

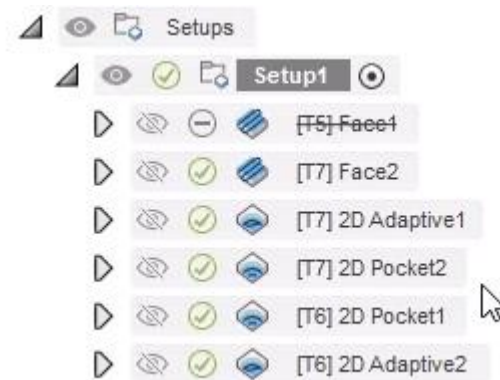
Step-by-step guide

Use roughing toolpaths to remove material

Compare a couple of different methods for roughing out a part's geometry.

Learning objectives:

- Create a 2D Adaptive toolpath.
- Create a 2D Pocket toolpath.



The completed exercise

1. Continue with the file from the previous video or upload the supplied *Cell Phone INCH – Rough.f3d* file. In the supplied file, the links to the external parent files are broken. It is better to use your own file if possible.

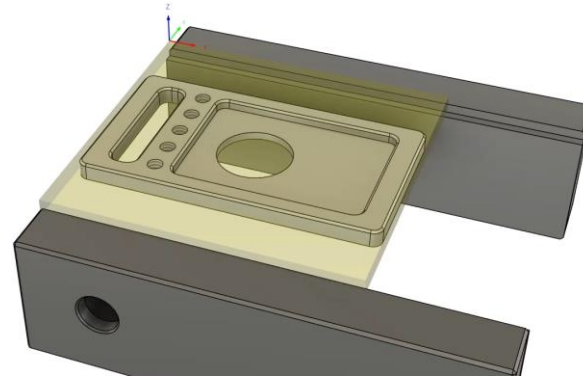


Figure 1. Open the file

2. Now that the stock has been faced, the part's pocket geometry needs to be roughed out. Two common options are the 2D Adaptive Clearing and 2D Pocket operations. The 2D Adaptive Clearing operation is a roughing-only operation but the 2D Pocket could be used to rough or finish. Click 2D> 2D Adaptive Clearing.



Figure 2. Create a 2D Adaptive Clearing operation

3. Make sure the 1/2" flat endmill tool is selected for this operation. If this tool is not selected, click Select and navigate to the Learn CAM 90 – INCH tool library and select Tool 7.



Figure 3. Select the correct tool for the operation

4. Continue to the dialog's Geometry tab and select the face shown in the image on the right. The blue area indicates that the operation is trying to cut inside the selection; this is correct.

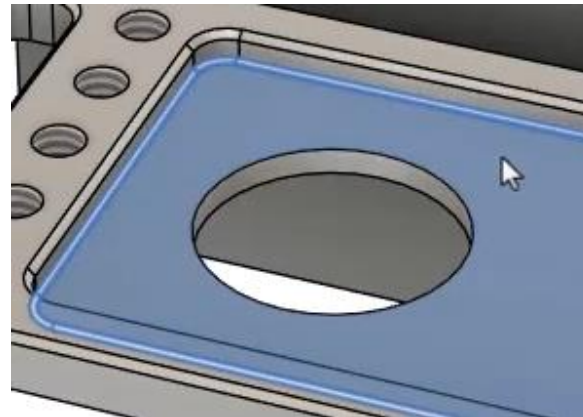


Figure 4. Select the face

5. Navigate to the dialog's Passes tab and notice that the Stock to Leave option is activated. This operation will leave 0.02 inches of material on the pocket's walls and floor. This operation is usually used to rough parts even though you can deactivate the Stock to Leave option. OK the 2D Adaptive dialog.



Figure 5. Notice the operation will leave stock on the walls and floor

6. Inspect the toolpath preview and note that the large hole was not completely avoided. This adaptive clearing operation optimizes the toolpath to maintain a consistent cutting load. Because of the Stock to Leave option, extra material remains on the pocket's walls and floor. The tool's diameter is too large to cut all the way into the pocket's corners.

