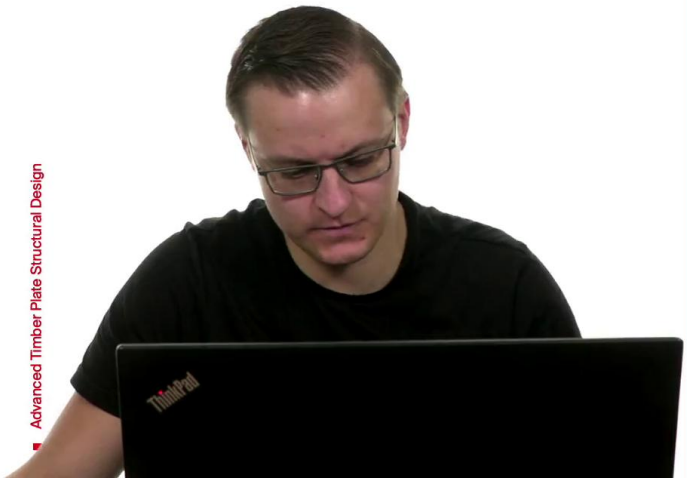
EPFL
IBOIS



Joinery Generation and Fabrication

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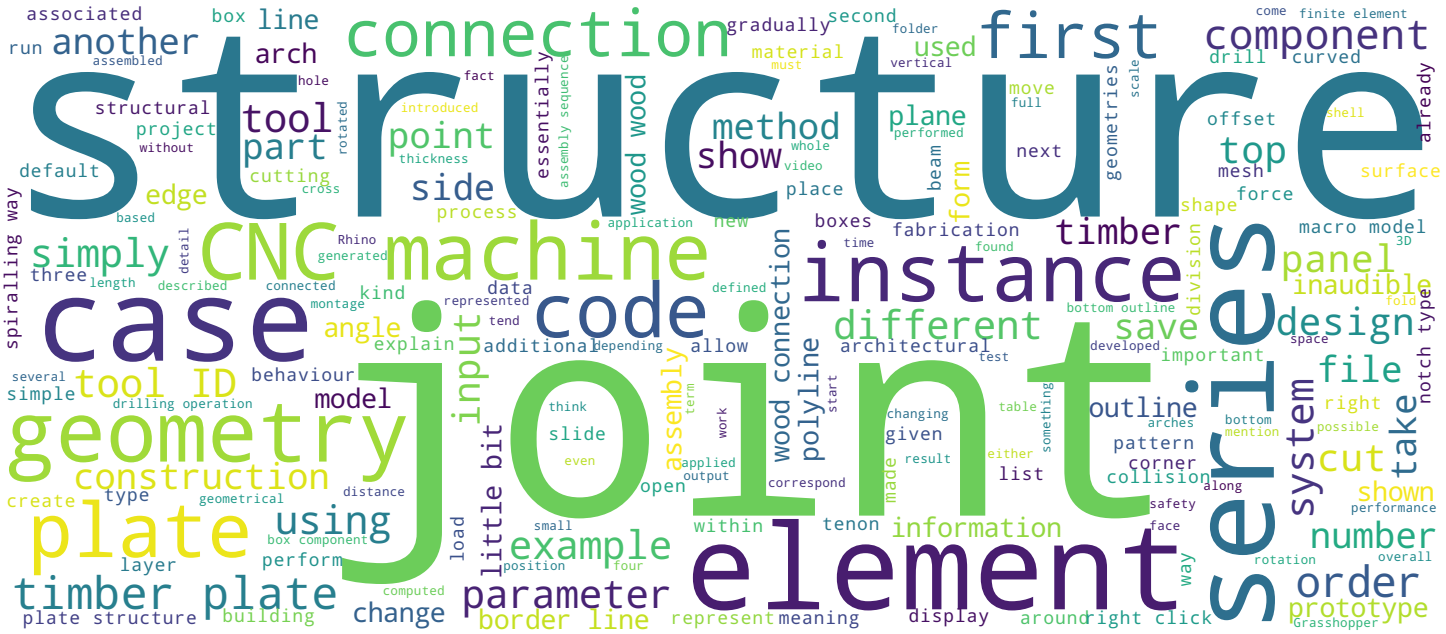

