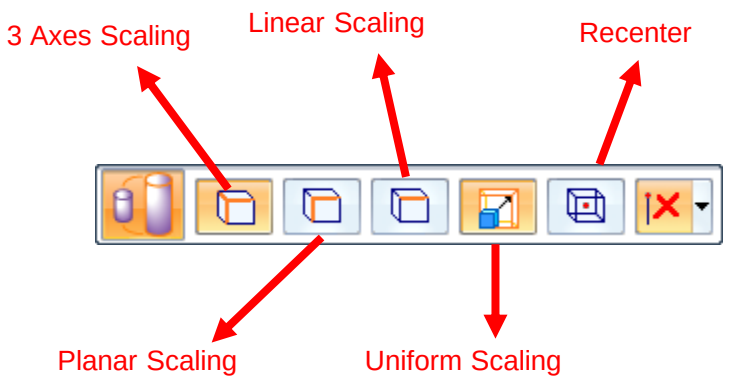
Subdivision Modeling

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- **Recenter** – moves the steering wheel origin to the center of the selection set
- **Keypoints – Center of Volume –** Move the steering wheel to the center of the cage. Useful when scaling with 3 Axes option
- **Uniform –** Scales the body uniformly when using 3 Axes or planar. When turned off, user can control scaling on each axis separately

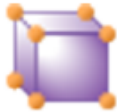






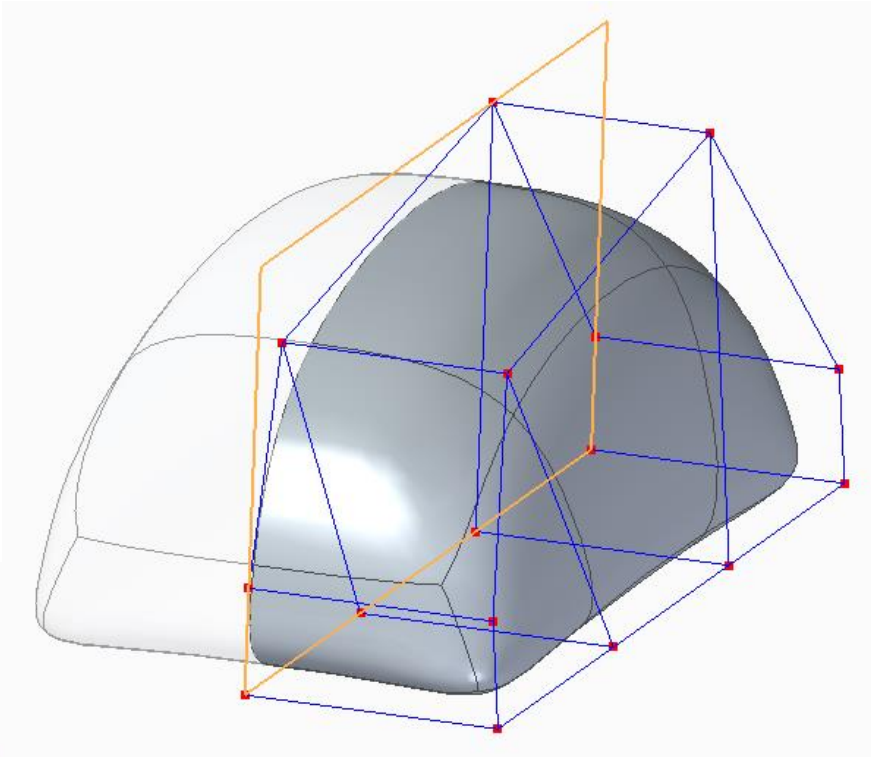
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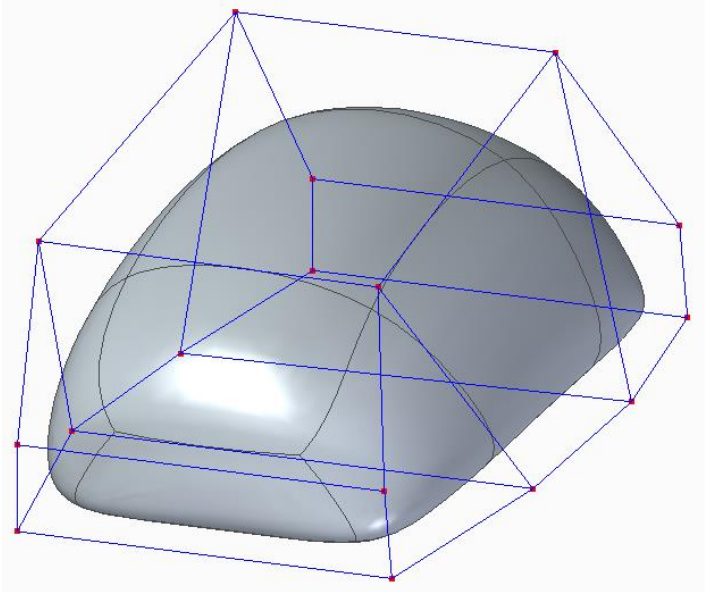
Subdivision Modeling
Symmetry Mode