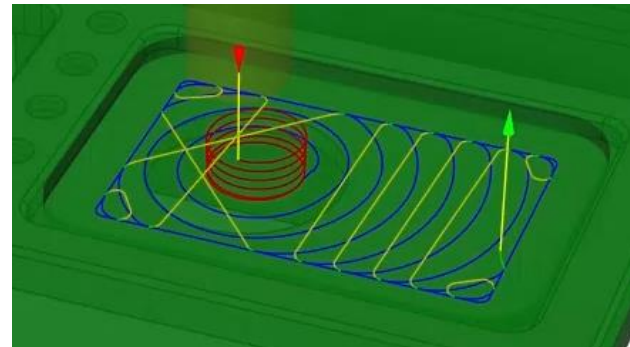


Figure 6. Inspect the toolpath preview

7. Create a 2D Pocket operation by clicking 2D> 2D Pocket.



Figure 7. Create a 2D Pocket operation

8. Click the dialog's Select to choose an appropriate tool for the operation.

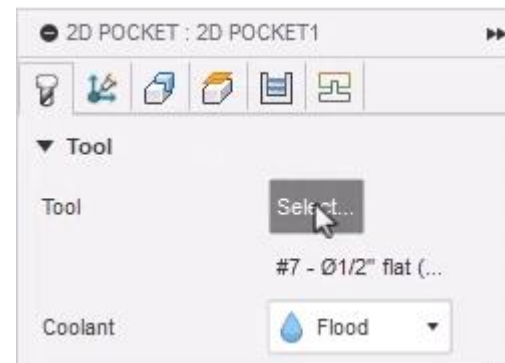


Figure 8. Click Select

9. Navigate to the Learn CAM 90 – INCH tool library and select Tool 6. Click the Select Tool dialog's Select.



Figure 9. Select the tool

10. Navigate to the dialog's Geometry tab and select the bottom edge shown in the image on right. The blue highlight indicates the operation will machine inside the selection; this is correct. If you instead needed to machine outside the selection, you could flip the machining region by clicking the red arrow.

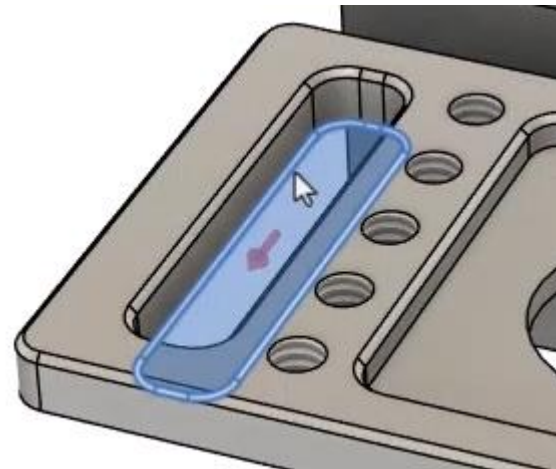


Figure 10. Select the edge

11. Continue to the Passes tab and enter **0 inches** into the Axial Stock to Leave box. This will make sure the operation does not leave any material on the pocket's floor.



Figure 11. Modify the Stock to Leave option

12. Navigate to the Heights tab and enter **-0.05 inches** into the Bottom Height section's Offset box. OK the dialog to generate the toolpath preview.

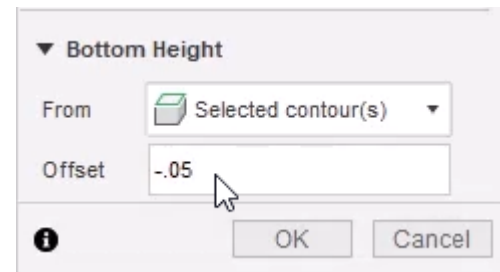


Figure 12. Add an offset to the Bottom Height

13. Inspect the toolpath preview and notice how the operation ramps down to the final cutting depth. This toolpath uses a different strategy than the 2D Adaptive toolpath. The 2D Adaptive toolpath is the better choice when you need to maintain a consistent tool load and use a faster feedrate.

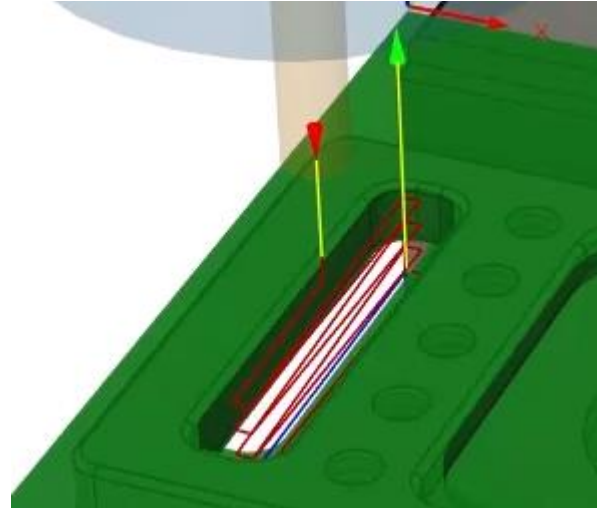


Figure 13. Inspect the toolpath preview

14. Viewing the stock from the side makes it easier to see how deeply the operation machines. The final cutting depth is easily below the model's bottom face.

