Aalto University
School of Engineering

NX.2 ASSEMBLY

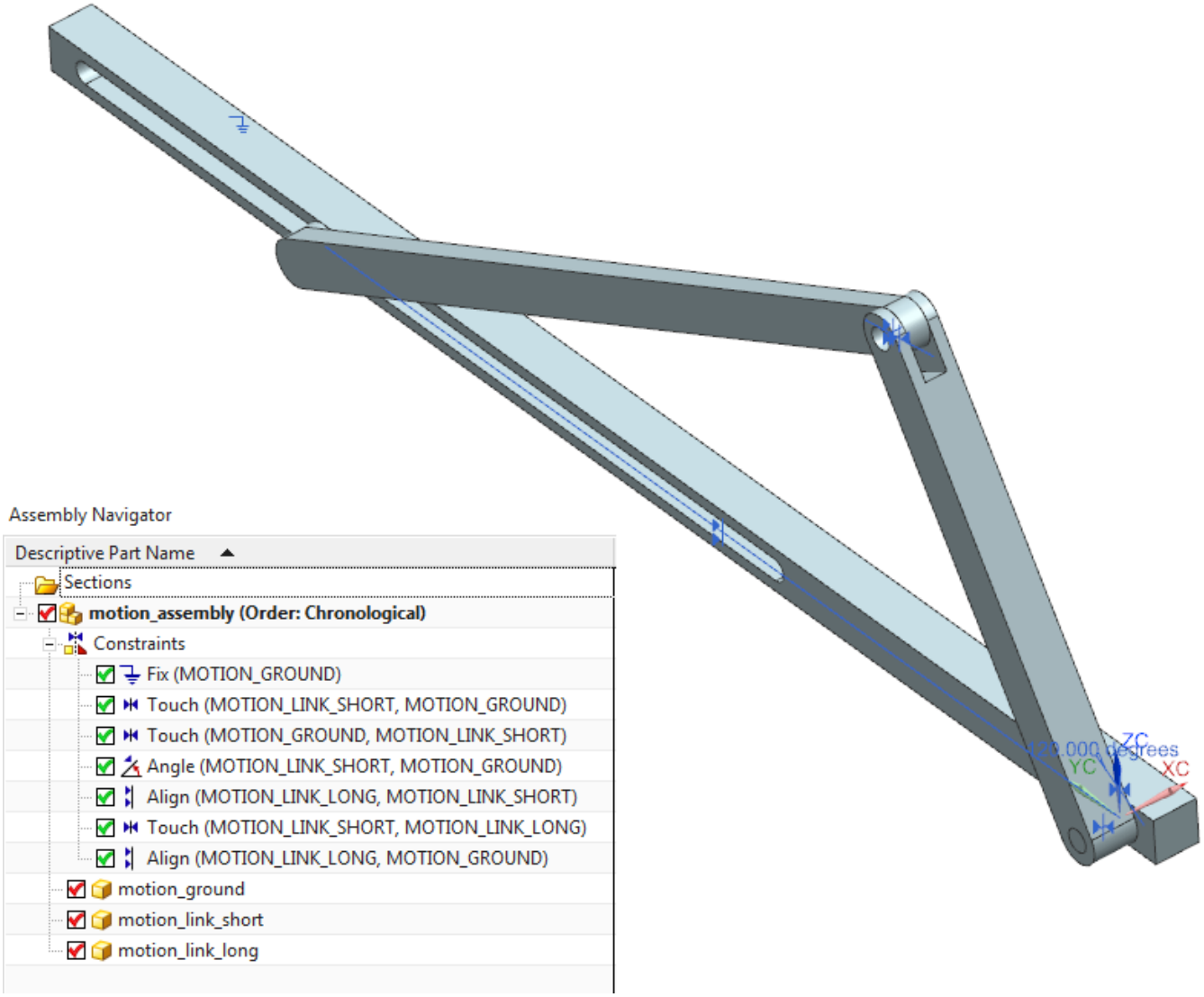

Figure 1: A crank-slider assembly and its model tree.

Learning Targets

In this exercise you will learn:

- ✓ to create assemblies
- ✓ to define constraints

Used program is Siemens NX 11.0.1.11.

Needed files in this exercise are:

- motion_short_link.prt
- motion_long_link.prt
- motion_ground.prt

Assembly

Unlike other CAD programs, NX uses same file extensions for both assemblies and individual parts (*.prt). This may be a little bit confusing in the beginning, but this enables easier handling of assemblies – every part can be also an assembly.

Setup

Be sure that you copied the needed parts (motion_ground, motion_short_link and motion_link_long).

Start NX and select **New** ( ). Select **Model** tab, **Assembly** and name it **motion_assembly**. If needed, you can define in which folder the program saves assembly files. OK (Figure 2).