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- Symmetry Mode allows the user to define a mirror plane for cage symmetry
- Cages are mirrored about the symmetry plane and any edits done on the parent side are reflected to the mirrored side
- Symmetry can be turned off, resulting in a complete cage for the entire body





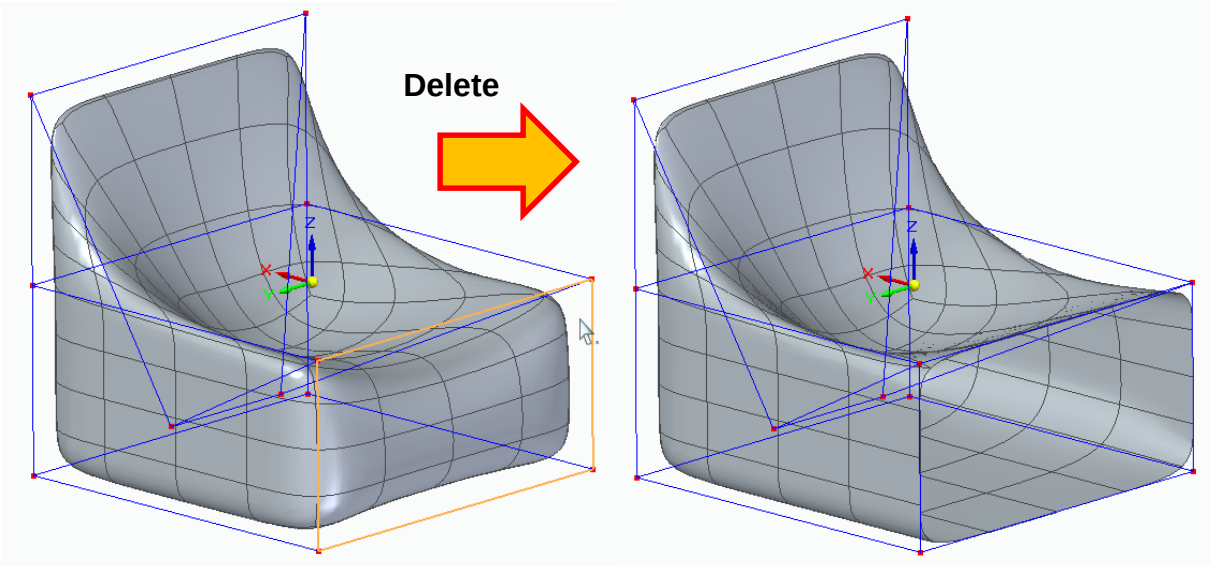
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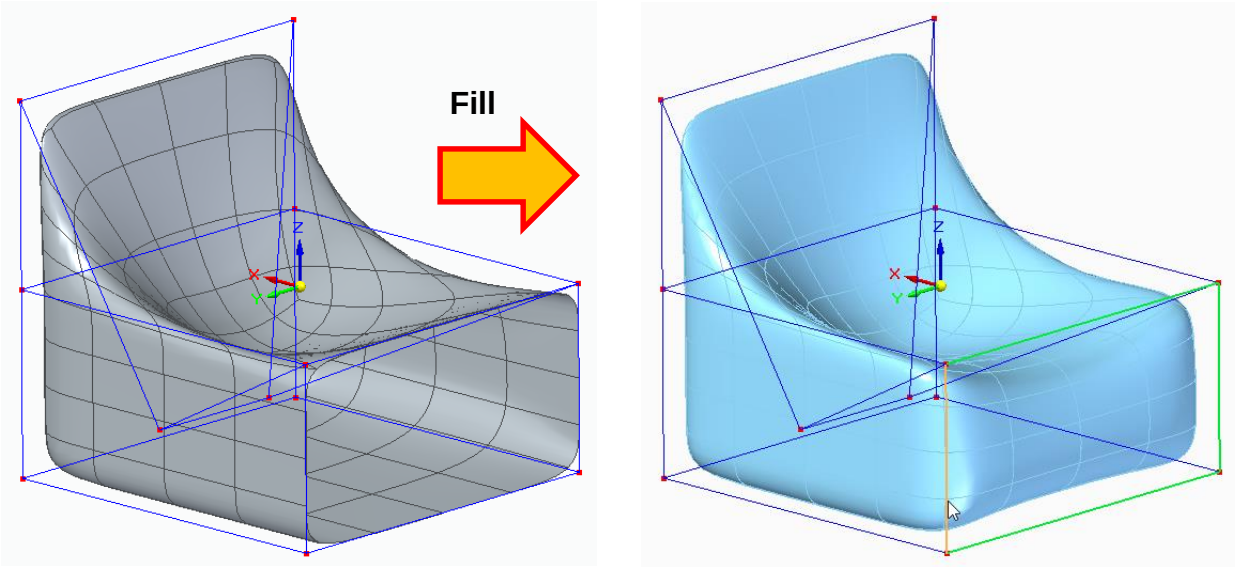
Subdivision Modeling
Delete and Fill Cage Faces