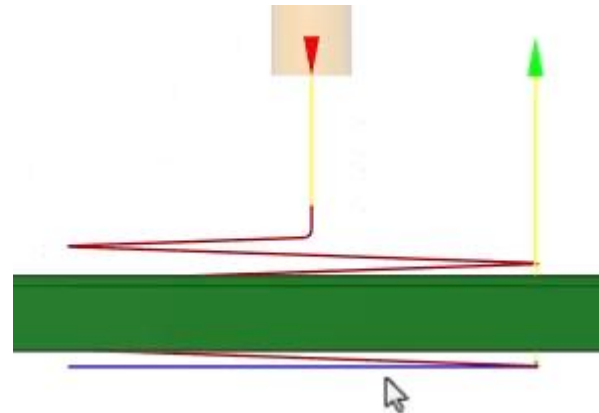


Figure 14. Note the operation's cutting depth

15. Create a new 2D Adaptive Clearing operation by clicking 2D > 2D Adaptive Clearing.

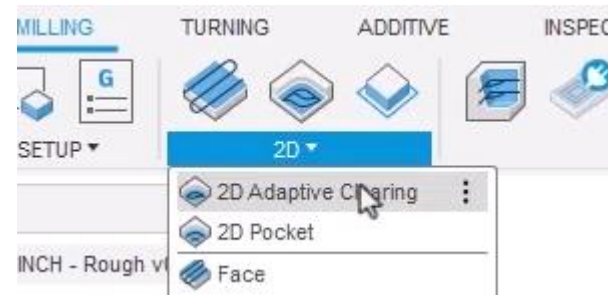


Figure 15. Create a 2D Adaptive Clearing operation

16. Navigate to the dialog's Geometry tab and select the bottom edge shown in the image on the right.

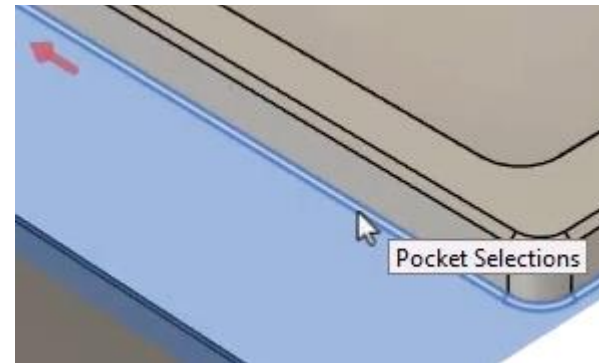


Figure 16. Select the edge

17. Navigate to the Heights tab and choose the Selection option in the Bottom Height section's From menu.

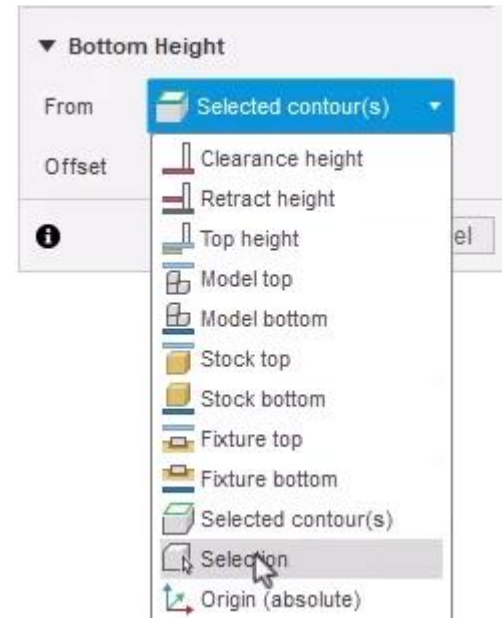


Figure 17. Change the Bottom Height type

18. For the Bottom Height section's Bottom Reference, select the point shown in the image on the right. The operation will machine down to this point.

