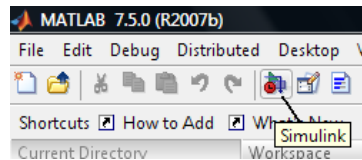


Virtual Reality

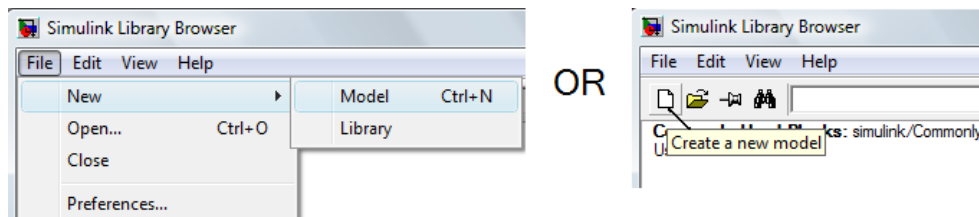
To **install** virtual Reality on MATLAB environment, Write **vrinstall** on Command window and follow the instructions.

1. Drawing Steps

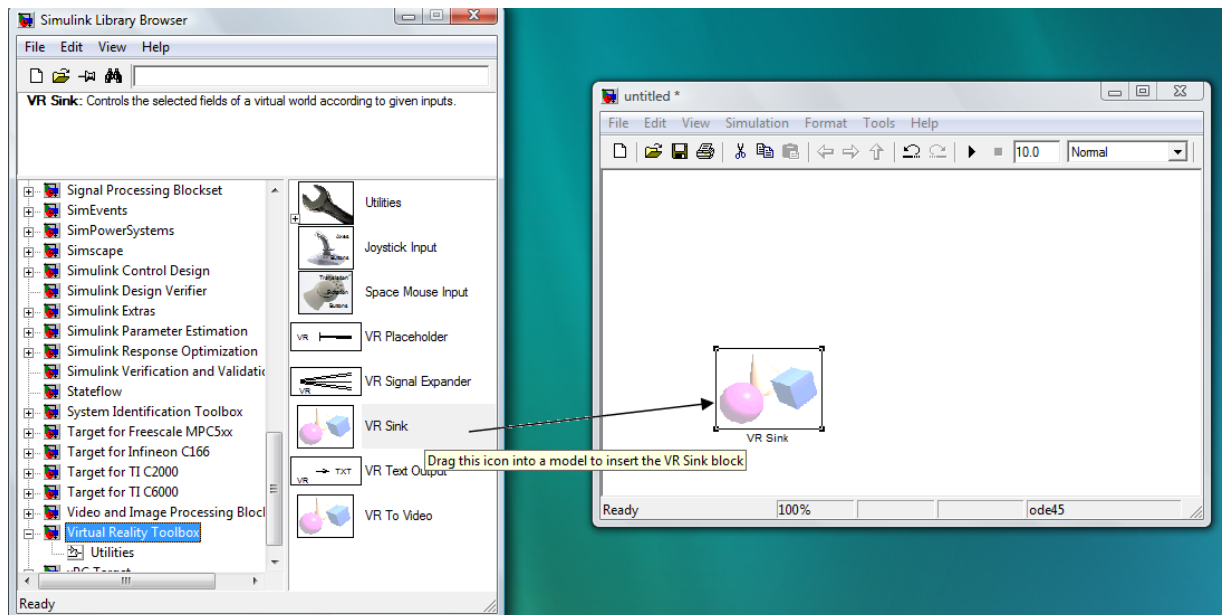
1. Click directly on **simulink icon** placed on Toolbar to open Simulink Library Browser.



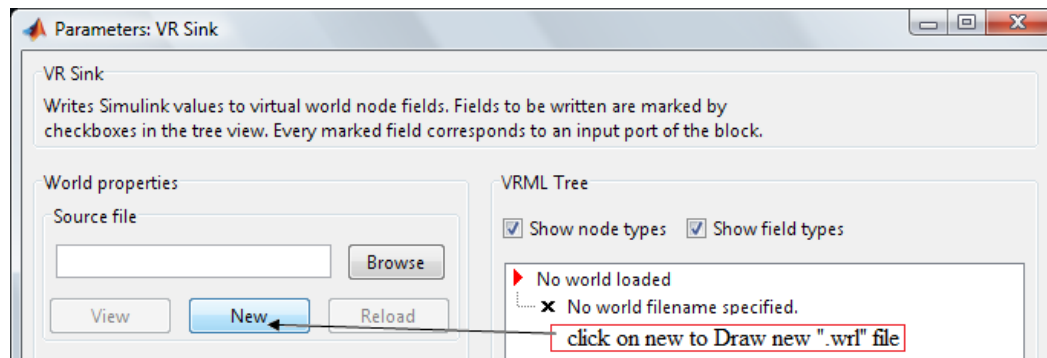
2. Open new model file (.mdl) by clicking directly on white page icon which placed on the toolbar of Simulink Library Browser or click on **file->new->Model** as shown bellow:



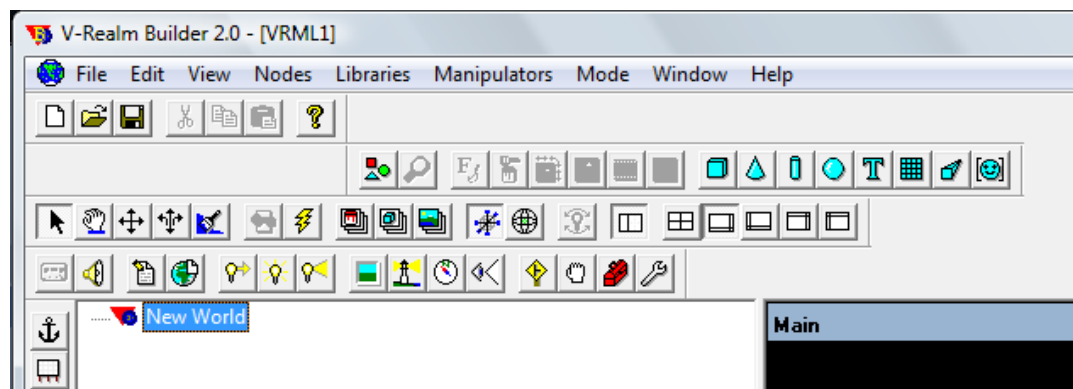
3. Click on “+” sign at **Virtual reality library** From **Simulink Library Browser** then Drag the block called “VR sink” to the opened model file (.mdl) as shown below:



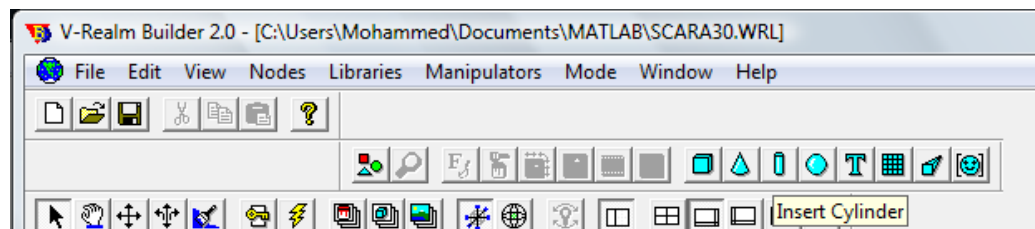
4. Double click on "VR sink" block which placed in model file to open window that can be used to load Drawn or to Draw new "3D Virtual Reality figure " *.wrl" in previous versions its "*.vwr1". After clicking, The 3D Virtual Reality builder will be opened



5. Click directly on white page icon which placed on the toolbar of "V-Realm Builder" or click on **file->new**, you will see the following window