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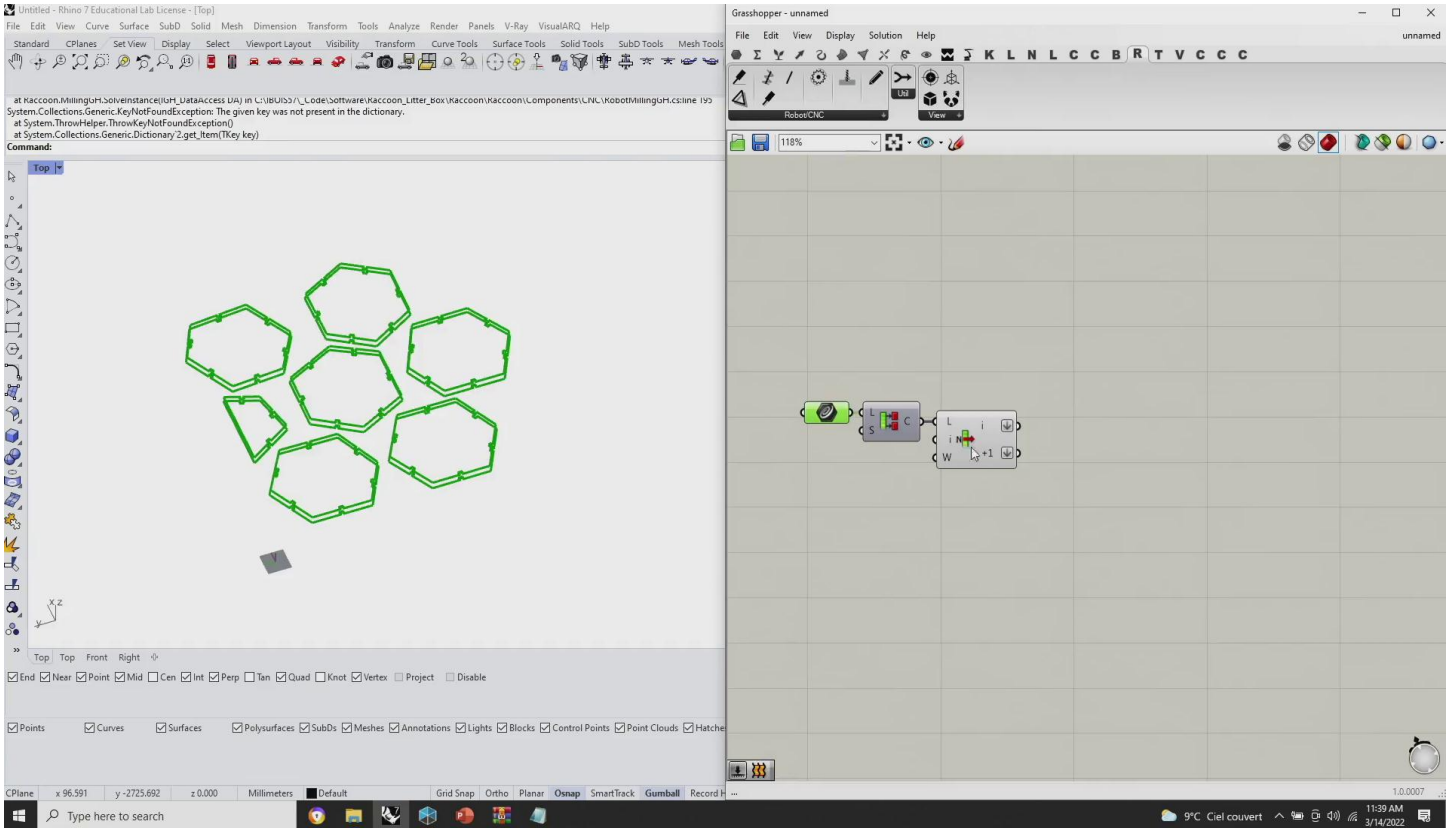
Video

