

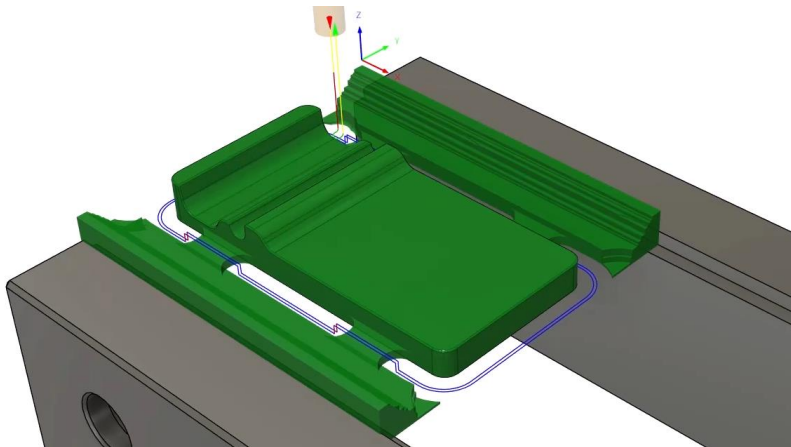
Step-by-step guide

Use finishing toolpaths to finalize a base model

Create and compare several operations to finish a part's geometry.

Learning objectives:

- Create a 3D Scallop toolpath.
- Create a 2D Contour toolpath with tabs.
- Create a 3D Contour toolpath.



The completed exercise

1. Continue with your file from the previous video or open the supplied *Cell Phone Stand INCH – Finish.f3d* file. If you decide to open the supplied file, notice the links to the external parent files are broken. For this reason, it is better to use your own file if possible.