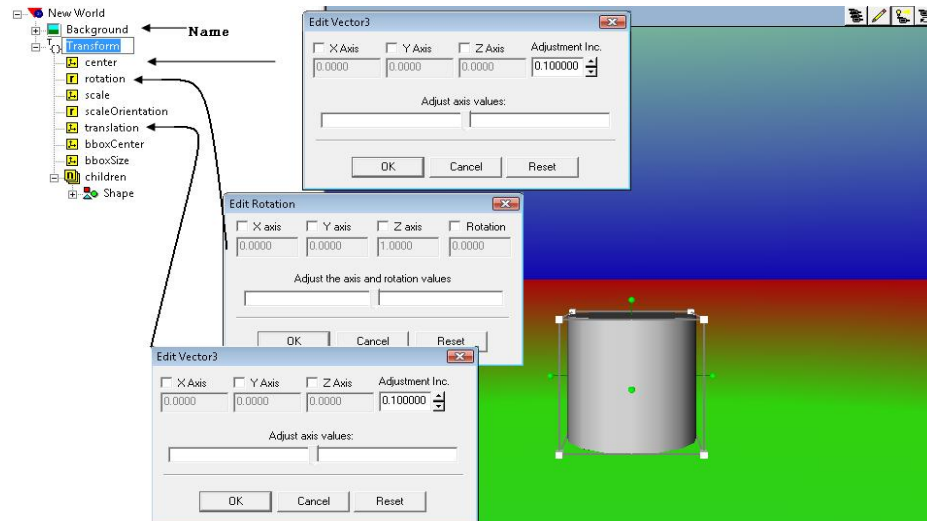


6. Insert new Cylinder by clicking on "Insert Cylinder" icon

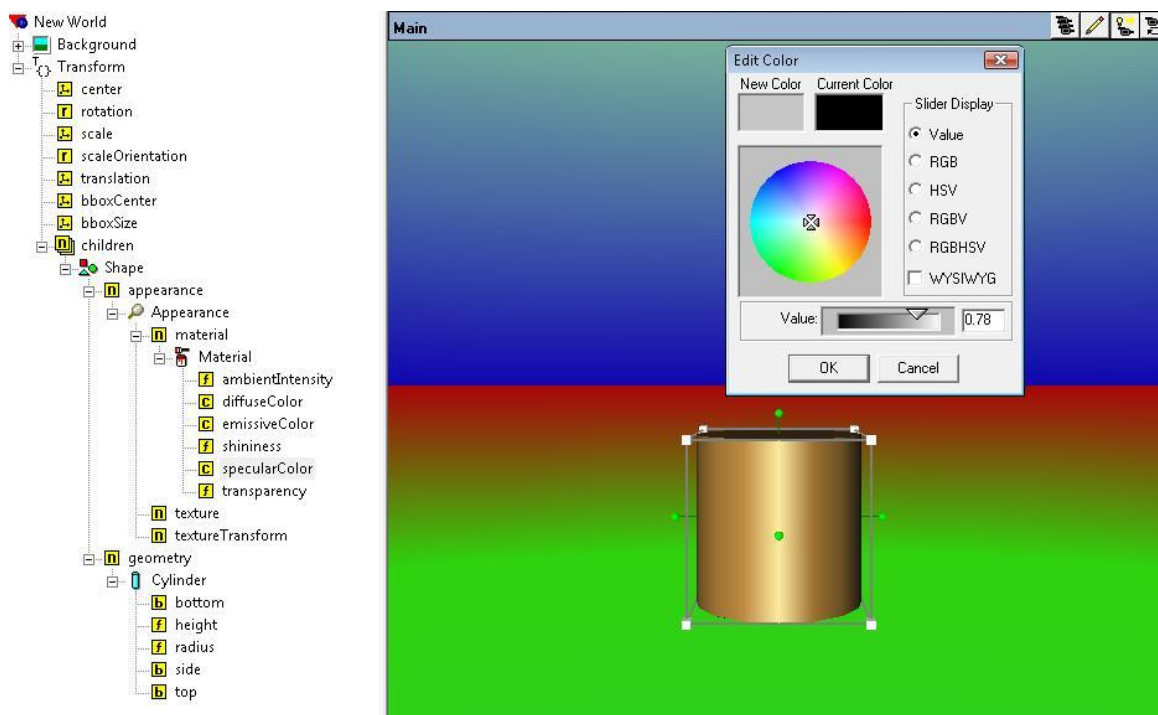


7. Any inserted object will have the name of "Transform" you should change this name before adding any new object.

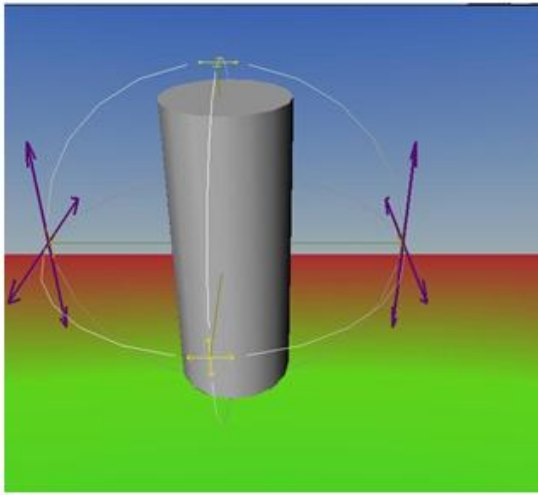
8. you can change the position of the object by using the tool which called “Translation”, you can Rotate the object by using the tool which called “Rotation”, you can change the center of three axes of rotation by using the tool which called “center” as shown below:



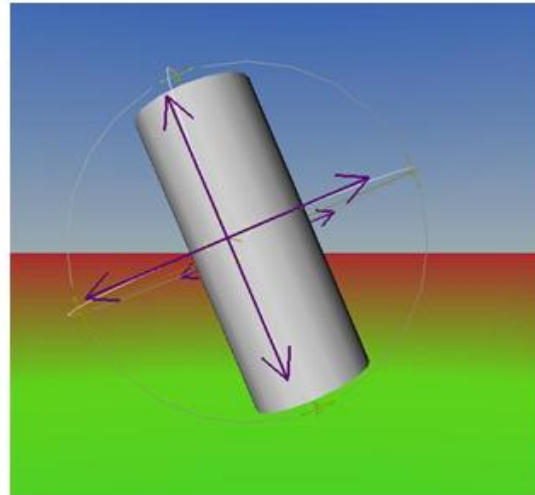
9. you Can change the object’s color by clicking on **children -> appearance-> appearance->material-> material->** Then click on “diffusecolor” to choose color of the object, and “specularcolor” to choose the color that will be appeared in the center of the object. As shown below:



10. X-axis, Z-axis is as follow



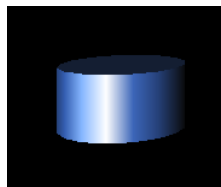
Rotation about X-Axis



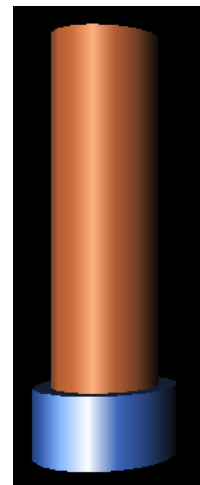
Rotation about Z-Axis

Hint: x-axis is the axis that is perpendicular to the plane of previous two axes and passes through the object.

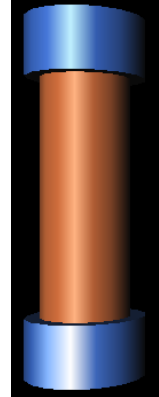
11. You can change the radius of abject and the height From **children -> shape-> Geometry->** for our project for the first object choose radius equal 0.8, height equal 0.8, choose the RGB diffusecolor [0.2 0.4 0.8], and choose the value of specularcolor = "1", you will see the following object:



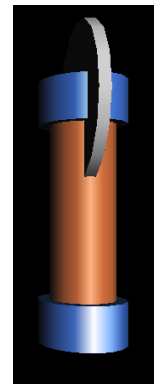
12. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.6, height equal 4.4, choose the RGB diffusecolor [0.8 0.4 0.2], and choose the value of specularcolor = "1" you will see the following figure:



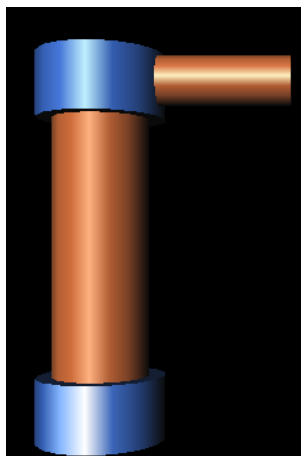
13. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.8, height equal 0.8, choose the RGB diffusecolor [0.2 0.4 0.8], choose the value of specularcolor = "1", and translate the object 1.8 along y-axis you will see the following object:



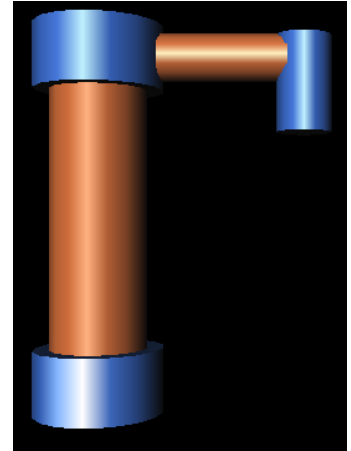
14. Click on the children of the previous object and add new cylinder as children to the previous one "hidden object", rotate this object 90 degree about z axis to make it perpendicular to the previous one till see the following figure
Reduce the radius of this object to be hidden inside the previous object