EPFL

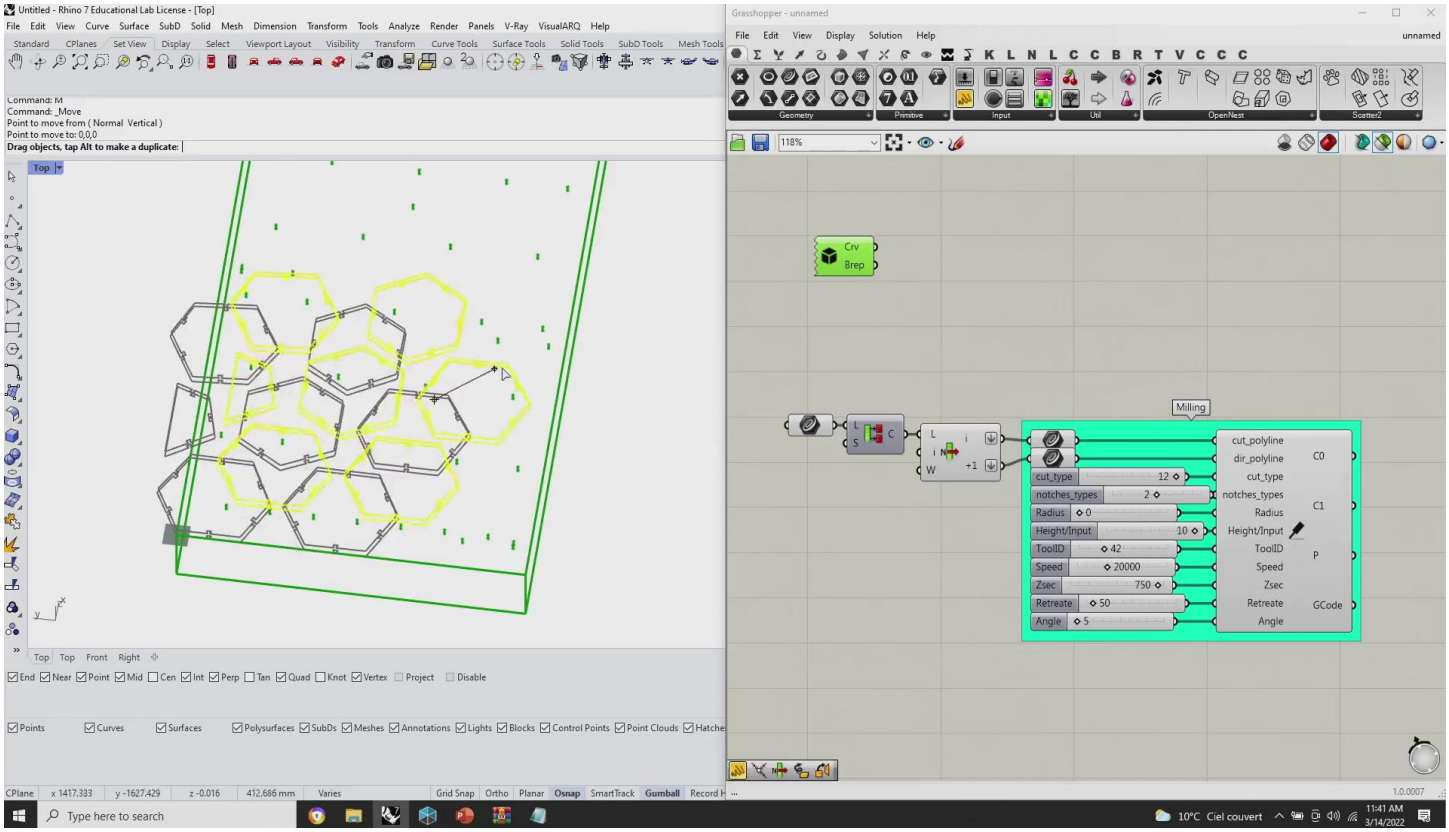


We are going to cover the CNC fabrication in this video. In this video, we are going to use the IBOIS CNC tool that can be found at IBOIS GitHub under the name Raccoon in the following link. This is a Grasshopper plugin that you can found this plugin under Releases, and you can simply download a series of zip files. That is the same Grasshopper plugin installation as was described before. In this file, it is important to mention there is a TXT file that corresponds to tool IDs in our CNC machine. Currently in our CNC machine, we have following tools. This is tool ID, the radius, the length of the tool, speed values, turn direction, cutting length, if it is a saw or a milling tool, and the holder radius. For safety reason, I tend to use the following TXT file so that we would not guess what kind of tool it is. But we do it once, and then we use it afterwards. Please download the following zip file that includes the plugin for the CNC machine. Let's continue with the last example of our series of nested border lines. I'll show you how to cut these border lines. This is a geometry, and that comes from, for instance, from Compass Wood. You would like to cut this geometry inside the CNC machine.

