

Creating Torus Knots

Building a knot

1. Select "Rectangle → Formula".
2. Insert the parametric equations for your knot.
 - a. For example, a (3,2) trefoil knot has the equations $x = \text{Cos}(3*t)*(3+\text{Cos}(2*t))$, $y = \text{Sin}(3*t)*(3+\text{Cos}(2*t))$, $z = \text{Sin}(2*t)$. Here, t goes from 0 to 2Pi . Note that this is the format that is necessary for Cinema 4D to read your formulae.
 - b. You may need to zoom in to see the curve.
3. Select "Subdivision Surface → Sweep".
4. Select "Rectangle → Circle". Set the radius of your circle. Do this under Attributes → Object → Radius.
5. In Object Manager, make "Circle" and "Formula" children of "Sweep". (Circle goes above Formula.)
6. You'll see that your torus knot does not look smooth. You can fix this. Click on Formula and look at Attributes. Go to "Object" and "Samples". Increase the number of samples until you are satisfied. (I picked 150.)
7. You can adjust how smooth the circle cross section looks too. Click on Circle, then look at Attributes. Go to "Object" and then "Number". Experiment with increasing and decreasing this number and see what effect this has on your torus knot.

Fixing the join

When you create a knot in Cinema 4D, sometimes the two caps of the knot will not fit correctly. If that happens, follow these steps:

1. Adjust Tmax until you see the join. In order to close the gap between the ends of the tubes, we need the ends to be as close as possible, but not touching. I ended up using $T_{\text{max}} = 6.281$ here.
2. We need to remove the caps on the ends of the tubes. Click on "Sweep" and go down the Attributes menu. Click on Caps, the uncheck the boxes that say "Start" and "End".
3. We need to make the object editable so we can fix the join. Click on the "Sweep", then go to the Object menu and select "Current State to Object". You'll see a new object, also called Sweep, with a triangle next to it. Let's name this Sweep1 for simplicity.
4. Click on the buttons next Sweep (the original one) so they show red. This means you have the data, but you aren't seeing the object in the view window.
5. Click on Sweep1. Click on the Points editor (leftmost on the top dock, a hexagon with a point). Click on the Brush tool (topmost on left dock, the arrow with a dotted square around it). Select Rectangle Selection. Put a rectangle around all the vertices at the ends of the tubes and let go. You'll see they are all highlighted.
6. Right click and select "Stitch and Sew". (If you can't right click, then go to the "Mesh" menu at the top bar of C4D, then "Remove", then "Stitch and Sew".)

7. Click on one vertex (it will be highlighted in white) and click on a vertex directly across from it. The tube is now joined.

Exporting your object

1. The C4D file has two objects in it, the Sweep and Sweep1. We only want to 3D print Sweep1. Save your file so you have all the information stored. Now delete the original Sweep. You can then export Sweep1 to an STL file. (You can then undo delete to get Sweep back. Alternatively, everything is saved, so you can recover the data from the saved file.)
2. Click on “File → Export → STL”.
3. Make sure you are exporting the file in Millimeters. Do this by choosing this option in Settings window that pops up. The Settings window can sometime be found by clicking on the gear icon next to STL.

Saving your work

Make sure you save both the C4D file and the STL file to your W&L Box folder in a place where you can find it.