Turning Kit

1. Bar setup.
2. Creating new chisels for cutting.
3. Bar Cutting Algorithm.
4. Algorithm for creating a 3D bar model.

1. Bar setup.

In order to create a bar, you need to create an empty object on the stage and add the “Wood” script to it (Figure 1). The script has three parameters:

1. Size – bar size to be created.
2. MaterialIn – interior material for 3d bar object.
3. MaterialOut – external material for 3d bar object.

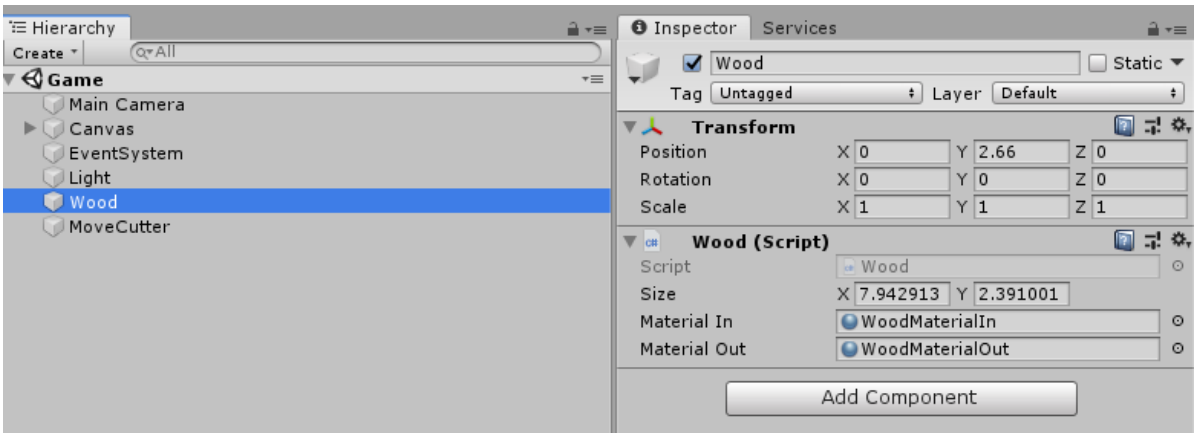

Figure 1

The size of the bar can also be changed in the editor window, for this you need to select an object in the “Hierarchy” and in the “Scene” window, hold down the green square with the mouse and drag it and change the “Size” parameter (Figure 2).

