# RBE/ME 4815 In-Class Assignment #2

This assignment builds upon the results of your first efforts with RobotStudio. In this assignment you will create a work object that is tied to the 'Curve Thing' work piece. You will re-create the targets on the work piece however this time the targets will be tied to the new work object. When you subsequently move the work piece, you can re-align the work object to the work piece. This obviates the need to recreate the targets if you find that the work piece needs to be relocated.

1. Open the station you created in Assignment #1. Using the linear move tool, move the work piece (i.e., the 'Curve Thing') a small random distance along each of the world axes. You will see that the targets did not move with the work piece. Adjusting the location (position) of the targets to match up with the new location of the work piece would not be too difficult as long as the translations of the work piece were known. But suppose the work piece was also rotated around one or more of its axes. If this were the case, then being able to manually correct the targets would be very problematic.

2. Close that station and create a new station in the same way as you did in Assignment #1. This includes importing myTool and the 'Curve Thing' work piece. Position the work piece as you did in Assignment #1. You know that the edges of the work piece are all reachable. You may optionally create the joint target at the kinematic home position.

3. On the Home tab, click on the Frame icon. This will give you a choice of "Create Frame" or "Frame from Three Points". Select the latter. This will open up a dialog box on the left side of the screen called Create Frame. Select the "Three Point" radio button. Then click in the red text box for "First Point on X axis (mm)".

4. A toolbar is at the top of the window where the robot is visible. Select the Snap Edge tool. Now move the mouse along the near edge of the base of the Curve Thing. You will see a ball snap to the nearest edge of the Curve Thing and track along that edge as you move the mouse.
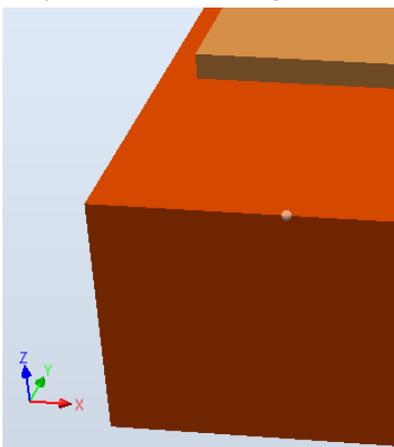

We intend to create a frame at the near left corner of the base of the Curve Thing, so click the mouse when the ball is near that corner. It will replace the ball with a yellow asterisk and fill in the coordinates of the selected point as shown in the next picture.
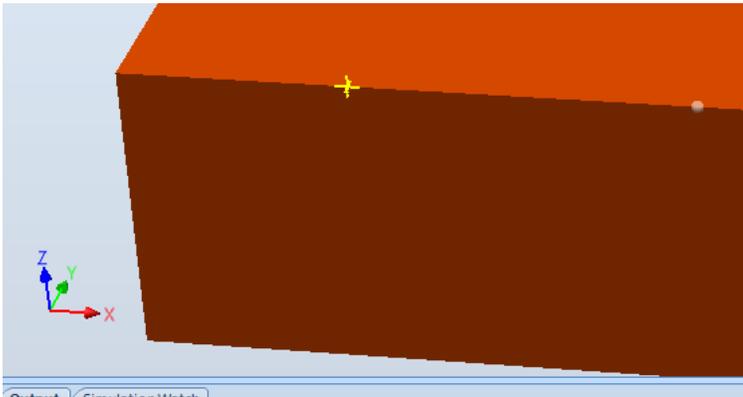
5. Now select a point farther out along the same edge and click again. The coordinates of this second point are filled in as the "Second point on X axis (mm)". Now move along the perpendicular edge to the left (you can see the ball in the picture below).
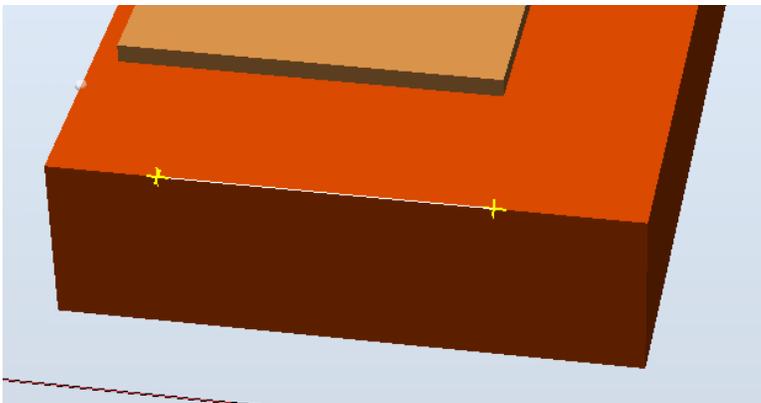

