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BOXER Tutorial:

Free-Form Deformation Transforms

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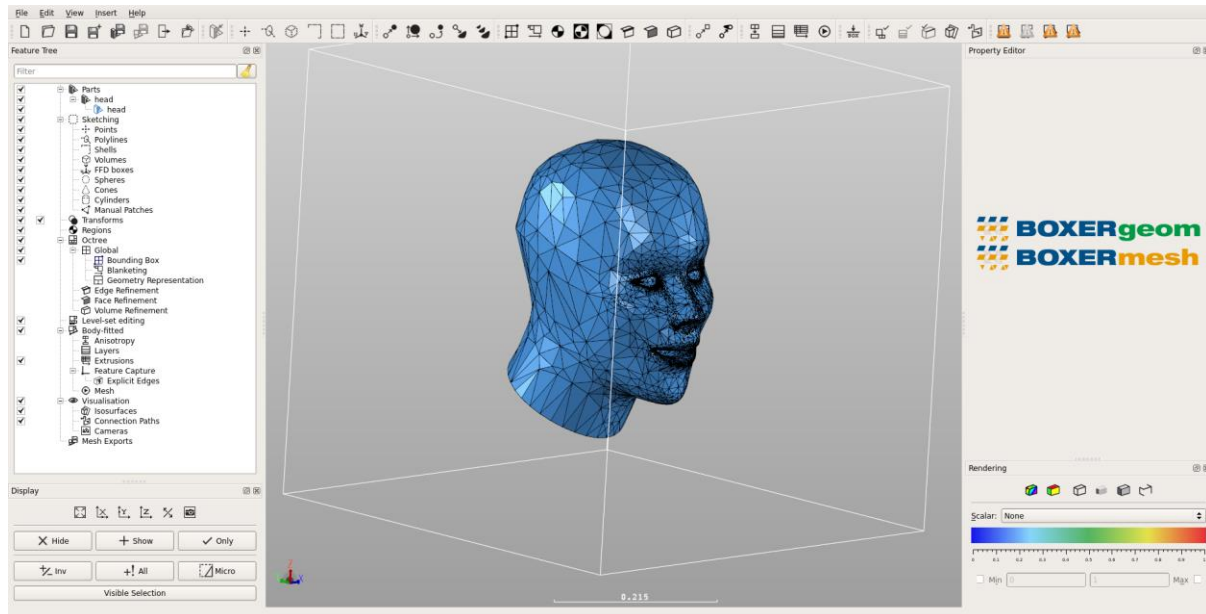
Free-form deformation transforms

This tutorial smoothly deforms a shape using FFD (Free-Form Deformation) transforms.

Import the geometry head.btf

- File > Import Part from the menu bar, OR
- Click the Import Part toolbar button, OR
- Use the keyboard shortcut Ctrl-G

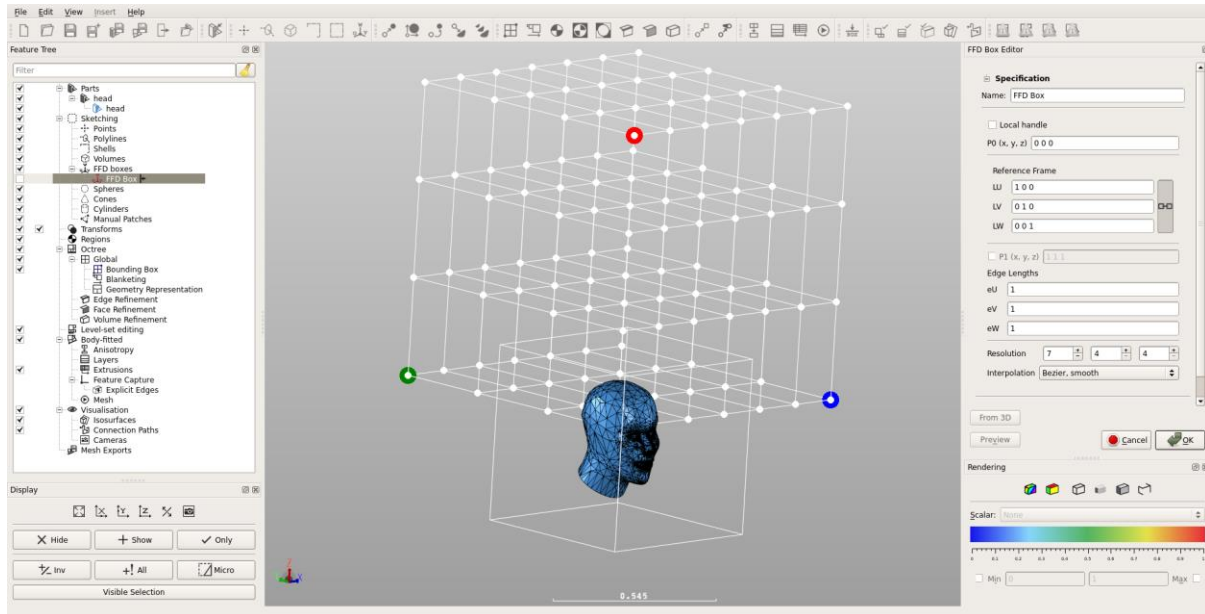
The geometry is imported as a single part containing one patch.