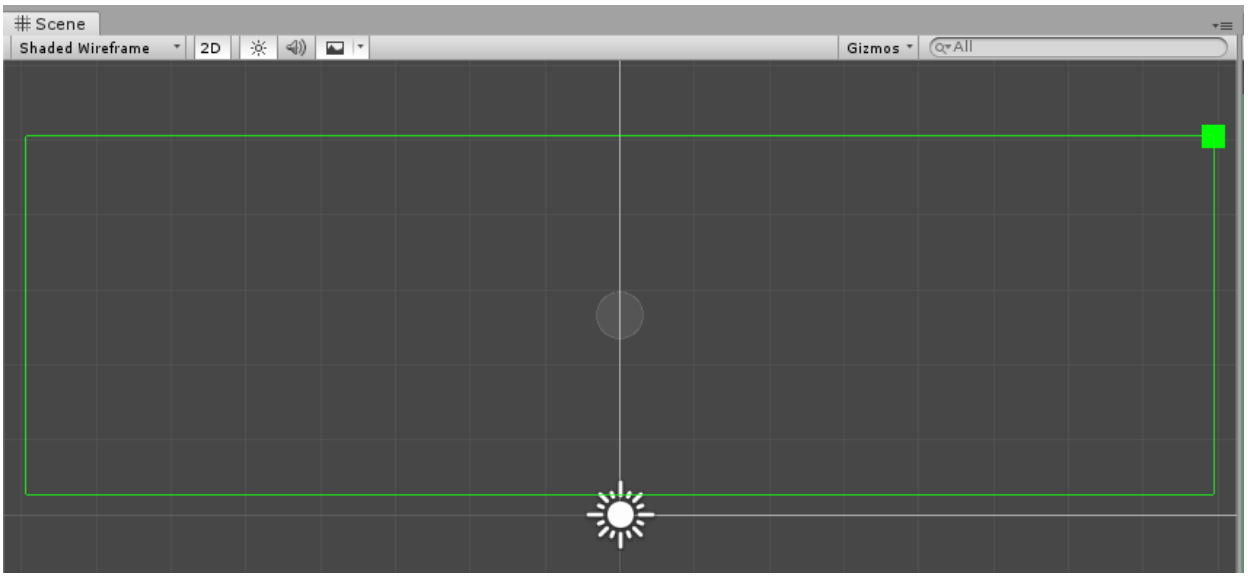

Figure 2

2. Creating new chisels for cutting.

In order to create a new chisel, you need to create an empty object on the stage and add the “Cutter” script on it (Figure 3). The script has parameters:

1. ChiselPrefab – this is a 3d object of the chisel handle (in this program it is one “chisel”, but you can add your own handle).
2. MaterialChisel – material for the created 3d object.
3. Size – Chisel blade size (figure 4).
4. Contour – the contour along which the cutting part of the chisel will be formed (figure 5).

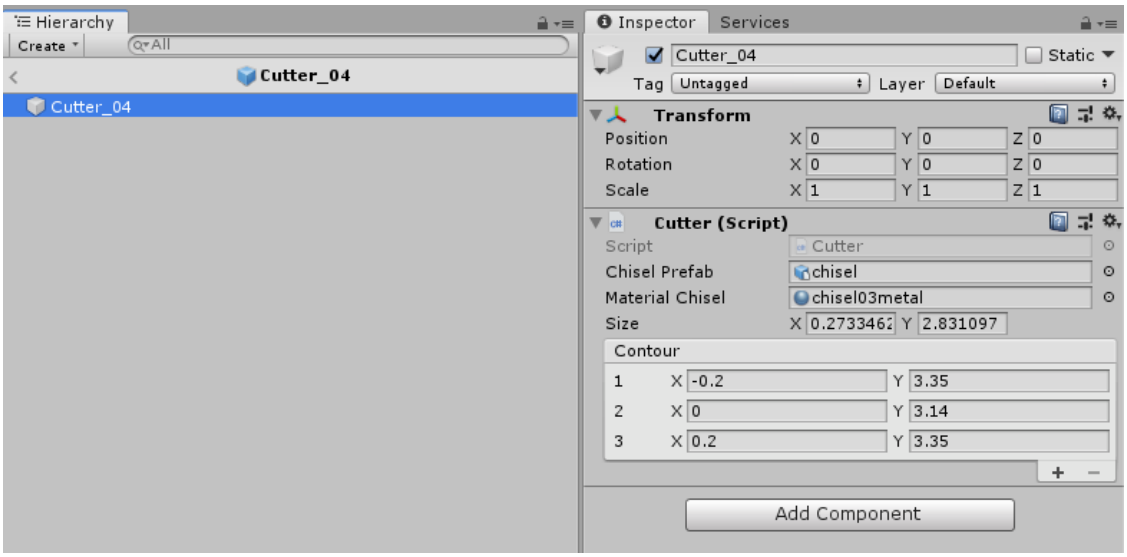

Figure 3

The size of the chisel blade can be changed in the “Scene” window by holding the mouse onto the green square (top right), drag it and change the “Size” parameter (figure 4).