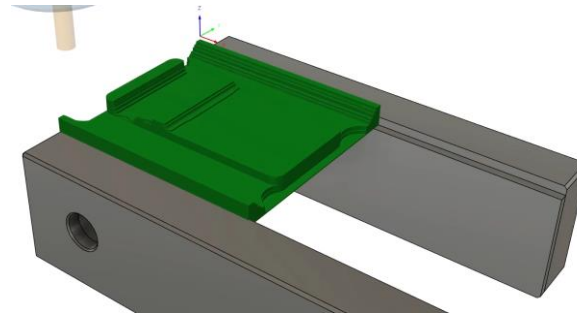


Figure 1. Open the file

2. Create a new 3D Contour operation by clicking 3D> Contour.

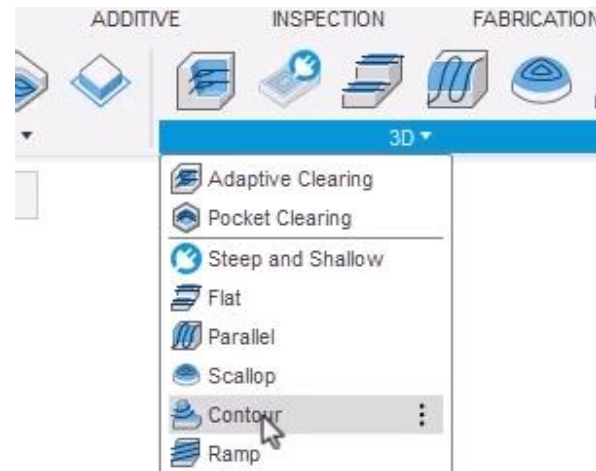


Figure 2. Create a 3D Contour operation

3. To choose an appropriate tool for this operation, click the Contour dialog's Select.

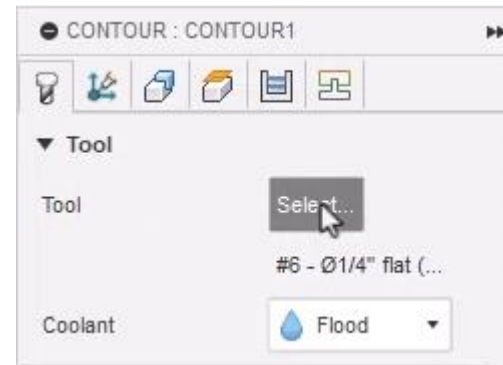


Figure 3. Click Select

4. In the Select Tool dialog, navigate to the Learned CAM 90 – INCH tool library.

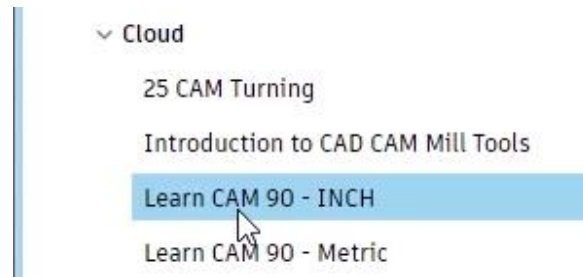


Figure 4. Navigate to the tool library

5. Select the 3/16 inch ball endmill, which is Tool 8.



Figure 5. Select the tool

6. Click the Select Tool dialog's Select to finalize the tool selection.

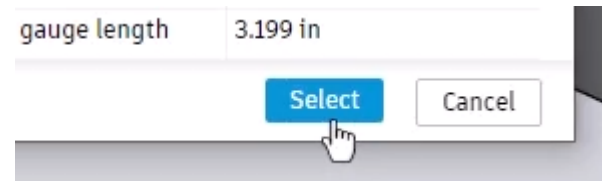


Figure 6. Click Select

7. Navigate to the Geometry tab. Before specifying the regions you want the operation to machine, choose the Model selection's Avoid Surface option shown in the image on the right.

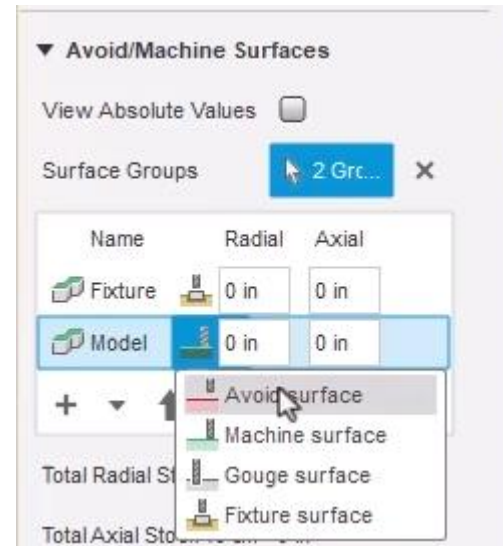


Figure 7. Change the selection type

8. Create a new selection by clicking the plus icon shown in the image on the right.

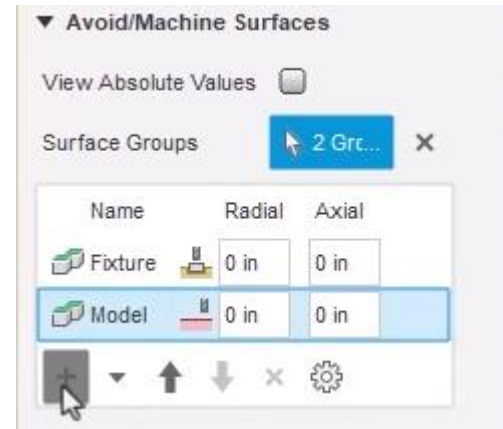


Figure 8. Create a new selection

9. Select the four faces shown in the image on the right, then OK the Faces dialog.

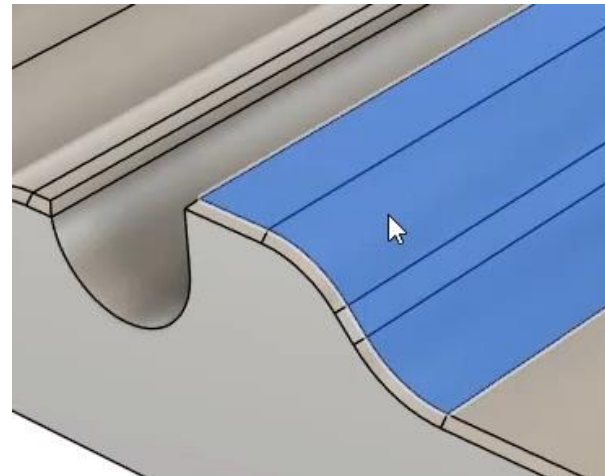


Figure 9. Select the faces

- 10.** The 3D Contour operation will avoid the red surfaces while machining the green surfaces. Verify that all the other settings are correct, then OK the Contour dialog.