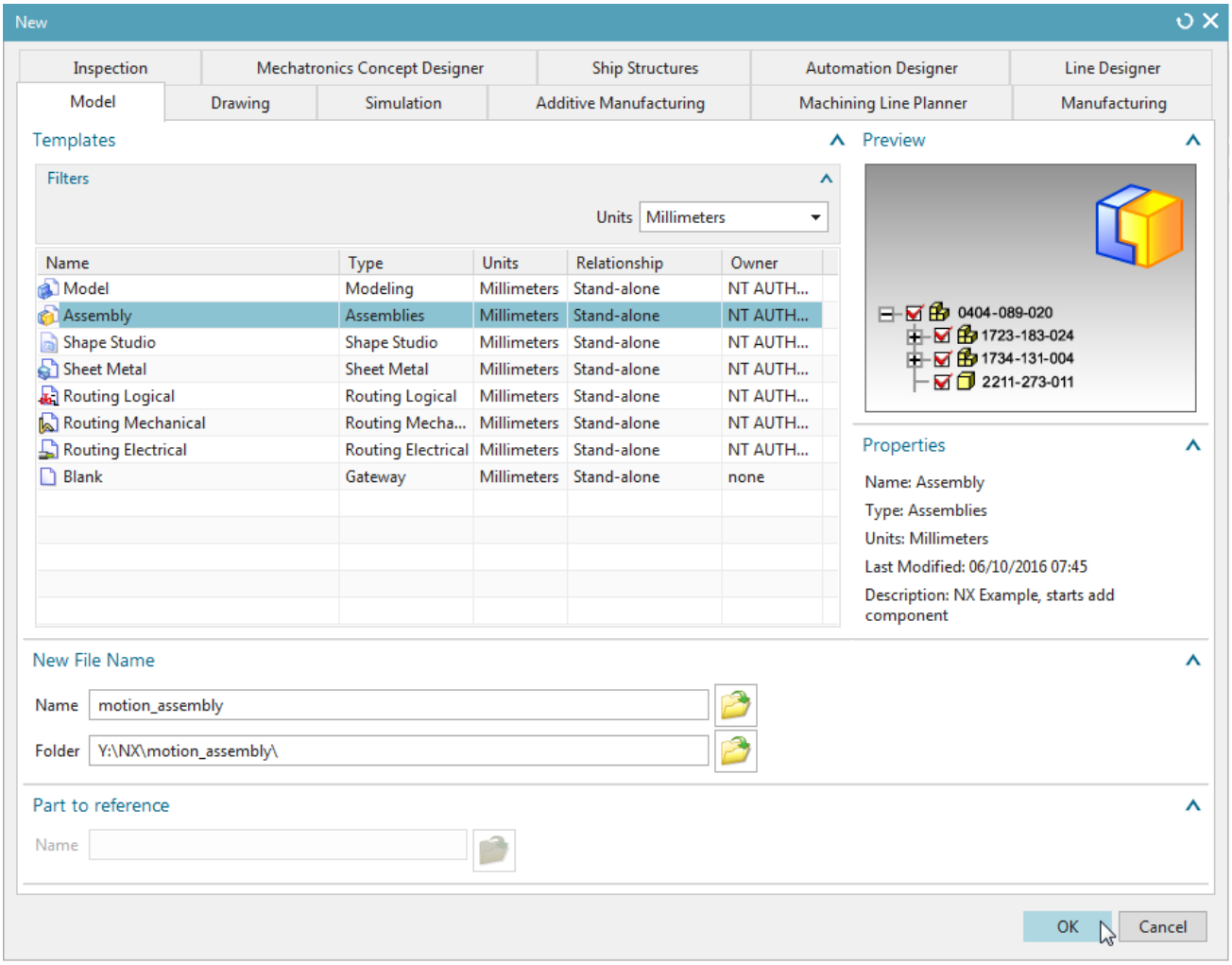

Figure 2: New window and settings for the assembly.

The ground part

Because assembly mode was selected, the program asks parts to be imported. From the *Add Component* window, select **Open** ( ) and choose **motion_ground.prt** part. In the *Placement* area, to the *Positioning* setting select **By Contraints** (Figure 3). Notice, that there are small arrows showing that some of the options may be hidden.

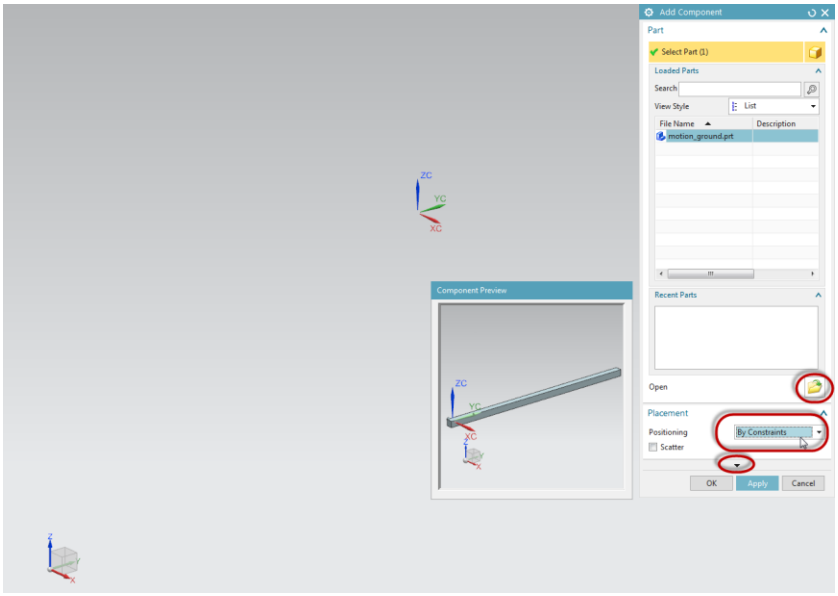

Figure 3: Part selected and *Positioning* type selected. Notice the small arrow.

Click **OK** to place a component. This opens *Assembly Constraints* tool that allows defining how components are placed in the assembly. The first part will be also our ground part, so select **Fix** ( ) icon and then select the part to be fixed. If not selected, select **Assembly Navigator** ( ) from the left bar (Figure 4).

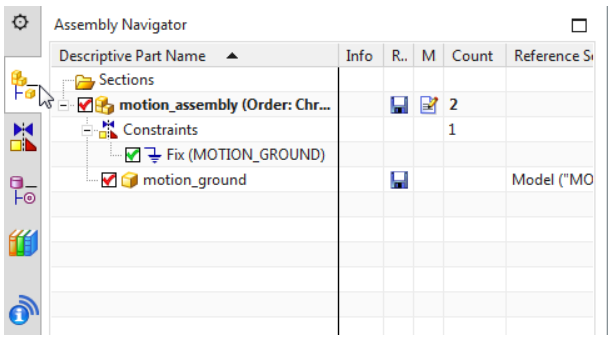

Figure 4: Assembly Navigator selected. In the tree, the assembly (motion_assembly), it's constraints (Fix) and parts can be seen (in this case only motion_ground).