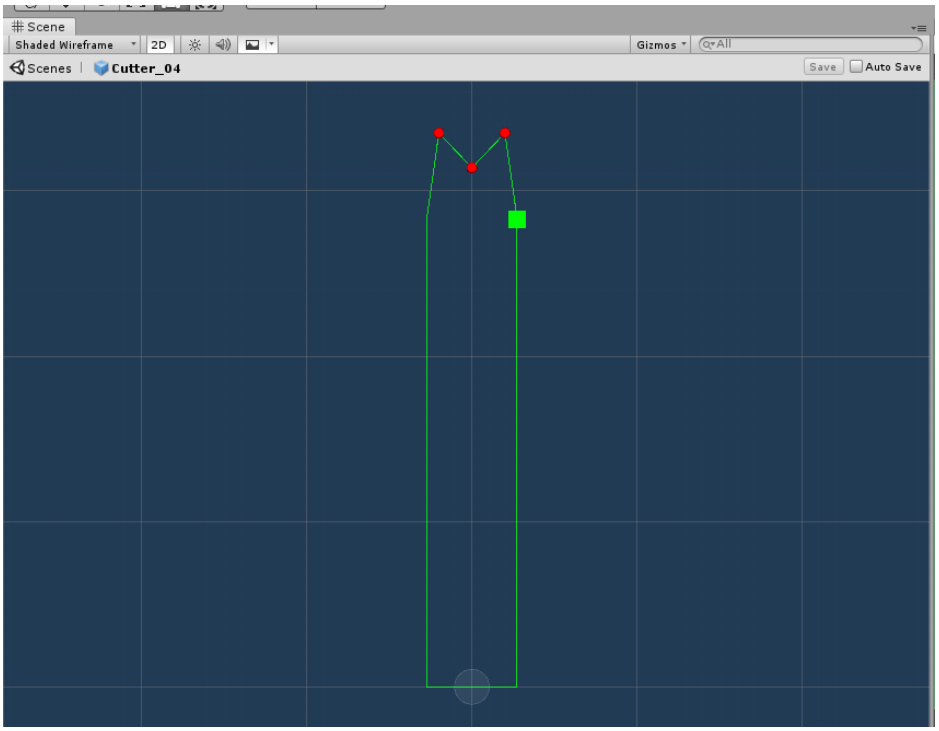

Figure 4

In order to change the contour of the tip, you can add a point by clicking on “+” in “Contour” (Figure 3), or delete an unnecessary point by selecting it in “Contour” and pressing “-” (Figure 3). You can change the position of the points of this contour in the Scene window, click on the red circle, it will turn into a green square (this means that the point is selected), then click on the green square with the mouse and drag it thereby changing the position of this point (figure 5).

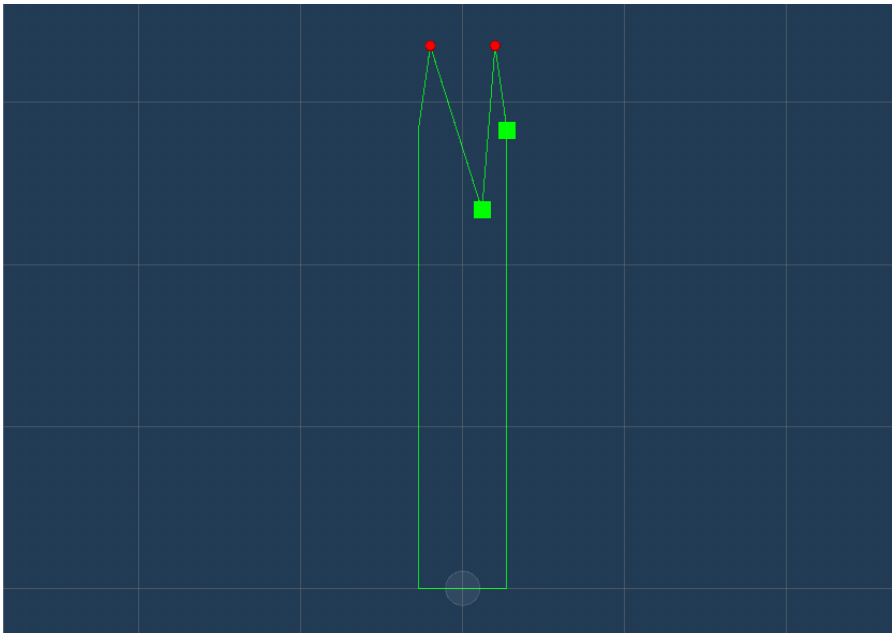

Figure 5

Now you need to add the ability to select a new chisel, create a prefab from the new chisel (for example, its name is “Cutter_04”), in the Hierarchy window add the prefab “Prefabs / UI / UI_B_Cutter” to “Canvas / Panel” (Figure 6), fill in the parameters:

1. Prefab – add the prefab we created «Cutter_04».
2. Sprite – add a picture with a new chisel.

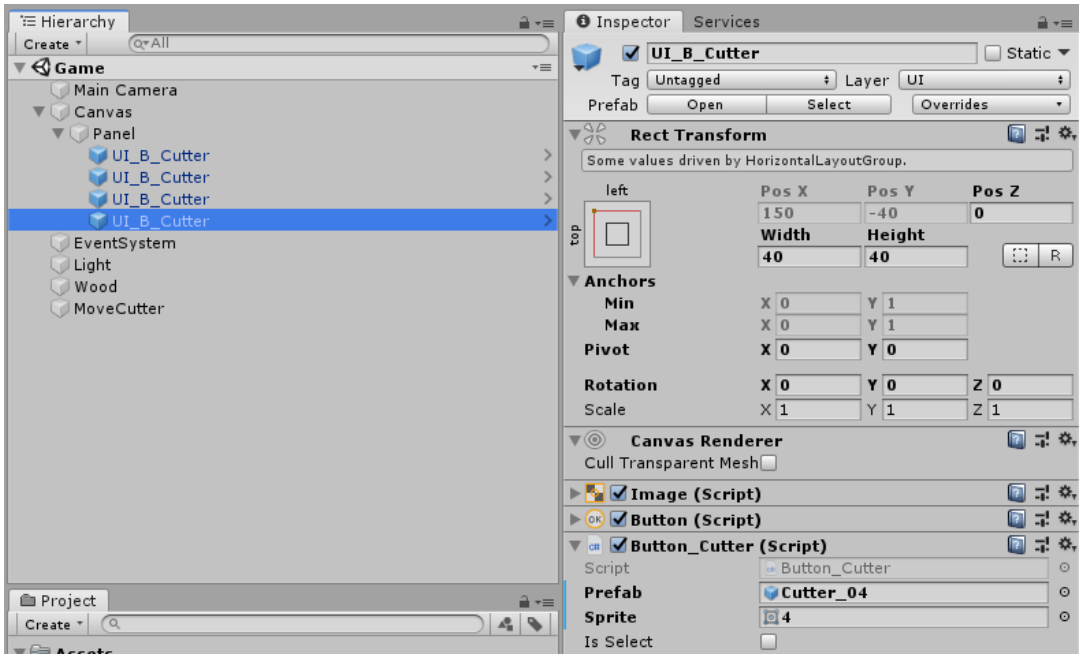

Figure 6

3. Bar Cutting Algorithm.

The cutting algorithm consists of 6 stages:

1) Creating a contour for the tool. At this contour, the point bypass should be clockwise, the end point should lie on the same line along the X axis with the first point in the contour (Y should be equal) and also X should be greater than the first point. As a result, we learn such a contour, Figure 7. In the code, this is the class “Cutter”, the method “GetAllContour”.