Notes

Summary

0m 04s

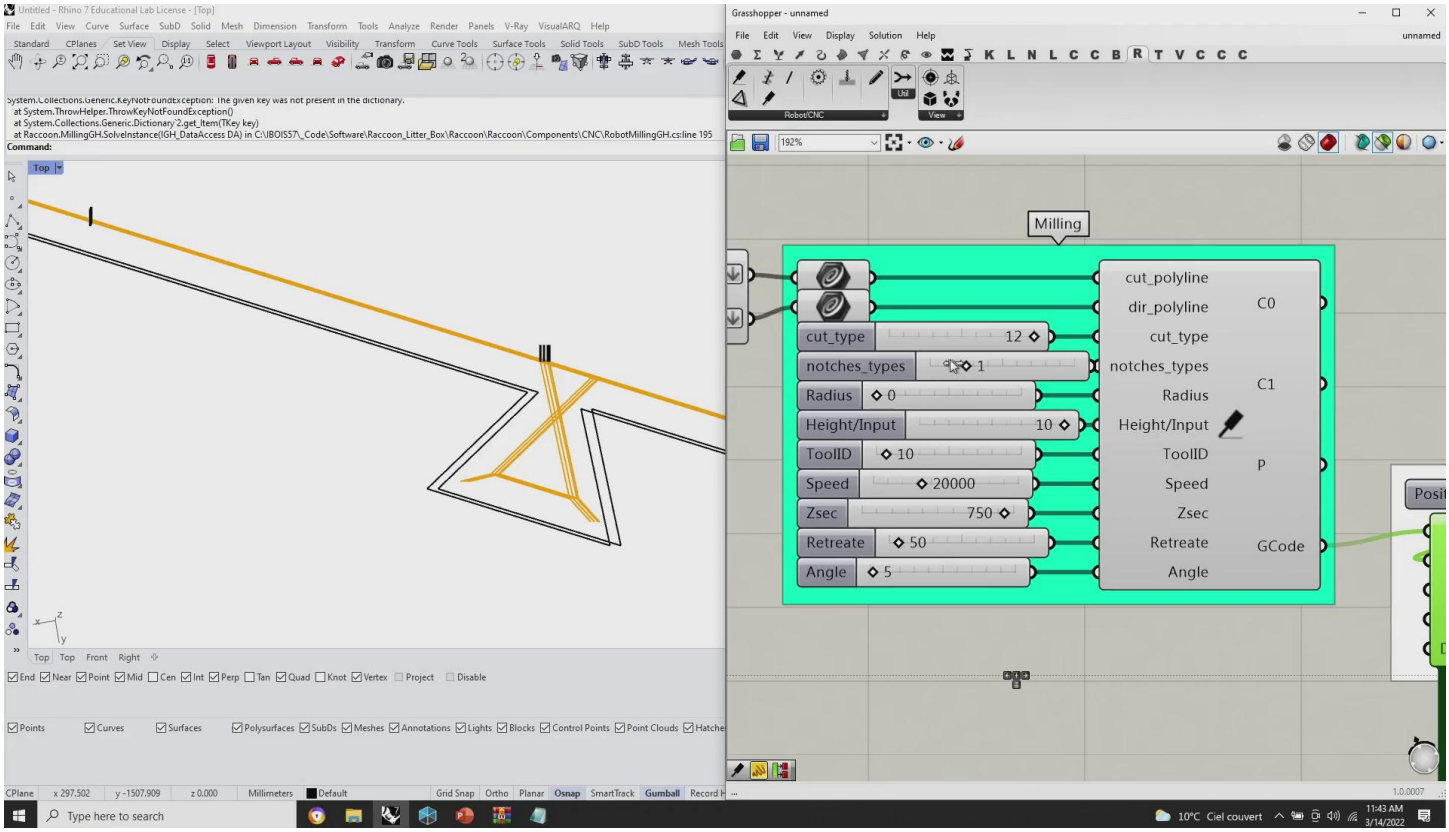


We have the freedom model of the CNC machine, which represented by the component Maka. The tool, zero point that is currently defined, it is 0,0 in Rhino. We have nested geometry like this and we would like to cut it. What we can do, we can use these outlines as a top and bottom outlines to guide the CNC machine using the component called Milling. So let's take this component, and by default, there are a series of inputs that I'm going to explain right now. Let's give the first item and the second item to a series of outlines. Just to go through, these are the top and bottom outlines. Then they are partitioned into two border lines that represent each individual plate. And then you need to take first and second outline in order to drive this component as a cutting outline and the direction of it. This geometry must be placed exactly on the table. For instance, right now there is some mistake here because this in the middle of the whole table, so there will be probably an accident if it runs like this. Let's, for instance, draw this geometry exactly on the 0,0 points. So for instance, I move this geometry to 0,0. Now it is in the correct location. I just move a little bit at the centre that it's properly positioned.