Notice the **bolded line** in *the Assembly Navigator*. This shows the active part, in this case motion_assembly. You can change the active part by double-clicking other parts in the list. To get back to main assembly, you can select **Work on Assembly** ( ) from *Assemblies* group in *Home* tab or by double-clicking the part in *Assembly Navigator*.

The short link part

Be sure, that **Assemblies** tab is activated. To add more components, select **Add** ( ) from the *Component* group. Click Open ( ), select **motion_link_short** to be added and **OK**. As *Constraint Type*, select Touch Align ( ) and select the inner surface (the program will recognize the axis) of the hole as seen in Figure 5.

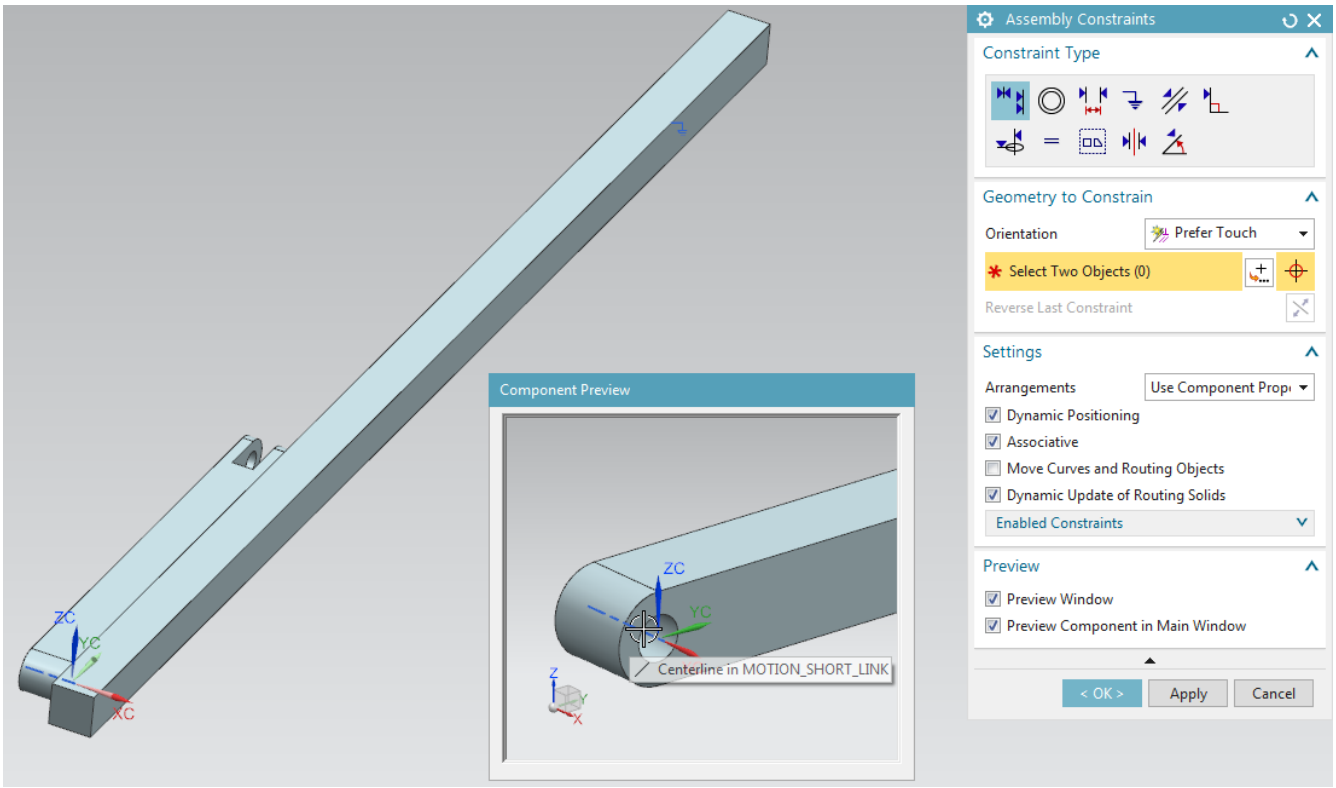

Figure 5: Selecting the inner axis of the hole.

Then rotate view (hold middle mouse button) and select the axis from the motion_ground part as seen in Figure 6.