Create a Cartesian FFD Box

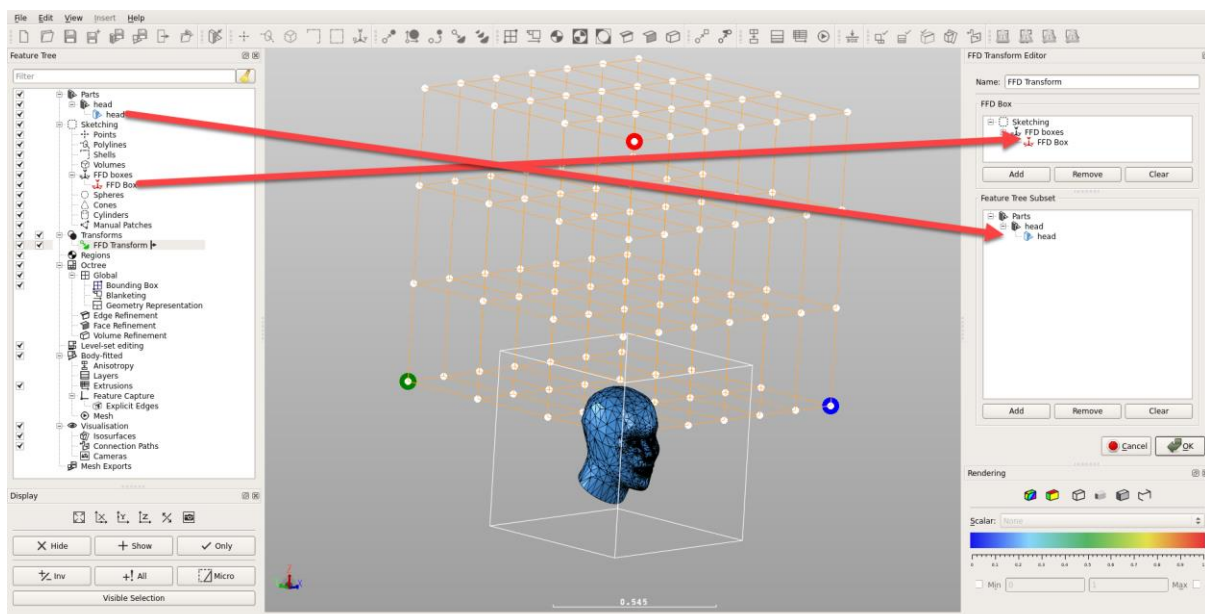
- Insert > FFD Box > Cartesian from the menu bar, OR
- Click the Create new FFD box toolbar button, OR
- Use the keyboard shortcut Ctrl-Shift-B

Change the resolution of the FFD box (the number of control points in u,v,w) to 7,4,4 and click OK. The FFD box appears in the 3d scene in the default position because you have not specified specific positions for the corner locations (P0, P1)