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- The Delete and Fill commands allow the user to remove or add faces to existing Subdivision cages
- If faces are removed the Subdivision cage is open and the body becomes a surface body
- We keep track of body topology as it is modified and reflect that in Pathfinder. Subdivision surface bodies are now listed in Pathfinder under Construction Bodies collector.

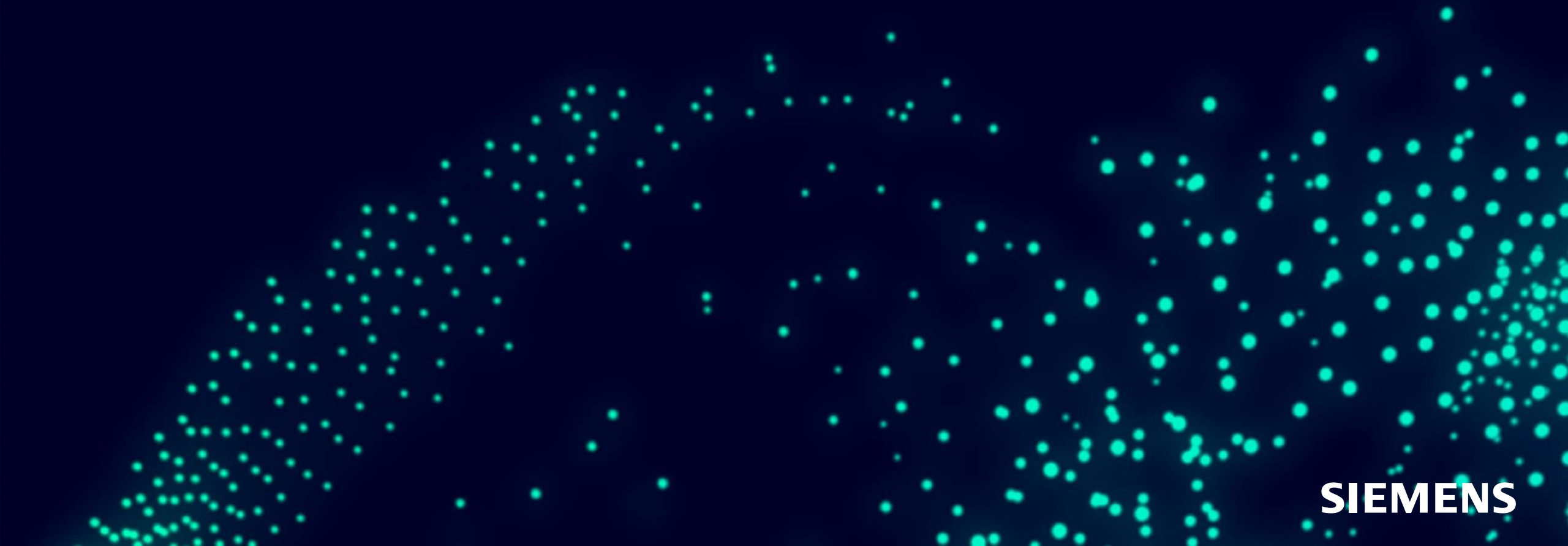




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Questions?



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