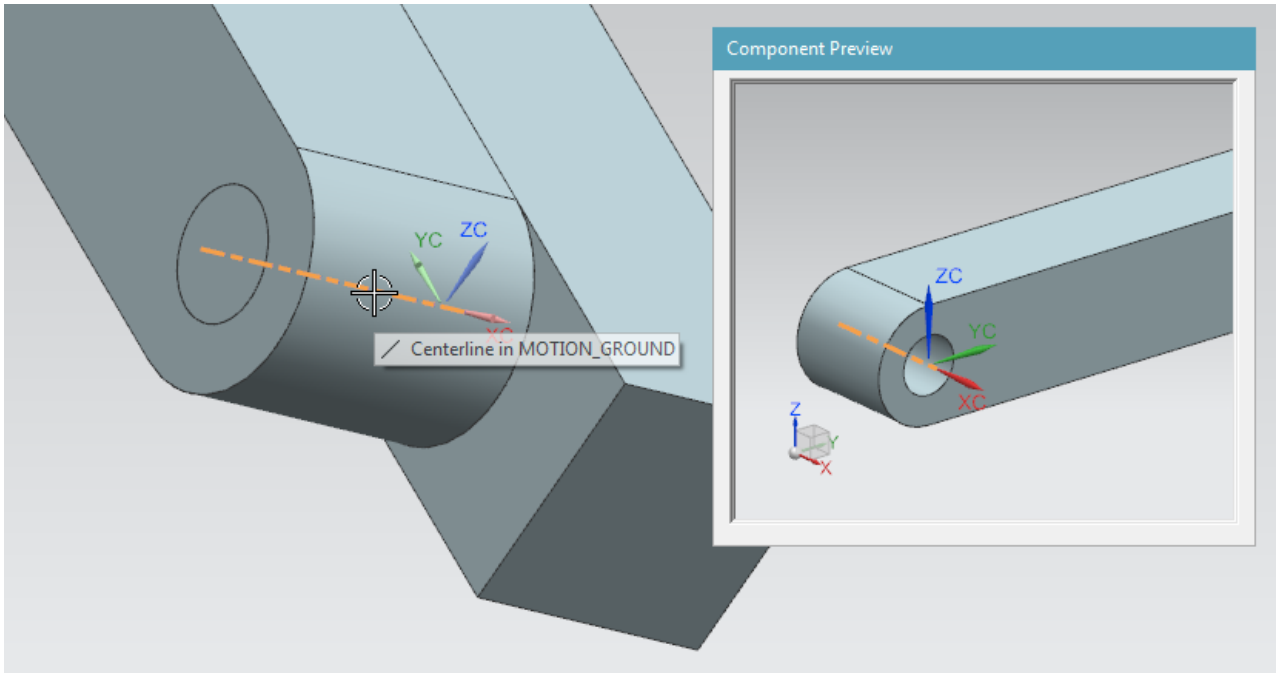

Figure 6: Selecting the centerline from motion_ground part.

HINT! To select geometric entities behind any geometry, move mouse cursor above the area, keep it there until three boxes (▭) appears and left-click to see all possible selections in that location (Figure 7).

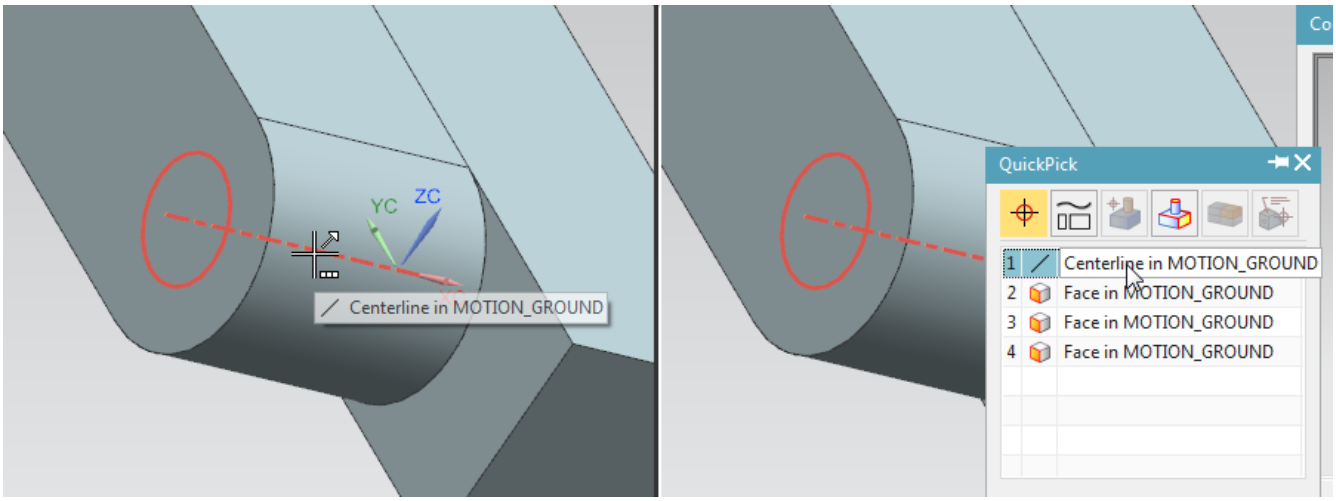

Figure 7: In left: keeping cursor on top until three boxes appears. On right: selecting centerline from the list.

The *Assembly Constraints* tool will stay active after every created constraint. If the collapsed *Constraints* list in the Assembly Navigator, you can notice, that a new Align constraint is created.

To see what degrees of freedom are still unfixed, right-click on motion_short_link and select **Show Degrees of Freedom** (Figure 8). You can see that rotation and translation around X-axis are still free.

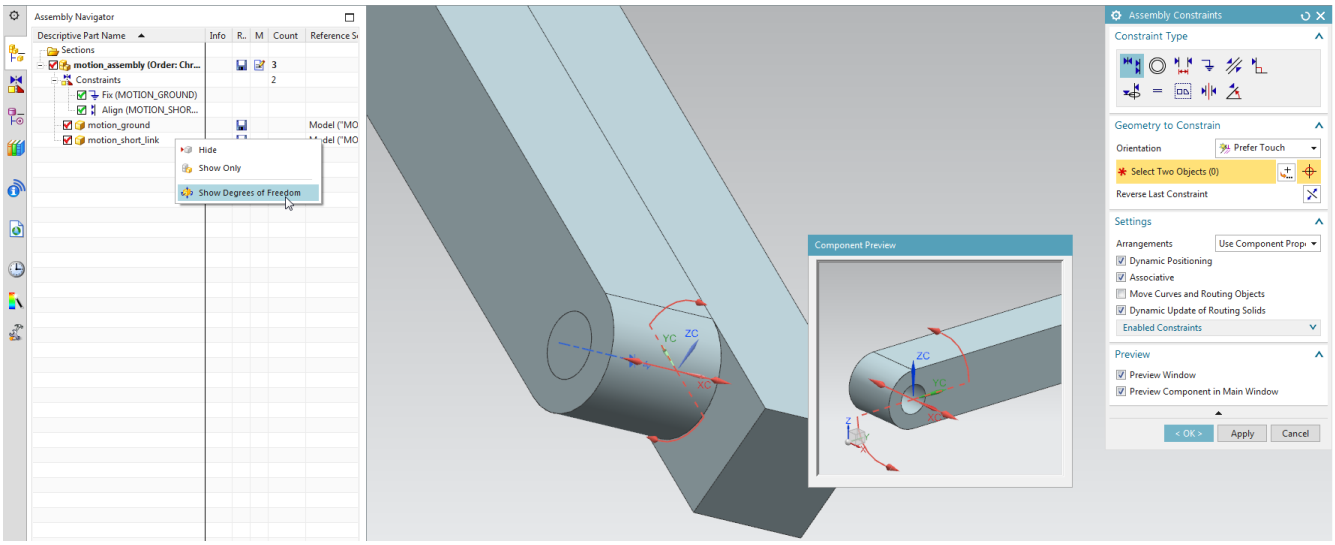

Figure 8: Showing degrees of freedom.