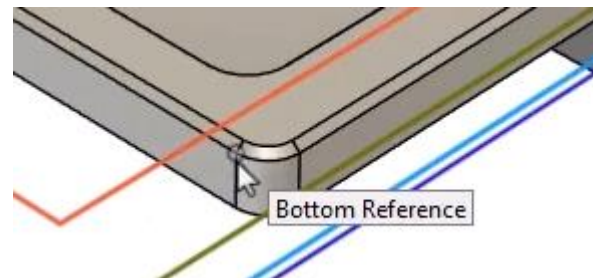


Figure 18. Select the reference

19. Enter **-0.05 inches** into the Bottom Height section's Offset box so that the operation machines slightly past the reference you selected in the previous step. OK the dialog to generate the toolpath preview.

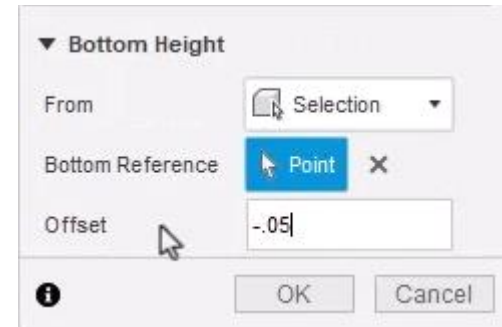


Figure 19. Offset the Bottom Height

20. Inspect the toolpath preview and notice the operation machines below the reference point you selected but the tool does not strike the vise.

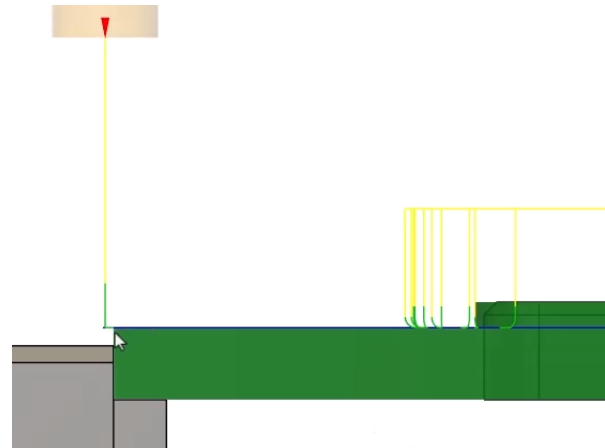


Figure 20. Inspect the toolpath preview

21. The large hole in the big pocket could be roughed by modifying an existing operation. Right-click the 2D Pocket operation and choose Edit from the menu.

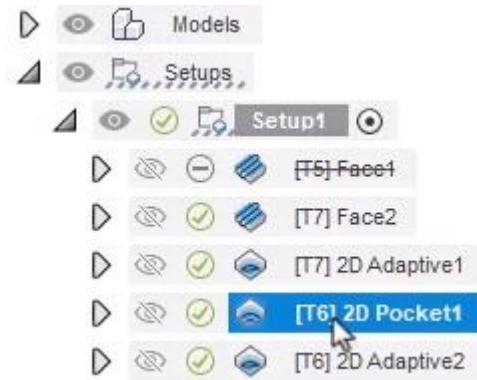


Figure 21. Edit the 2D Pocket operation

22. Navigate to the Geometry tab and add the circle's bottom edge to the Pocket Selection. OK the dialog to generate the toolpath preview.

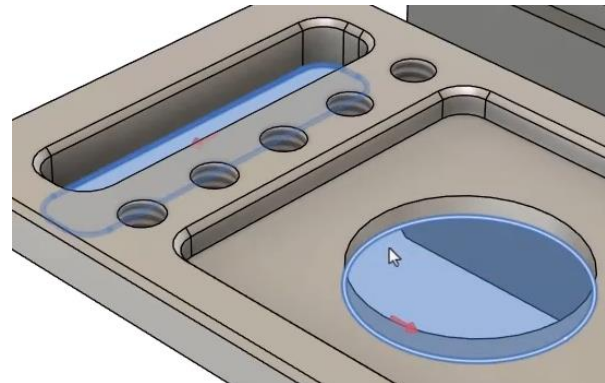


Figure 22. Add the edge to the Pocket Selection

23. Inspect the toolpath preview and notice the operation now machines the slot and the hole. Instead of modifying the existing 2D Pocket operation, you could use a larger tool to rough this hole by creating a new 2D Pocket operation.