Notes

Summary

1m 46s

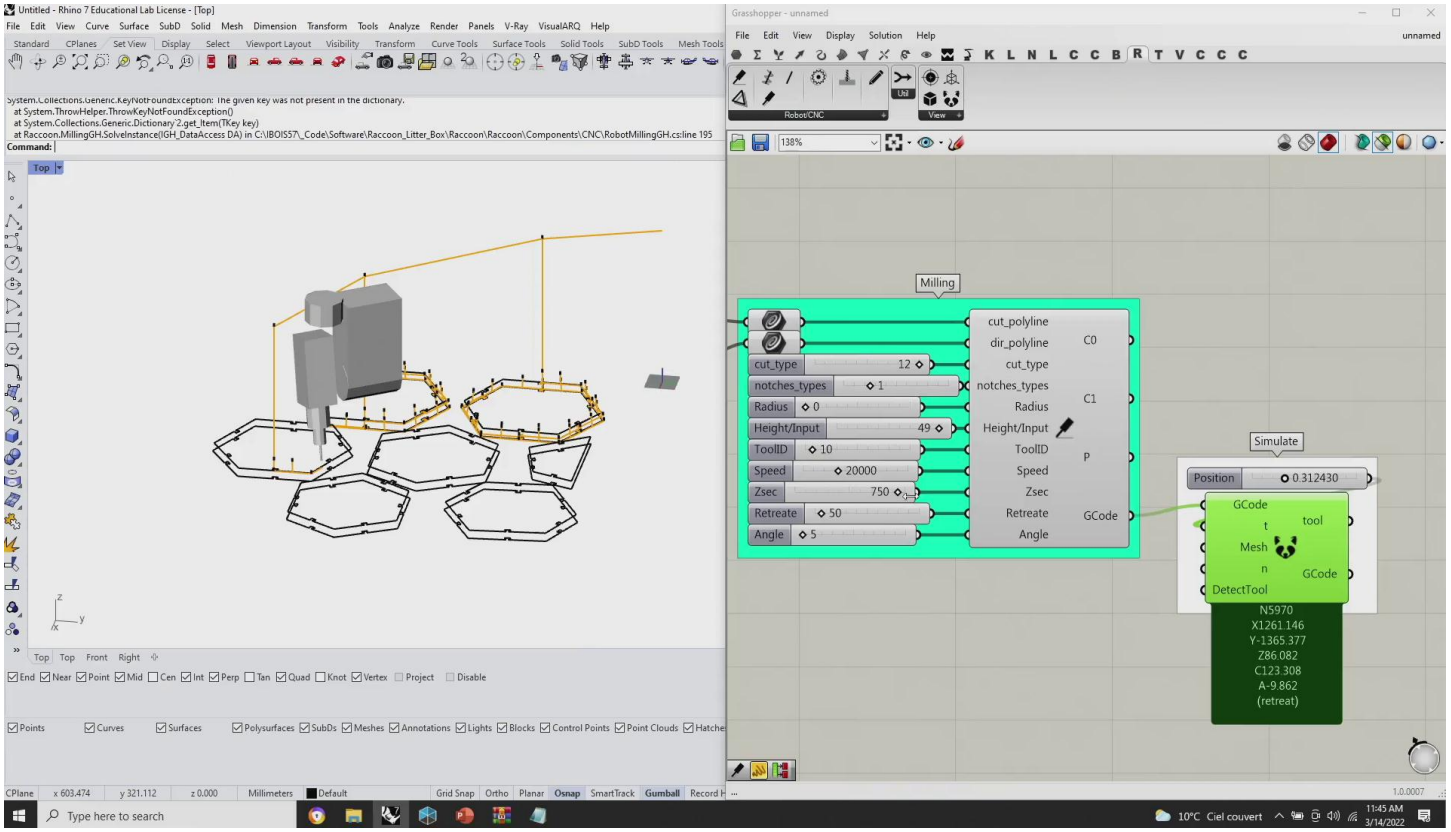


Now you see that by default, something has been generated, and this something is a G-code that is essentially a series of X, Y, and Z coordinates and a few rotations depending on how your CNC machine is configured. In our case, we have two rotations angles to get the five-axis cutting. In order to explain what I meant by tool ID, this is a parameter for tool ID. If I'm changing this parameter, the offset between the original border line is changing. For instance, let's right now use number 10 to have a smaller tool. To visualise this tool, we can use the visualisation to simulate the G-code. This is a simulation component that we can simply run the simulation process. I'll show this and this. We see gradually, the two path has been processed by series of rotations. This was a tool ID. Then there's a height number. For instance, this is how many divisions you would like to have. The smaller the number, there are more divisions because this is a division by distance. Then in case you don't want to use a specific tool ID, you simply can choose the tool radius. Then there are a series of operations or methods for the notch type. You can use Bisector for instance, notch. You can not use notch at all.