Create another **Touch Align** ( ) and select the faces seen in Figure 9.

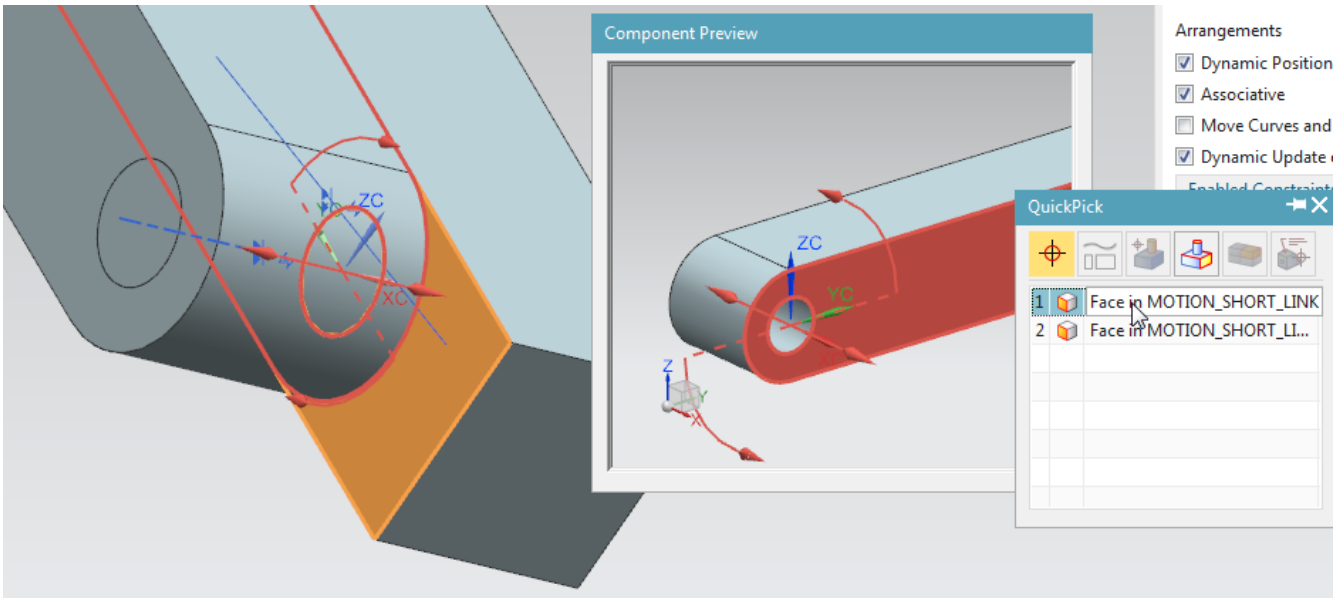

Figure 9: A face from ground part (yellow) and added part (red)

To fix the rotation around X-axis, select **Angle** ( ) as *Constraint Type*. Select the top surfaces of both parts to place a constraint and give **120** as a value (Figure 10). To update view, press **F5**.

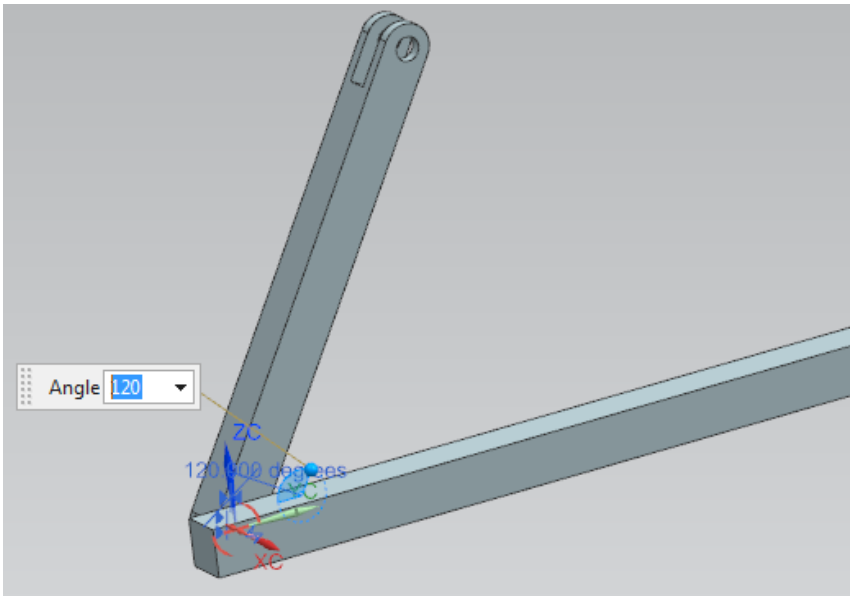

Figure 10: motion_short_link component placed.

The long link part

Next longer link part will be added. **Add** (, *Assemblies* tab, *Component* group) a motion_long_link to the assembly. As *Assembly Constraints*, select **Touch Align** () between motion_short_link and motion_long_link as seen in Figure 11.