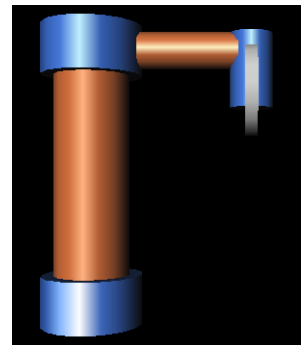
15. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.3, height equal 1.6, choose the RGB diffusecolor [0.8 0.4 0.2], choose the value of specularcolor = "1", and translate it -1.55 unit along y-axis you will see the following figure:



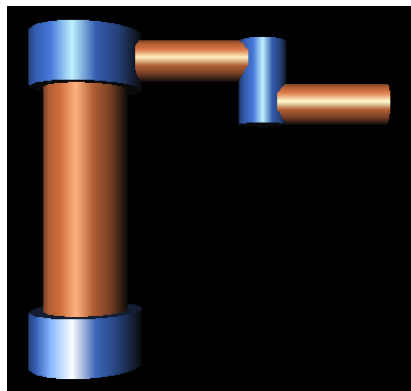
16. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.35, height equal 1.2, choose the RGB diffusecolor [0.2 0.4 0.8], choose the value of specularcolor = "1", rotate the object 90 degree about Z-axis, and translate the object -0.32 along X-axis and -1 along y-axis you will see the following object:



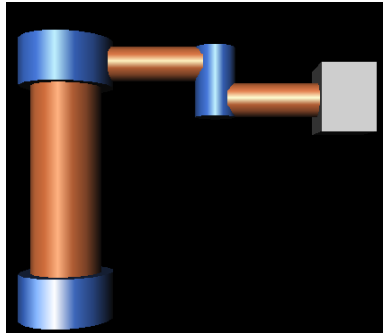
17. Click on the children of the previous object and add new cylinder as children to the previous one "hidden object", translate it 0.3 unit along Y-axis rotate this object 90 degree about z axis to make it perpendicular to the previous one till see the following figure
Reduce the radius of this object to be hidden inside the previous object



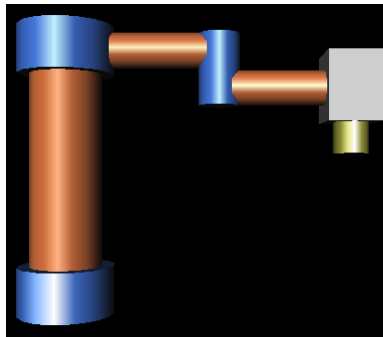
18. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.3, height equal 1.6, choose the RGB diffusecolor [0.8 0.4 0.2], choose the value of specularcolor = "1", and translate it 1 unit along y-axis you will see the following figure:



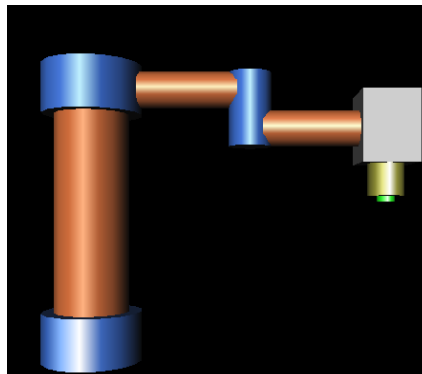
19. Click on the children of the previous object and add new cube by clicking on “**Insert box**” icon as children to the previous cylindrical object, choose its size by choosing x-length , y-length , and z-length, you will see the following figure:



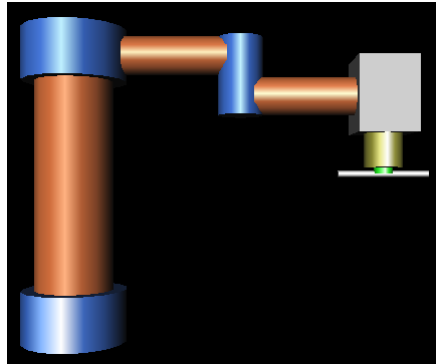
20. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.3, height equal 1.6, choose the RGB diffusecolor [0.6 0.6 0.2], choose the value of specularcolor = “1” , rotate it 90 degree about z-axis, and translate it 0.3 unit along X-axis you will see the following figure:



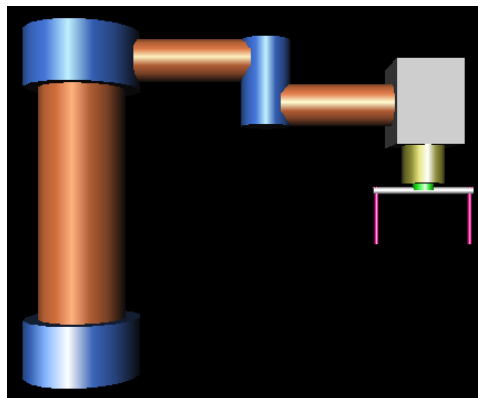
21. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.15, height equal 1.8, choose the RGB diffusecolor [0.1 1.0 0.1], and choose the value of specularcolor = “1” , you will see the following figure:



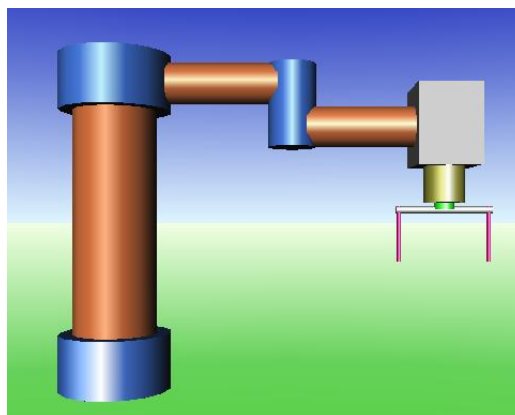
22. Click on the children of the previous object and add new cylinder as children to the previous one, choose radius equal 0.05, height equal 1.4, and Rotate it 90 degree about z-axis, you will see the following figure:



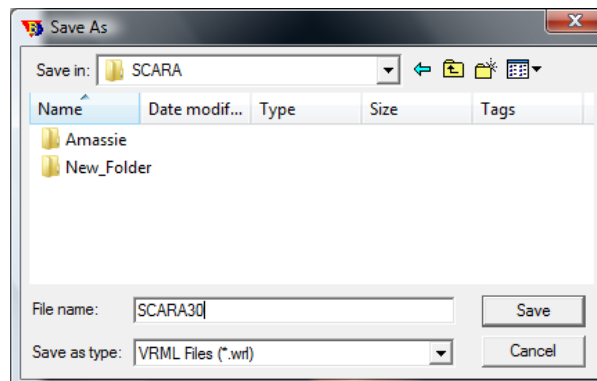
23. Click on the children of the previous object and add new two cylinders as children to the previous one, choose radius of two cylinders equal to 0.03, height equal 0.8, choose the RGB diffusecolor [1.0 0.0 0.5], choose the value of specularcolor = "1", rotate them 90 degree about z-axis, and translate one them -0.35 unit along X-axis, translate one cylinder .65 along y-axis and Translate the other -.65 along y-axis you will see the following figure:



24. You could insert background by clicking on "Insert background" Icon. After changing its color you will see the following figure:



25. Save the Drawing 3D by using any name with an extension (.wrl) , lets choose (SCARA30.wrl) as shown below



How to Control your drawing file by using m-file

1. Before controlling your project you should Read the file to the variable by using the following command
 - `SCARA30 = vrworld('SCARA30.wrl');`
 2. You should open your variable by using the following command.
 - `open(SCARA30)`
 - `View(SCARA30)`
 3. Before using The Rotation commands you should change the degrees to radian by using the following command
 - `radian=T1*pi/180.`
 4. The two arms of SCARA manipulator will rotate about x-axis so we can use the following commands:
 - `SCARA30.a1.rotation = [1, 0, 0, radian]`
 - `SCARA30.a2.rotation = [1, 0, 0, radian];`
 5. End Effector will rotate about y-axis so we can use the following command:
 - `SCARA30.d4b.rotation = [0, 1, 0, radian]`
 6. Also, The translation of End Effector will be on The y-axis so we can use the followingCommand
 - `SCARA30.d4b.translation = [0, distance, 0];`
 7. The End Effector has two pins to pick and place an object, these two pins has a constant position on x-axis(-.35), the translation will be along y-axis, first I will read the required distance between two pins, divide the distance by 2 to determine the positive translation of the first pin, and the negative translation of the second pin. So we can use the following command
 - `SCARA30.EndV1.translation = [-0.35, y1, 0];`
 - `SCARA30.EndV2.translation = [-0.35, y2, 0];`
-