

Brep Face Grip Edit

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Abstract

This document is a detailed completion to the specification for the Face Grip Edit of the Free Form Massing Element.

Preface

There are a number of different edit modes for the Brep faces. If the user selects a face and performs a grip move operation, the grip edit engine will give a visual feedback about the current edit mode (supplement bitmap cursor appears near the acad cross). Each mode provides a specific behavior how the edited face will look like after the operation is completed. In this document you will find a description of the 6 different grip edit modes. The user can toggle between the edit modes using CTRL key.

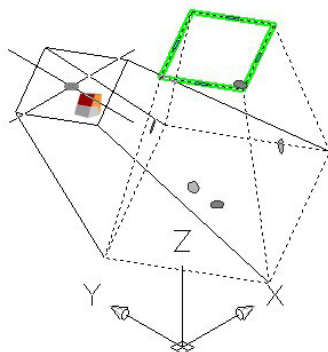
Edit Modes

- Move
- Modify
- Lift
- Lift Ortho
- Pull
- Move Ortho

Move

This is a common grip edit mode that allows the user moving the face without changing the face geometry. There is no additional UCS setting for this operation. That means the current cursor position will simple define the new position of the face centroid in 3D by using current CS. Faces, adjacent to the modified face will change the geometry (starched) but the number of faces will be constant. The resulting body will be always a valid body. If the edit operation will cause an invalid body the previous body will be restored. This mode does not provide any explicit constraints for the moving face.

An example for this mode can be a simple repositioning of the face using the OSNAP feature or direct input of the new point position from the command line.

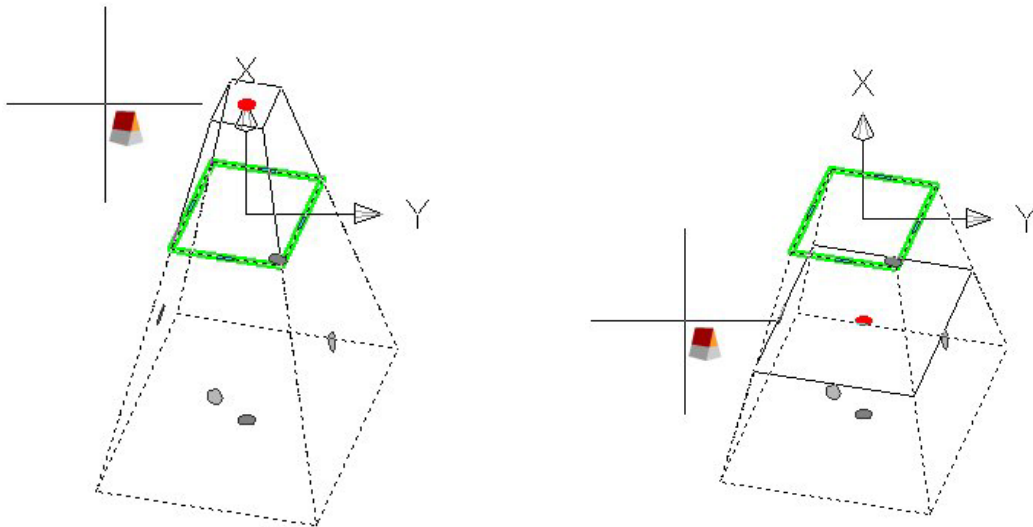


Modify

This mode will change the face geometry by keeping adjacent faces geometry. The temporary UCS for this mode is defined so that the X-Axis is directed to the "apex" point. The Y-axis direction defined as a cross product "X * Viewport direction". UCS origin is the face centroid. Apex point in this context is the point where modified face will lose its geometry (degenerate to the point). If no apex point exists (e.g. Box), the X-Axis is parallel to the intersection lines between edited face and its neighbours.

This mode is constraint-based so the user should not be able to produce an invalid geometry like self intersected body or "negative volume". To support that we use a dynamic line segment constraint where first point (apex) will be calculated before grip operation starts. The second interval point will be calculated "on-the-fly" and justified iteratively.