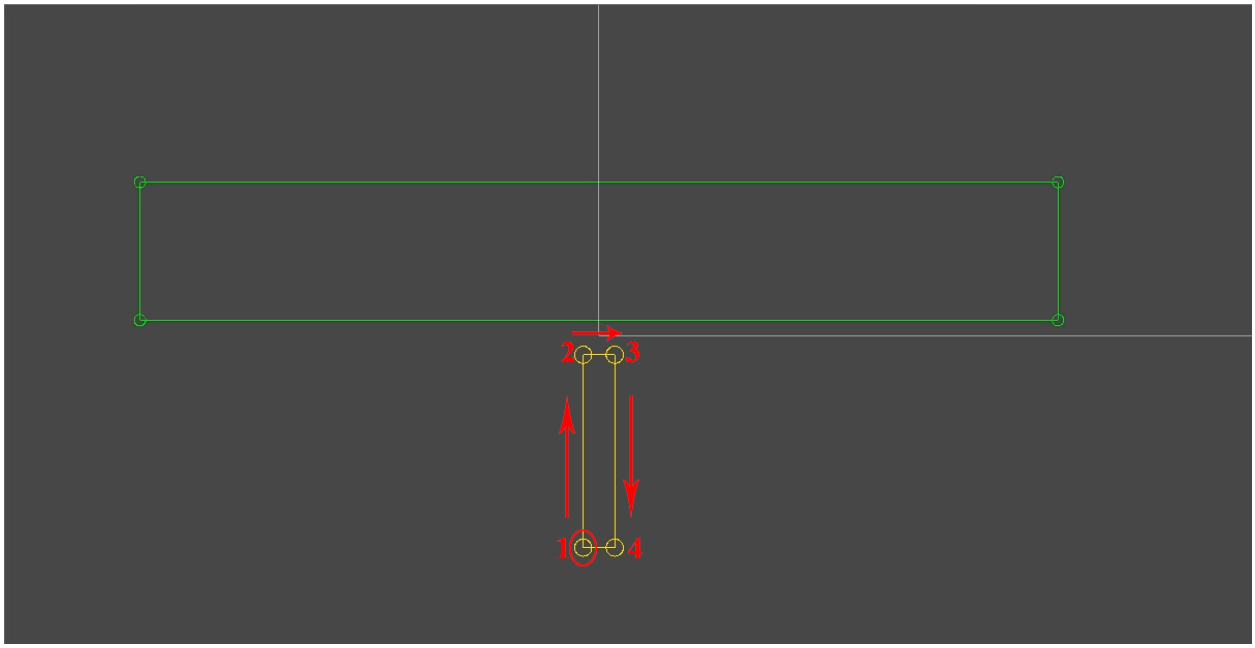

Figure 7

2) Create the initial contour for the turning bar. At this contour, the point bypass should be counterclockwise, the end point should lie on the same line along the X axis with the first point in the contour (Y should be equal) and also X should be greater than the first point. Because this is the initial contour, it will be very simple and consist of four points, the result will be such a contour, Figure 8. In the code, this is the “Wood” class, the “GetAllContour” method.