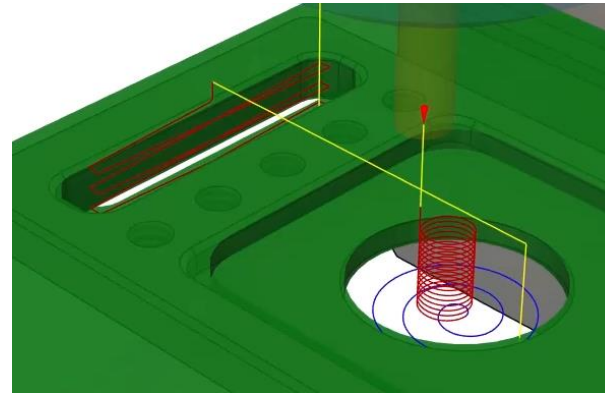


Figure 23. Inspect the toolpath preview

24. If you do choose to create a new operation using a larger tool, it would be efficient to use Tool 7 since the first two operations are already using that larger tool. Then you can drag the new operation up with the other Tool 7 operations to minimize tool changes. Minimizing tool changes is a great way to increase your program's efficiency. You can check the setup's estimated machining time by right-clicking Setup1 and choosing Machining Time from the menu.

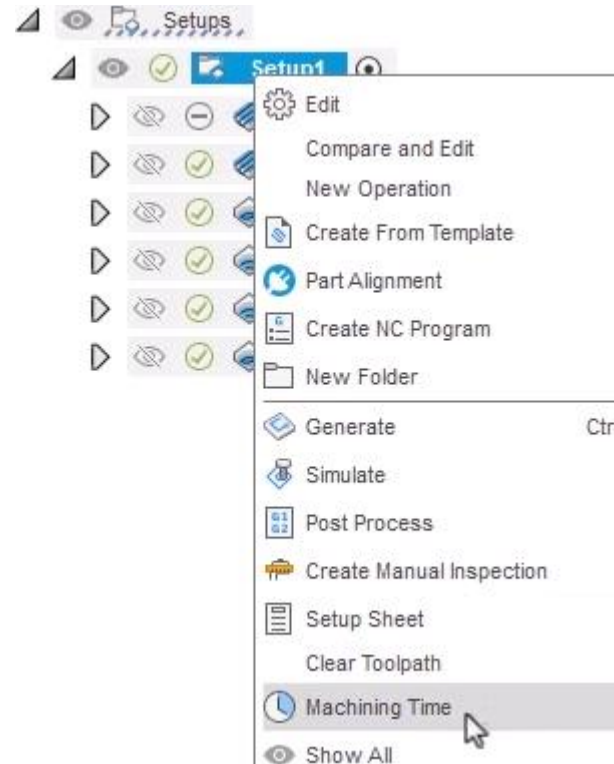
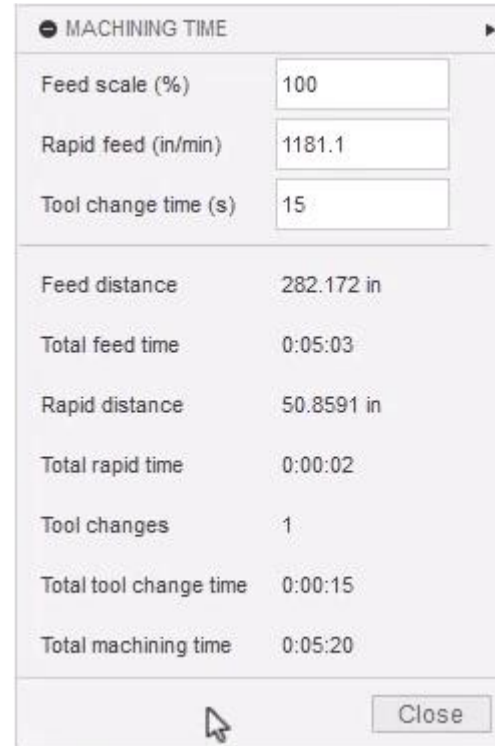


Figure 24. Inspect a setup's machining time

25. Fusion estimates that the setup will take roughly 5.5 minutes to complete. Close the Machining Time dialog after you finish exploring the information. Save the project.



The Machining Time dialog box displays the following information:

MACHINING TIME	
Feed scale (%)	100
Rapid feed (in/min)	1181.1
Tool change time (s)	15
<hr/>	
Feed distance	282.172 in
Total feed time	0:05:03
Rapid distance	50.8591 in
Total rapid time	0:00:02
Tool changes	1
Total tool change time	0:00:15
Total machining time	0:05:20
<hr/>	
Close	

Figure 25. Note the estimated machining time