Define an FFD Transform Object

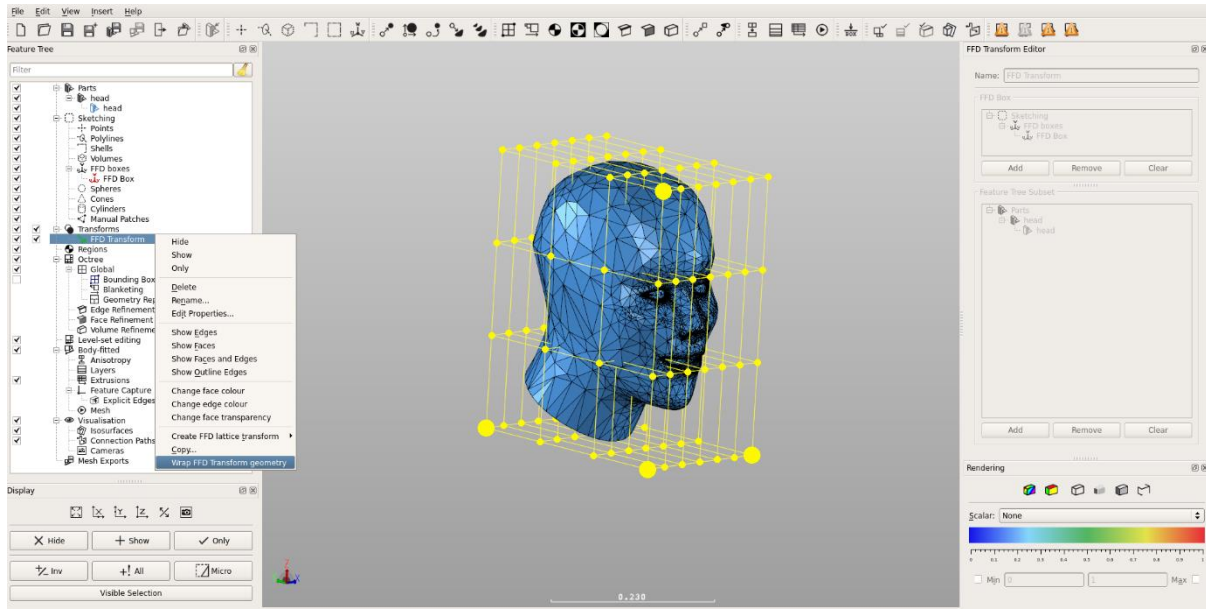
- Insert > Transform > FFD Transform
- The FFD Transform Editor appears
- Drag the created FFD box from the Feature tree to the FFD box specifier window in the Editor
- Drag the geometry patch 'head' from the patch list into the Feature Tree Subset window in the Editor
- Click OK



Wrap the FFD box around the Geometry

The previous step assigned an FFD box to a geometry. 'Wrapping' the FFD box makes it fit exactly around the specified geometry envelope.

- Right mouse over the 'FFD Transform' item in the Feature tree
- Select 'Wrap FFD Transform geometry'
- The FFD box will move and resize to exactly enclose the 'head'