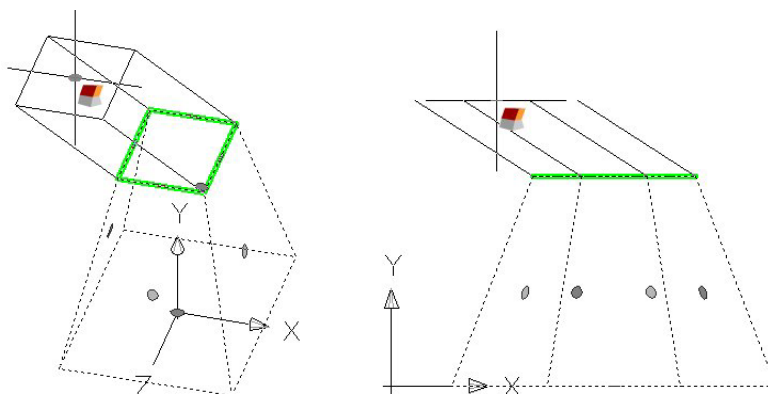
Example – top face of the cut pyramid body. The adjacent faces will keep their normal directions.



Lift

The face will be moved to the new position so that the angle between move vector and the normal is less than $\pi/2$. Side faces will always be added to connect the moved face with the rest of the body. These newly added faces are not merged with the existing faces of the body, even if they are coplanar with them (This description is lifted from the Amodeler documentation. See Amodeler::Body header).

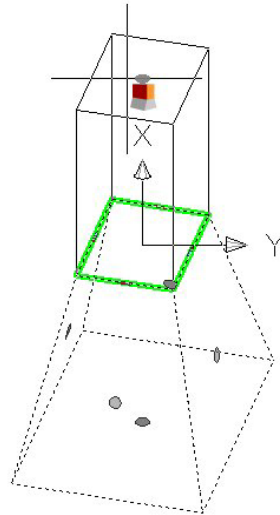
This mode will not change the face geometry but the topology of the whole body. There is no temporary UCS defined for this mode. To prevent creating of the invalid geometry we provide "half-space" constraint, which allows the cursor position above the edited face.



Lift Ortho

This is a special case of the lift described above. The face will be moved to the new position along its normal vector but only in "outside" direction (like Boolean add).

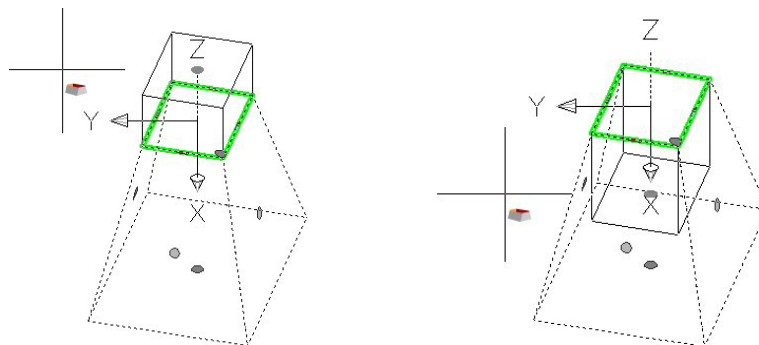
There is a temporary UCS defined where X-Axis is directed from the face centroid and is co directional to the face normal. To prevent creating invalid geometry, the Ray constraint is used.



Push/Pull

This mode reflects two Boolean operations (union or subtract). The face can be moved only along the normal vector. If we move the face in the same direction as a normal vector (Pull) we will provide a Boolean add. The face will keep its geometry in this case and the result will be the same as by Lift Ortho. By moving into the anti-normal direction the face may change depending on the slopes of planes of the adjacent faces. The planes of the adjacent faces remain fixed, but their geometry may change, the faces may be stretched or shrunk. (This description is lifted from the Amodeler documentation. See Amodeler::Body header)

Used Ray constraint to keep the cursor position always on the line, which is normal to the face, and intersect the face in the centroid. UCS X-Axis directed opposite to the face normal direction.



Move Ortho

This is a special case of the move mode described above. The face will be moved to the new position along its normal vector.

There is a temporary UCS defined where X-Axis directed from the face centroid and co directional to the face normal. To prevent creating invalid geometry dynamic Ray constraint is used (like in the Modify mode)