6. Now click again. This will select a point along the edge and define the XY plane of the frame. This fills in the address of the third point in "Point on Y axis (mm)". Now click on Create in the dialog box to create the frame. The origin of the frame will be where the last point forms the shortest perpendicular to the line formed by the first two points – in this case at the corner of the supporting platform of the Curve Thing as shown below. You may now close the Create Frame dialog box.
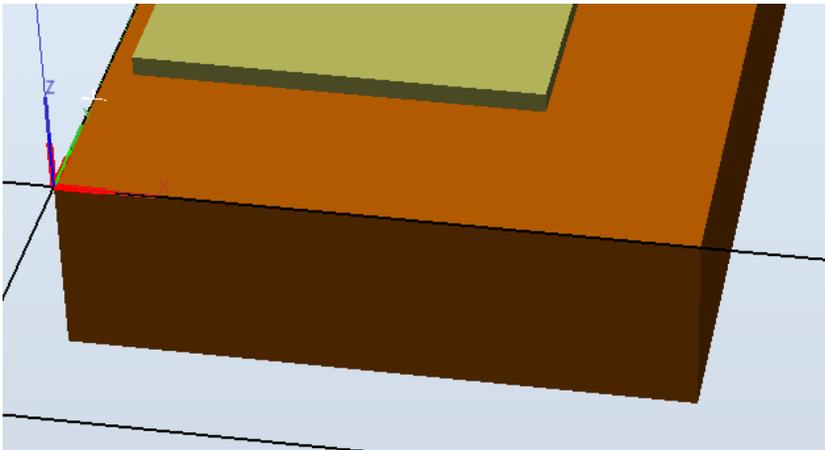
7. The next step is to turn the frame into a work object. Go to the Layout tab in the left-hand pane, then right-click on the newly created frame, then select "Convert Frame to Workobject".
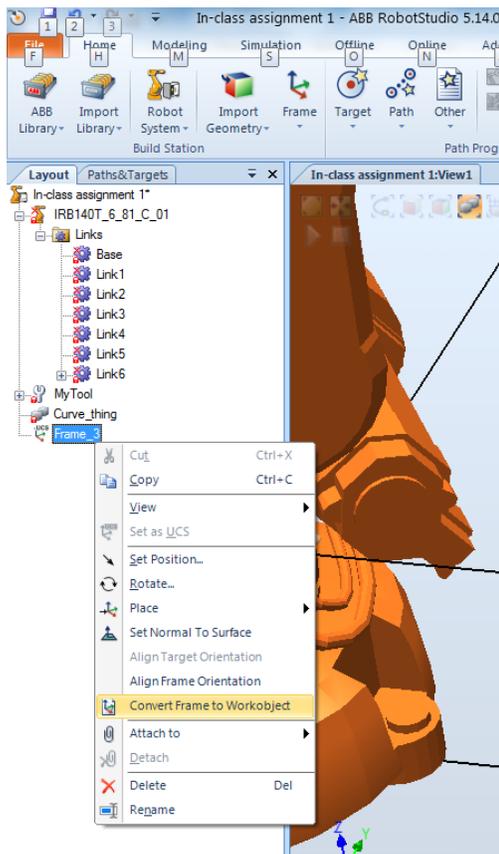
8. The frame disappears and is replaced by a workobject (Workobject_1 in this case) which you can see in the Paths&Targets tab.
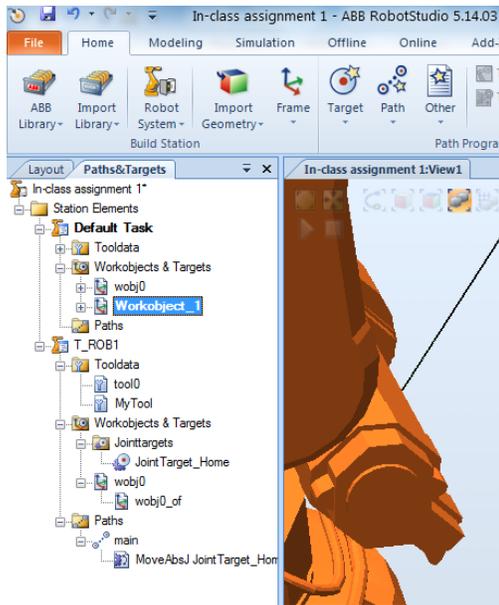
9. You will notice that the newly created workobject is now set as the default.
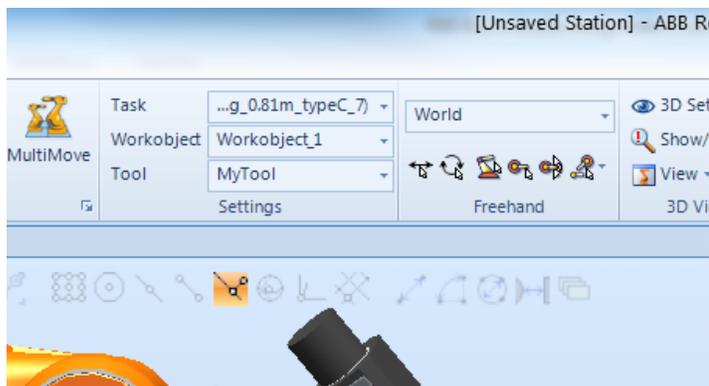
10. Now create the paths as you did in the previous exercise. [You need only create one path for this exercise if you wish.] The difference in this case is that the targets are created with respect to the new workobject (Workobject_1) as opposed to the default workobject (wobj0). When you are done creating the path, go through the usual process of orienting the tool and setting up the target configurations.