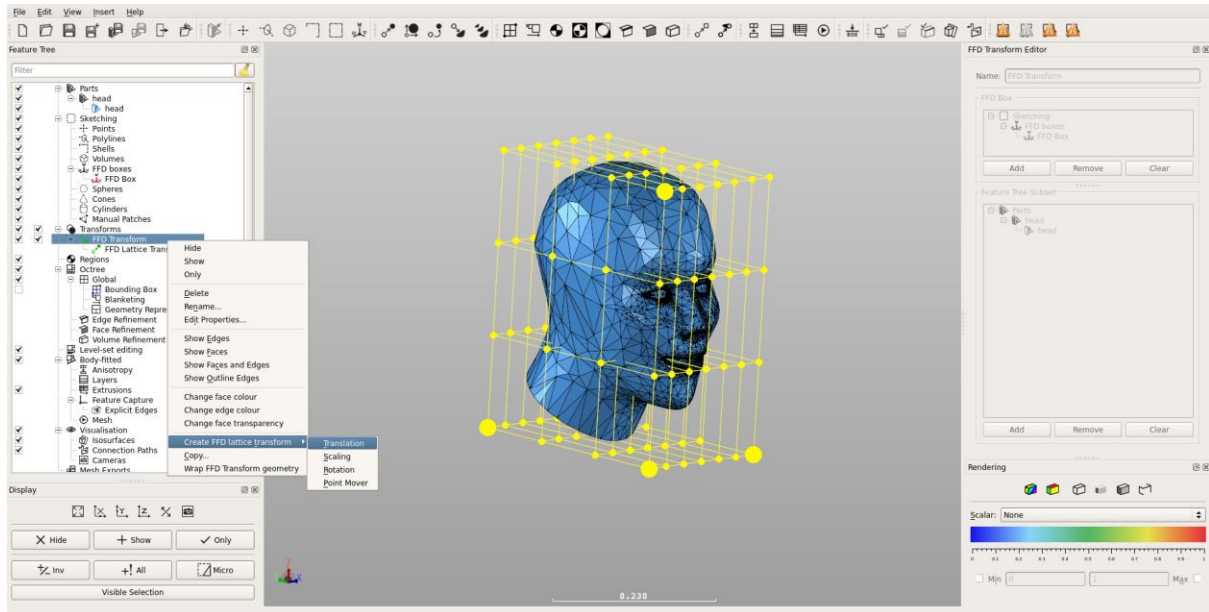


Create a Lattice translation

We now translate some of the points in the FFD lattice and the geometry will smoothly deform as the points are moved

- Right mouse over the 'FFD Transform' item in the Feature tree
- Select 'Create FFD lattice transform'
- Select Translation

The FFD translation Editor will appear

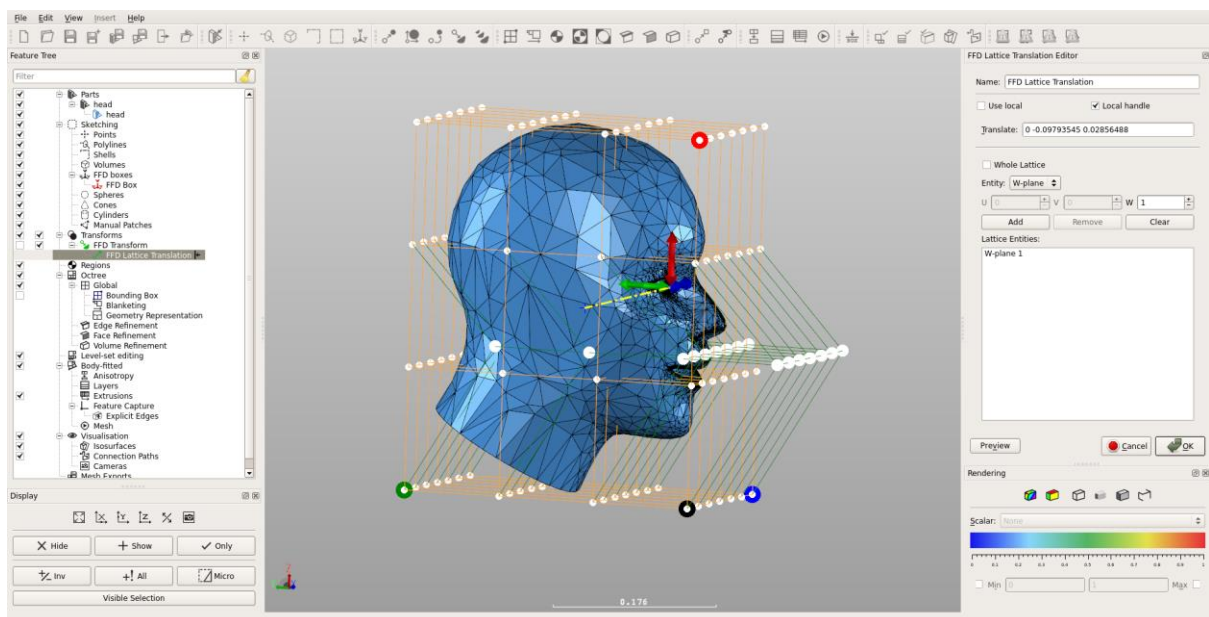


In the FFD Lattice translation Editor:

- From the 'Entity' pull down menu select 'W-Plane'
- Click on the 'W' index counter to increment the value in the W field to 1
- Click 'Add'. This add plane W=1 to the entity translation list