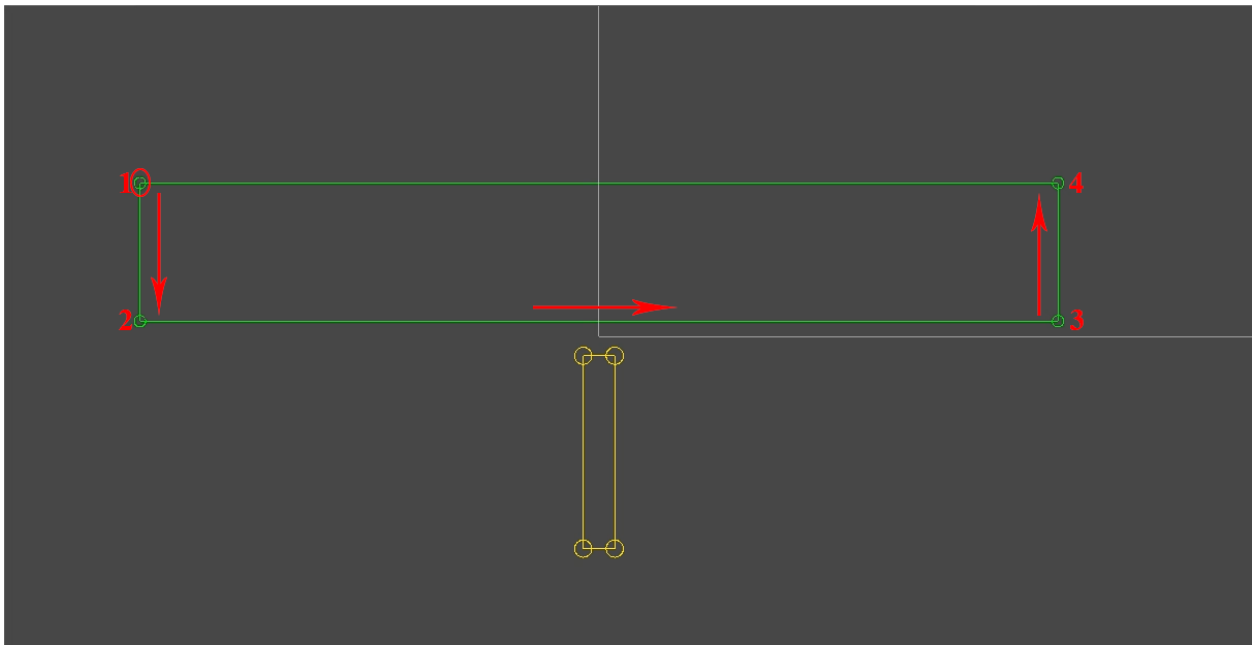

Figure 8

3) Change of contours. For both contours, you need to add the intersection points between the contours; when adding, you cannot violate the order of traversing the contour (Figure 9). After the points have been added, it is necessary to remove the points (except for the points lying on the tool contour lines) that fell inside the tool contour. And now we delete the points from the contour of the tool that did not fall into the contour of the bar (unchanged contour of the bar) or lie on its lines. Deletion - Figure 10. The result is Figure 11. In the code, this is the Wood class, the _cut method.