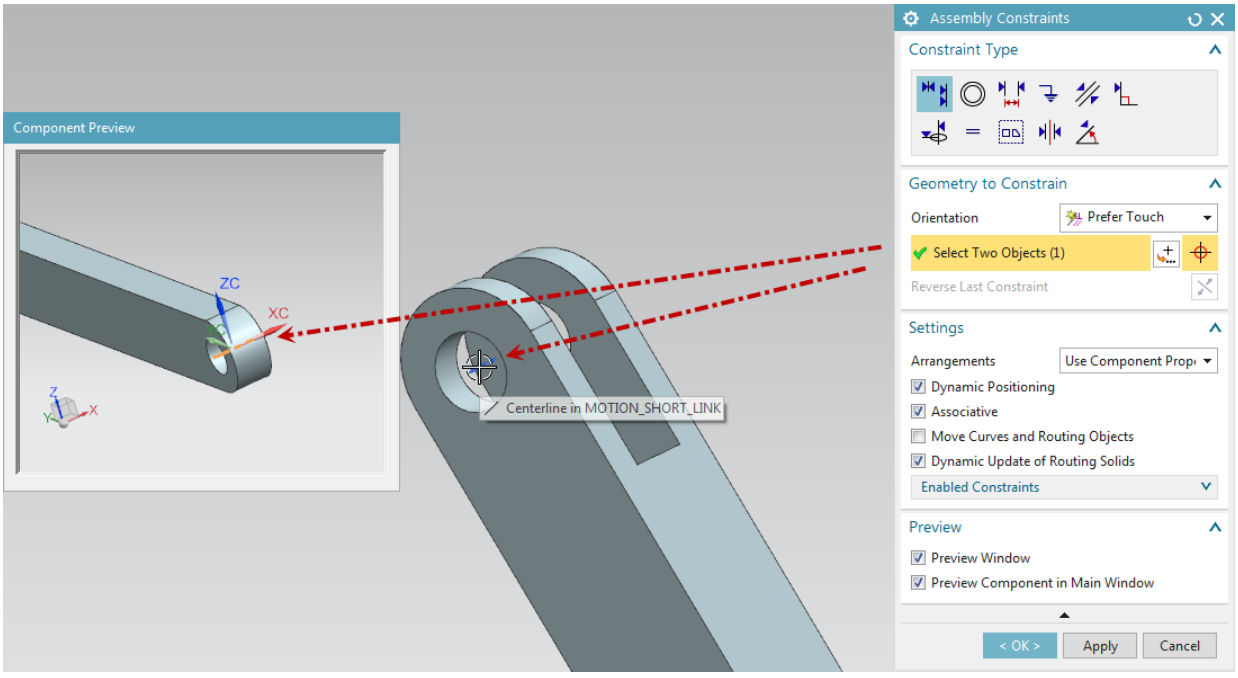

Figure 11: Centerline for longer link selected, selecting centerline from shorter link.

Use **Touch Align** ( ) to limit the translation in X-axis (Figure 12).

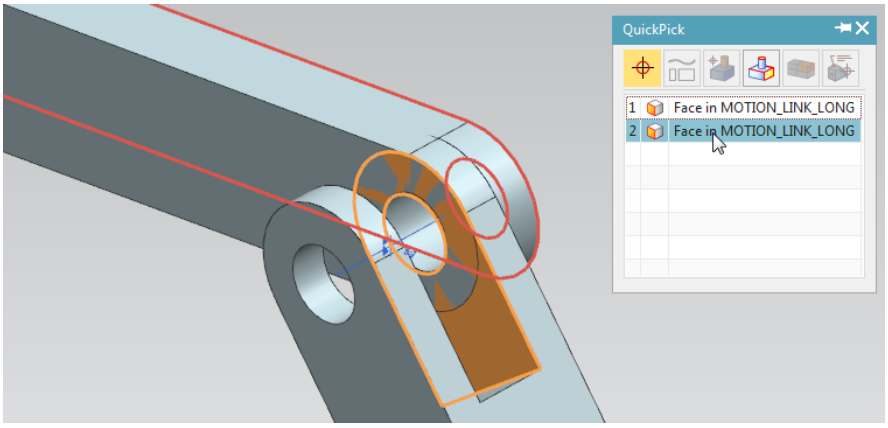

Figure 12: Face from shorter link selected (highlighted in yellow), selecting face from longer link (highlighted in red).

As the last constraint that attaches the other end of the longer link to the groove in the ground part, some visibility changes has be done. In both parts, reference geometries for this attachment are defined. To see those, click **OK** in the *Assembly Constraints* window. Then, right-click **motion_ground** in the *Assembly Navigator* and select **Replace Reference Set → Entire Part** (Figure 13). This allows referring to the reference geometries (i.e. datum, axis) in that particular part.

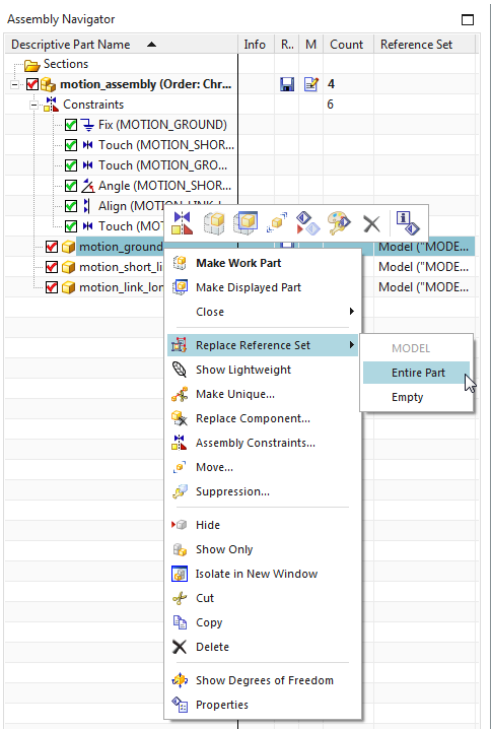

Figure 13: Replacing reference sets for motion_ground part.