Notes

Summary

3m 31s

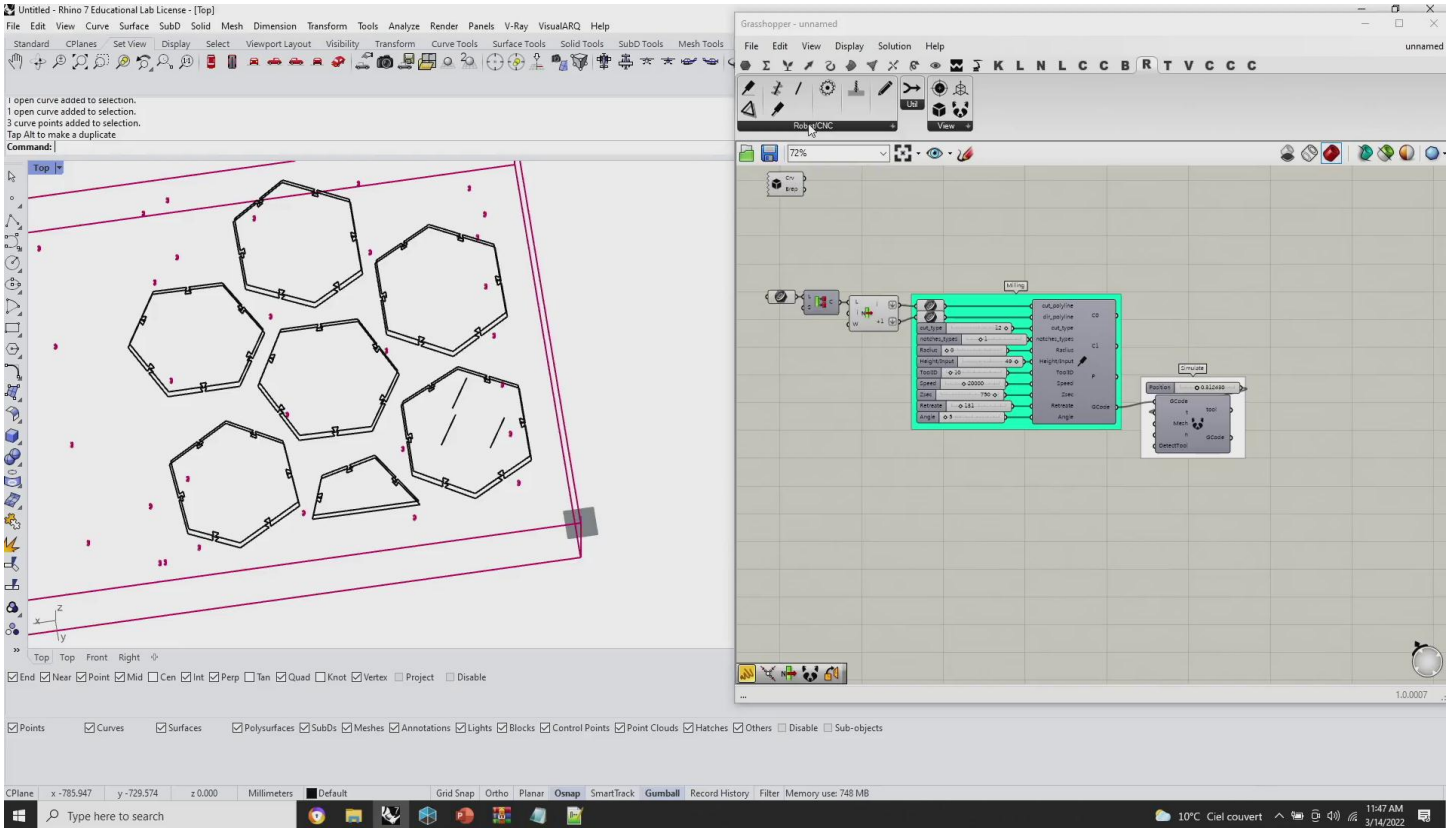


In that case, all the elements will be around it. I'll explain why. For instance, if you would move this tool... See that every tool has its own thickness. And if you simply go to the corner, the corner would be around it. We tend to use notch types. The tool can go a little bit inside and cut a little bit more material, but there will be a valid geometry to insert. I think there are a few notch types and conflation bisector. Let's use, by default, bisector one, and there are a series of cut types. For instance, you can meld the full geometry. You can also cut first border line, if I remember correctly. You can, for instance, cut the same outline. What is important to mention is that the cutting operation is running in spiral. If you would see more closely, these outlines are not offsets but they are cutting in a spiralling way. If I would reduce the division, for instance, we have only one. You see that the tool gradually is rotated in a spiralling way. We do in such a way because we would like to save as much work piece and the tool as possible. That's why we are cutting in a spiralling way. Then we have a speed value. We have retreat distance for the safety.