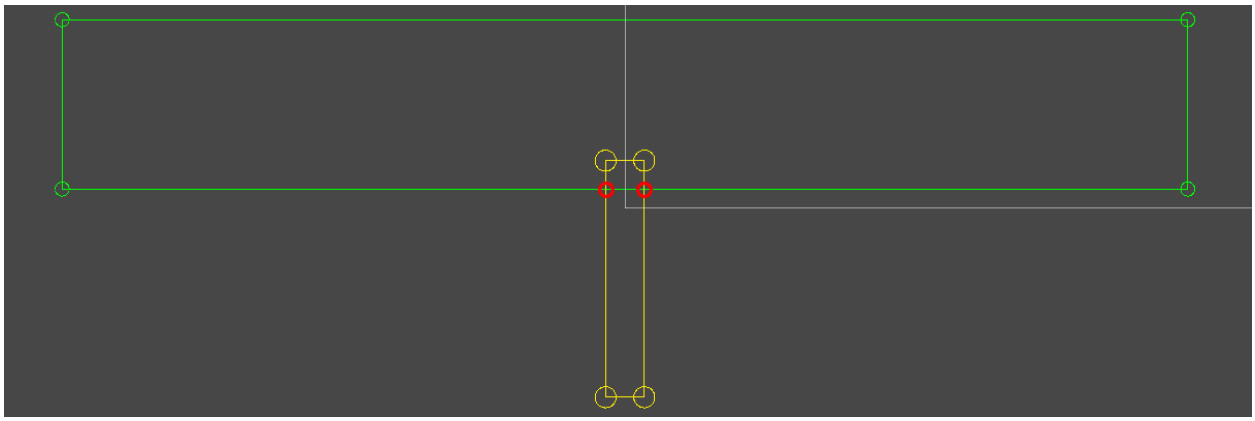

Figure 9

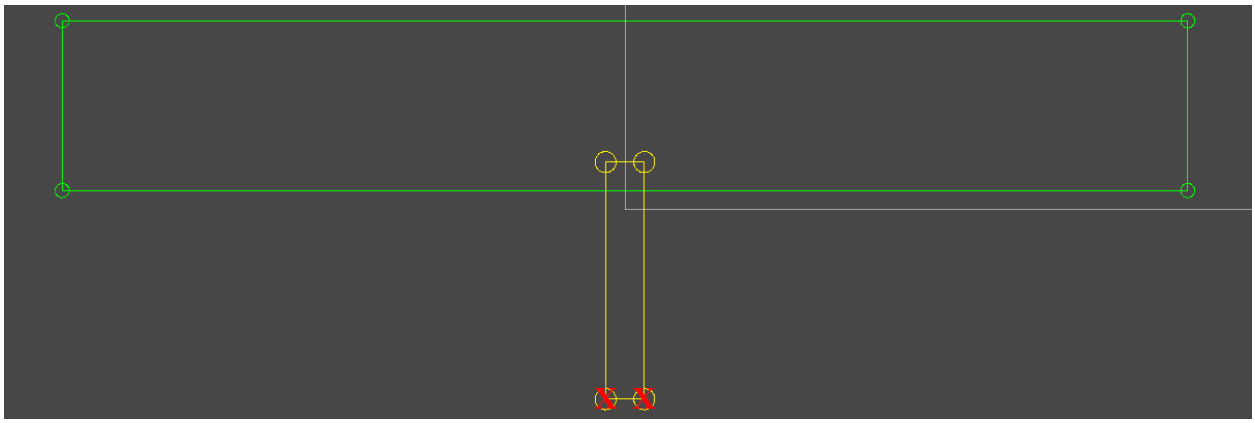

Figure 10

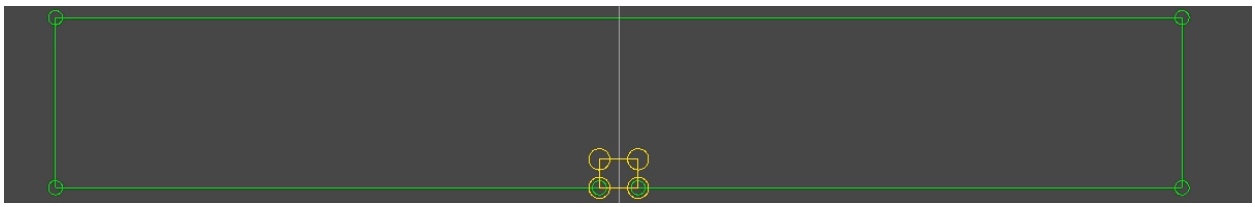

Figure 11

4) Formation of a new contour of the bar. To form a new contour of the bar, we take two adjacent points from the updated contour of the bar, add the first point to the new contour and check both points that they are in the updated contour of the tool, if they are both, we recognize these indices, add points to the new contour from the updated tool contour between the resulting indices. We do this until we reach the end of the updated outline. And we get a new outline Figure 12. In the code, this is the class “Wood”, the method “_cut”.