As a result, a violet datum plane and part's coordinate system appears (Figure 14). This allows to referring to the Y-axis in the ground part.

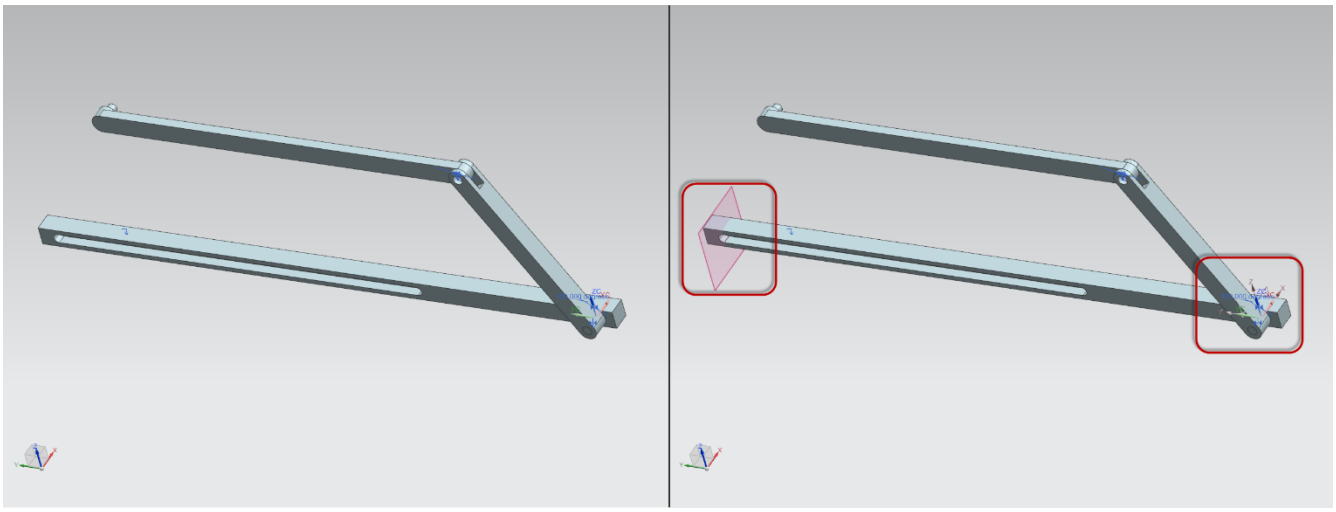

Figure 14: On left: default reference sets. On right: part's reference sets.

Select **Assembly Constraints** (, *Component Position* group) and select **Touch Align** (). From *Geometry to Constrain* field, select **Point Dialog** (). From *Point* window, select **Arc/Ellipse/Sphere Center** as *Type* (Figure 15).

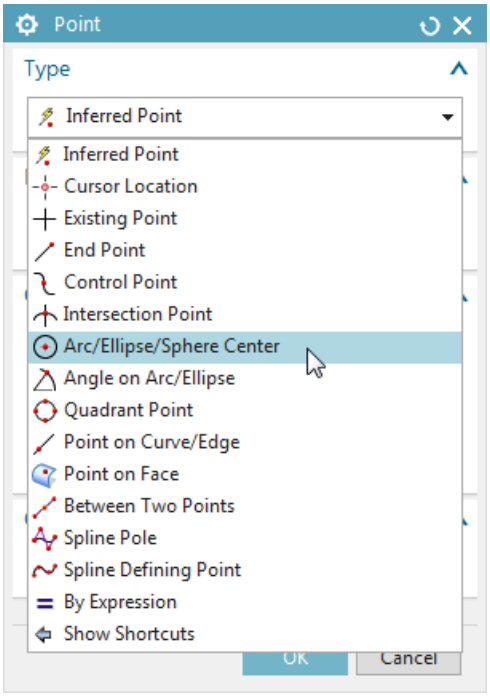

Figure 15: Point window and changing Type.

Then, select an edge from motion_link_long as seen in Figure 16 and click **OK**.