Notes

Summary

5m 20s

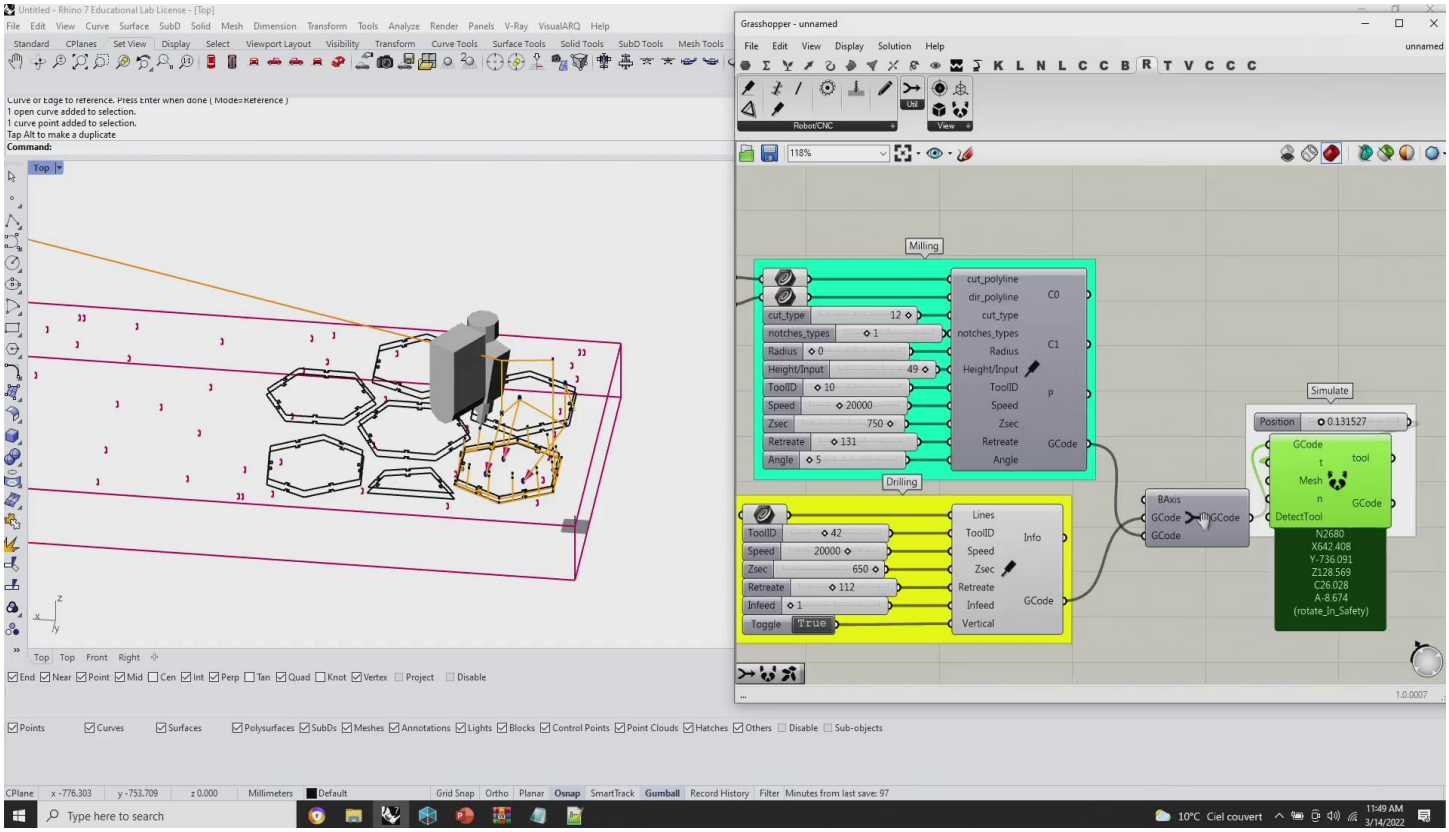


If there is an angle, we have arbitrary distance as well. The last parameter is for safety. In case we have really really sharp angles, we display that the geometry cannot be cut because the angle is too sharp. This is just G-code that can be run directly in the CNC machine. If you would like to save this code, you can right click, select Directory and Address, and, for instance, I would save it on Desktop. I could change a name, which is by default, it has to be six numbers in our CNC machine. I would save this file and I would open it. You can see that this G-code is ready to go, meaning that you can place this file where you want on the drive of the CNC machine and you can perform the cutting operations. The second point that is usually used besides milling or drilling or cutting is the drilling operation. For instance, if you would like to drill a series of holes in order to fix those elements, I would temporarily hide all geometries so that it's not intersecting, that you can more cleanly see what you're doing. Since you have a series of lines that you would like to drill into the piece, let's take three of them. This will be a drilling operation. In Robot CNC, you can take Drilling.