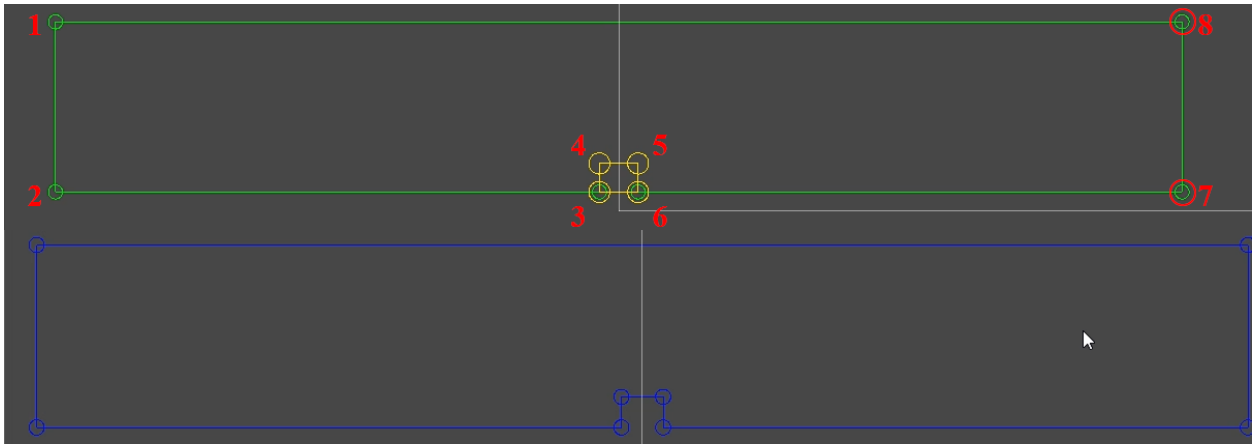

Figure 12

5) Creating a 3d bar model, Figure 13. In the code, this is the “Wood” class, the “getMesh3D” method.

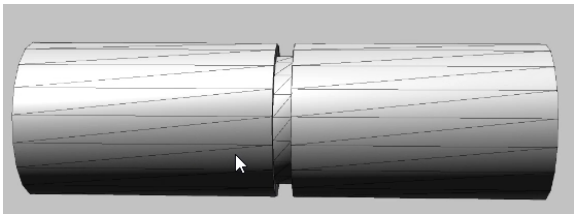

Figure 13

6) A new cut in the contour, you need to start from step 3. In the code, this is the class “MoveCutter”, the method “Cut”.

7) Algorithm for creating a 3D bar model.

Because if the contour of the first and last points lie on the same X axis, then you need to rotate the contour around this axis in increments of 20 degrees and triangulate between the points.

The algorithm for creating such a 3d model is not complicated and consists of such points:

1) Add 1 and the last point from the path to the points.
2) We create a cycle from 2 points to the penultimate in the circuit.
3) We go through the cycle. If the cycle is over, go to step 8.
4) If the first point is from the cycle, then we make triangles of 3 points (the first point added in paragraph 1 and two points with an angle of 20 degrees), Figure 14.

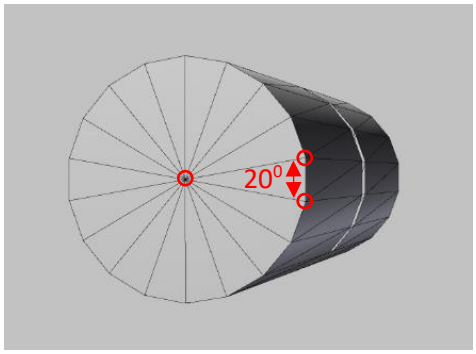

Figure 14

5) If after the first point from the cycle, then we make two triangles of 4 points, Figure 15.

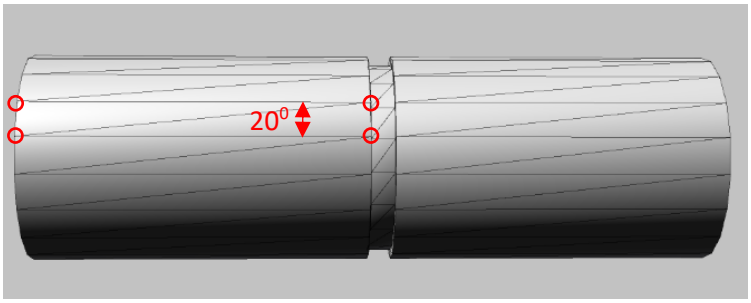

Figure 15

6) If the last point from the cycle, then we make triangles of 3 points (the 2nd point added in paragraph 1 and two points with an angle of 20 degrees), Figure 16.

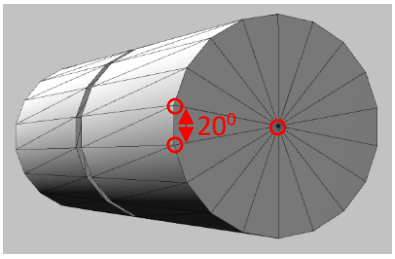

Figure 16

7) Go to point 3.
8) Updating mesh 3d models.