11. Go to the Offline tab. Click on the "Synchronize the VC " button to cause the RAPID code to be written that reflects the work objects, targets and paths you have defined.

12. Add a "Main()" procedure and have it call the path(s) you have defined. Make sure that you can successfully run the code.

13. Now go back to the Home tab and select the Layout tab in the left-hand pane. Click on Curve_thing in the menu. Now go up to the toolbar and use the Move and Rotate tools to change the position and orientation of the work piece. [Don't get too carried away. If you move it too much the robot may no longer be able to reach!]

14. Notice that the work object and the targets did not move along with the work piece. We obviously want to be able to fix things up without having to recreate all of the targets, etc. We will use the fact that the targets were created relative to Workobject_1 to make this easy. So if we can correct the pose (position and orientation) of Workobject_1, then the targets will move accordingly.

15. Go to the Paths&Targets tab in the left-hand pane. Right-click on Workobject_1 – then click on "Modify Workobject…". The Modify Workobject dialog box will appear.
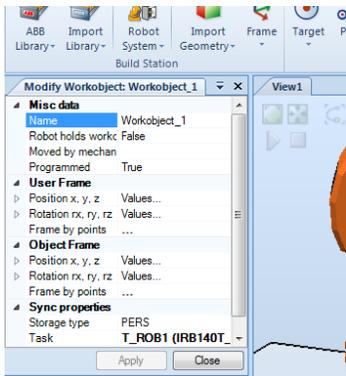
16. In the "User Frame" section of the dialog box, click on "Frame by points" and then click the down arrow to open another dialog box.
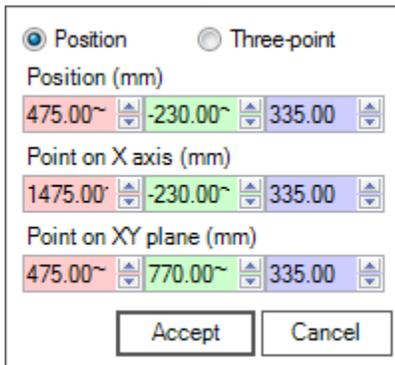
17. Click on the "Three-point" radio button; then click in the red text box under "First point on X axis (mm)". Now go back to the view of the robot and again select the Snap Edge tool (just as you did in step 4). Then click on two points along the same edge of the work piece as you did before (the X axis) and then click on a point along the Y axis. Go back to the dialog box and click Accept when you are done. Then click Apply in the Modify Workobject dialog box. You can also close the dialog box.

18. You should now see that the work object and targets have moved so that they are now re-aligned with the work piece. Note that you will need to re-verify the configuration data for the targets. The process for doing that is exactly the same as before.

19. There remains one thing to do – which is to synchronize your code with the changes you have made to the station. Click on the Offline tab. Then click on "Synchronize to VC". Select all of the items that appear in the pop-up dialog box and then click on OK.

20. Remember that if you make changes to your code (such as changing the default zone setting of z100 to another setting such as z1), you should propagate those changes back to the station. Click on the "Synchronize to Station" button to do that.

21. If you look at the RAPID code, you may be wondering where the data related to myTool and Workobject_1 is kept. It is not kept in Module1 but rather in a separate module called CalibData.

22. Now that you understand the process, please do the following:
    a. Reorient the work piece so that it is once again parallel to the 'floor'
    b. Now rotate the work piece relative to the robot's base. To do this select the UCS coordinate system.
    c. Finally, relocate Workobject_1 to match the new location of the work piece. Update the RAPID code and run the program again

23. If you examine the RAPID code, you will note that the only thing that has changed is the data for Workobject_1 in the CalibData module. The code in Module1 will be unchanged as the data for the targets is relative to Workobject_1 – so the target data has not changed.