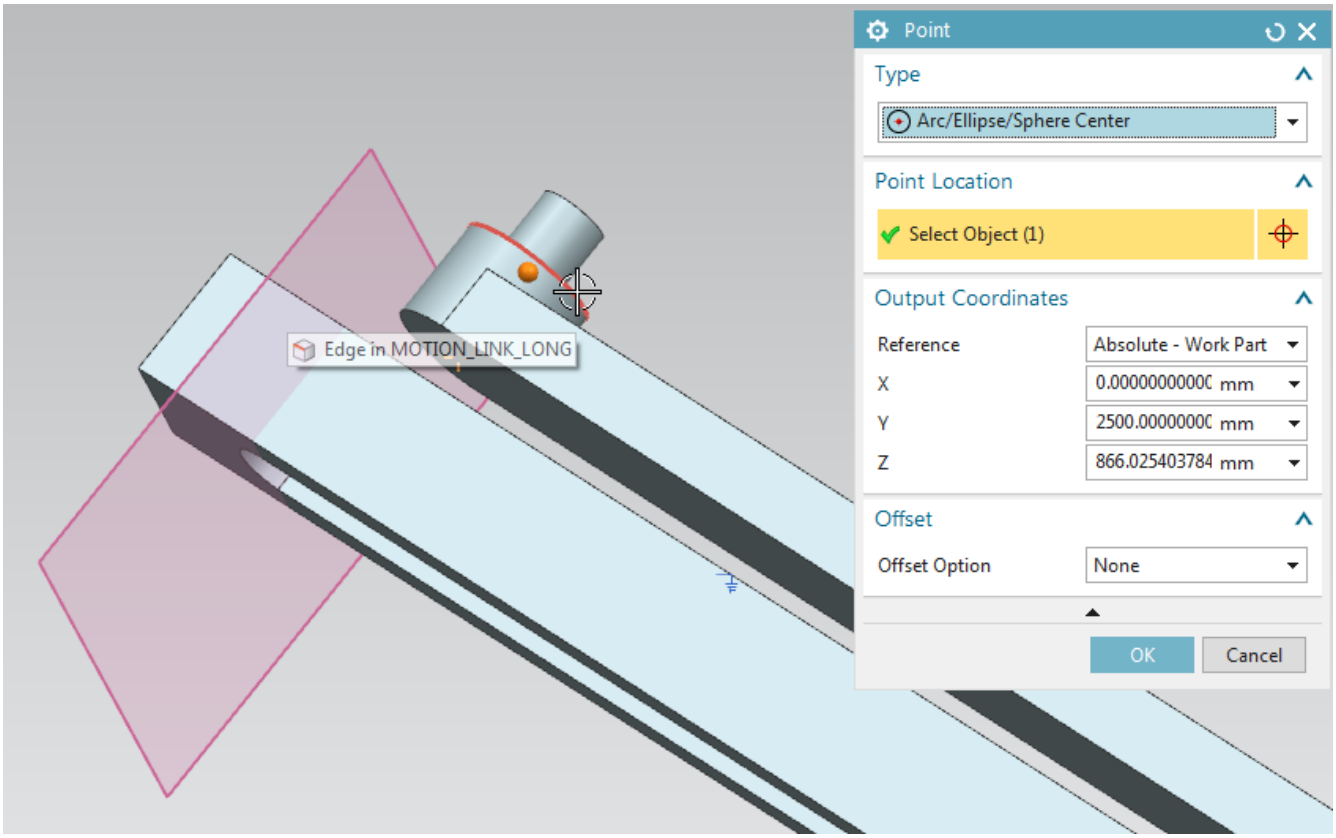

Figure 16: An edge selected as reference. Notice the point in the center of the circular shape.

Now we have the first reference. Select **Y-axis** from motion_ground part as second reference (Figure 17). This creates a constrain, that keeps the previously created point in the Y-axis, thus completing the mechanism. Click **OK** to close the *Assembly Constraints* tool (*Apply* will accept the previous reference and reopen the tool, *Cancel* will dismiss the last reference).

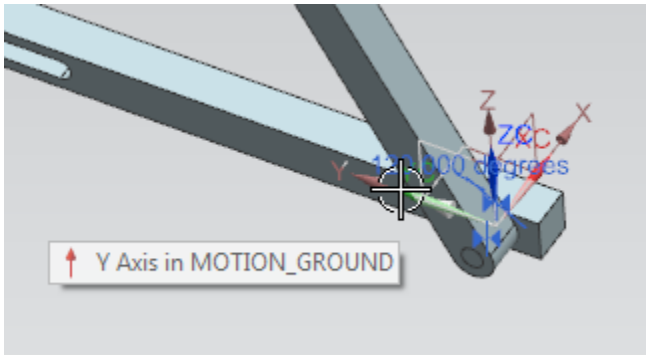

Figure 17: Selecting Y-axis from motion_ground part as second reference.

This completed this mechanism. To ensure that there is no degrees of freedom, right-click on a part and select **Show Degrees of Freedom** (). If no exists, in the bottom of program screen following text should appear (Figure 18).

Figure 18: A text showing that component is fully defined.

To see how mechanism behaves, **uncheck** *Angle* constraint from the *Assembly Navigator* (Figure 19) and select **Move Component** () from *Component Position* group.

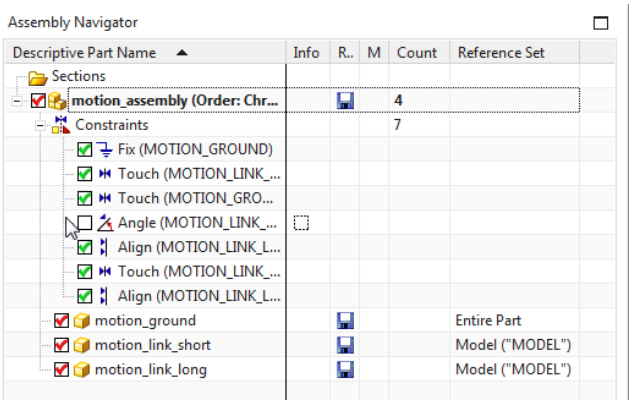

Figure 19: Angle constraint unchecked.

Select the part you want to move, in this case motion_link_short, click MMB (middle mouse button) and use drag handles to move part (Figure 20). When mechanism functionality confirmed, **check** *Angle* constrain in *Assembly Navigator* to lock the mechanism to default position. **Save** (**Ctrl + S**)

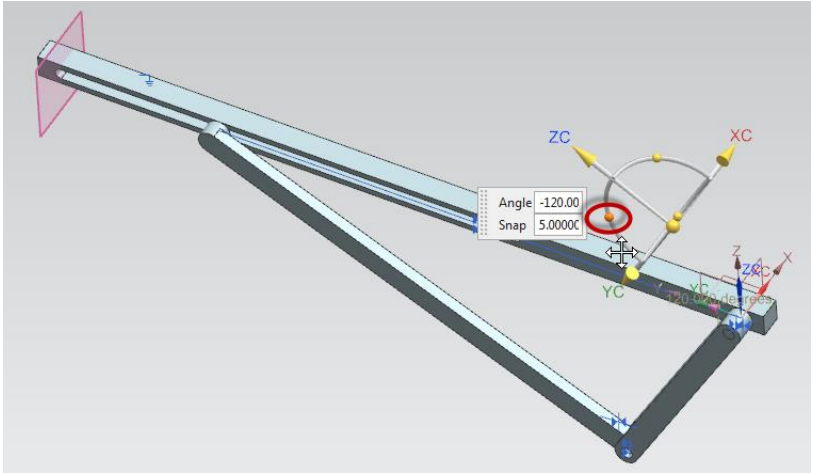

Figure 20: Dragging mechanism from the highlighted point.