Click in the 'Translation' field. The interactive GUI drag handles for translation appear

- Grab either u, v, or w (blue, green or red) 'arrow' handles with the left mouse button and move them around the 3D scene. Note that the values in 'Translate' field update in real time
- Click ok to move the control points on plane W=1 by the specified translation amount. The geometry will update in real time



Create a Lattice rotation

We now rotate some of the points in the FFD lattice and the geometry will smoothly deform as the points are moved

- Right mouse over the 'FFD Transform' item in the Feature tree
- Select 'Create FFD lattice transform'
- Select 'Rotation'

The FFD Rotation Editor will appear

In the FFD Lattice Rotation Editor:

- From the 'Entity' pull down menu select 'V-Plane'
- Click on the 'V' index counter to increment the value in the V field to 2
- Click 'Add'. This adds plane V=2 to the entity translation list
- Repeat for plane V=3

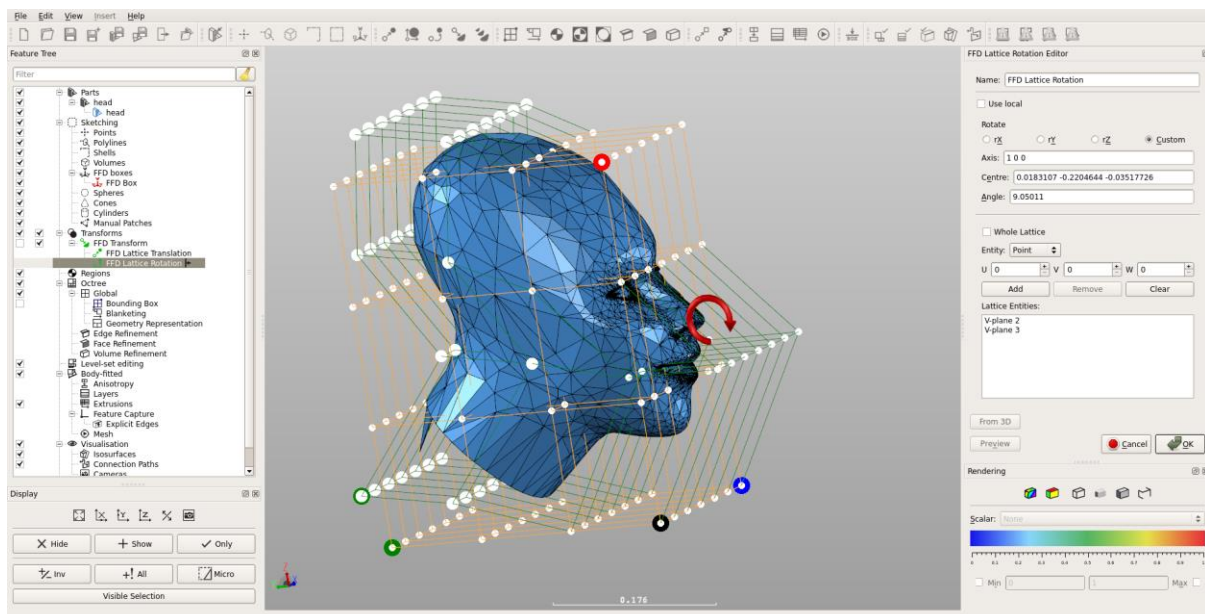
Select the 'Custom' radio button

Click in the 'Centre' field. The interactive GUI drag handle for positioning the centre of rotation appears

- Grab either u, v, or w (blue, green or red) 'arrow' handles with the left mouse button and move them around the 3D scene. Note that the values in 'Centre' field update in real time. Move the centre of rotation to the end of the nose

Click in the 'Angle' field. The interactive GUI drag handle for rotation appears

- Grab the red a circular 'arrow' handle with the left mouse button and move it to rotate the specified control points around the specified centre point. Note the value in the 'Angle' field updates in real time.
- Click OK. The geometry updates in real time.



Export the Transformed Part

The transformed part can be saved without effecting the 'untransformed' base part

- File > Export transformed part

Choose a new name for the part and click OK