Notes

Summary

7m 17s

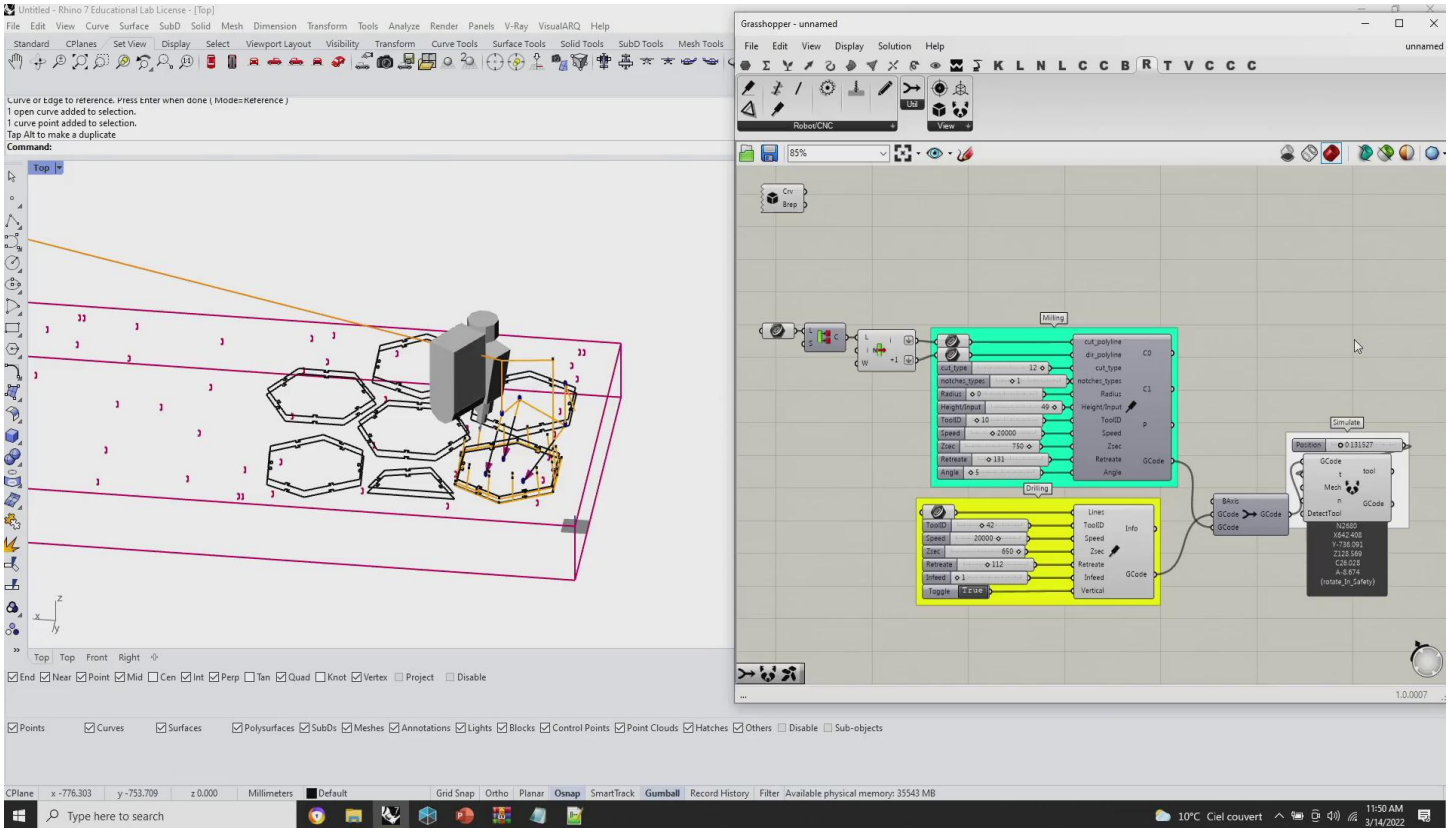


You can select those three lines. They can be in 3D or just vertical, it doesn't matter. If I would now connect G-code to G-code, do you see that there's a different method, a little bit, that you can drill a series of holes that corresponds to the drill angle. The input parameters are pretty much the same, it's the tool ID, the speed, the security value, the retreat distance, and the infeed, how many essentially drilling steps you would like to make either at once or multiple times, depends on you. Finally, there is a boolean toggle for vertical orientation because users usually tend to create mistakes. If the drilling operation is opposite to a table, there is a collision, and the CNC machine does not know about the collisions. That's why I have additional check in case you're cutting panels, to always orient the lines to a vertical position. And then you can again either do a right click and Save, or you can merge multiple pass. For instance, we have one G-code, we have another G-code, and you can also perform both steps together. So first you can drill, and then you can mill. In this case, this is the component in the plugin called Merge.

Notes

Summary

9m 15s



You can right click and select Directory and Address in order to save this file again. These are the basic components for CNC cutting. There are more for sure. But this is the basic principle for the tool IDs, for the parameters that you can use for cutting panels with the CNC machine at IBOIS EPFL using five axis. Thank you very much for watching. This was my last tutorial on the joinery generation for timber plates. To the nesting and fabrication using a CNC machine.

Notes

Summary

10m 57s