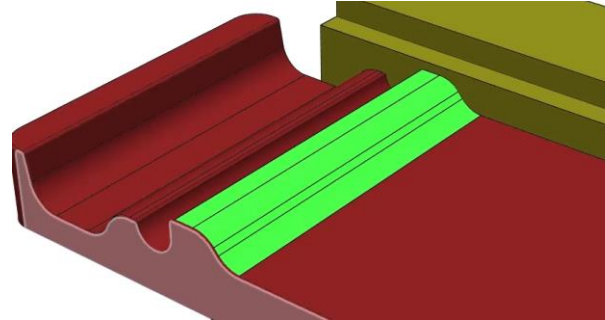


Figure 10. Note the machining regions

- 11.** Inspect the toolpath preview and notice that the operation needs to be tweaked so that it removes more material.

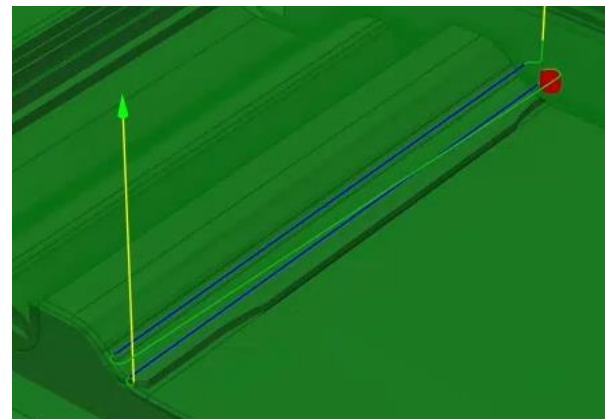


Figure 11. Inspect the toolpath preview

12. Right-click the Contour operation and choose Edit from the menu.

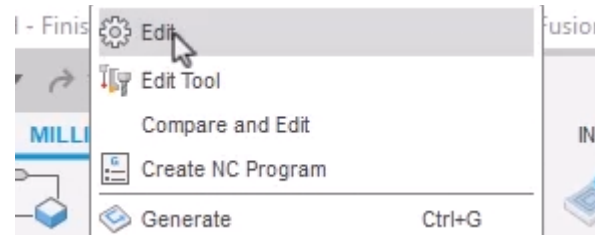


Figure 12. Edit the 3D Contour operation

13. Decrease the Cusp Height value and notice the Maximum Stepdown value automatically updates. OK the Contour dialog to update the toolpath preview.

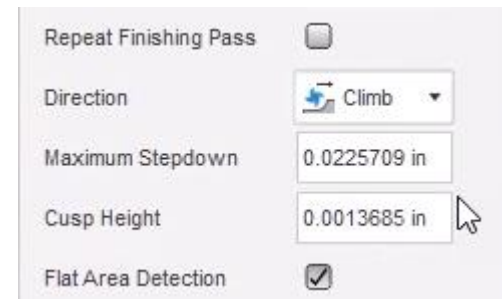


Figure 13. Decrease the Cusp Height value

14. Notice the operation does a better job of removing more material. Press F7 to toggle the toolpaths so you can better see the geometry.

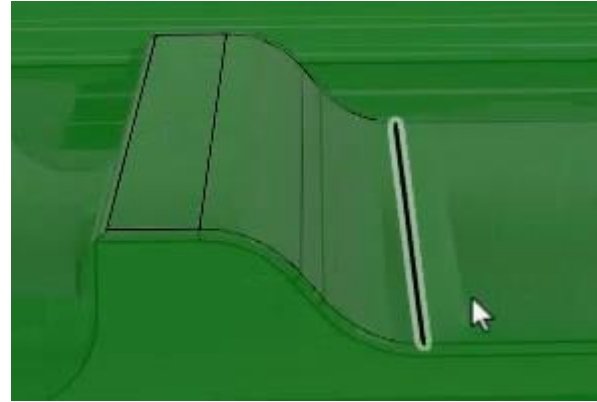


Figure 14. Inspect the toolpath preview

15. A different operation could be used to machine this area. Right-click the Contour operation and choose Delete from the menu.

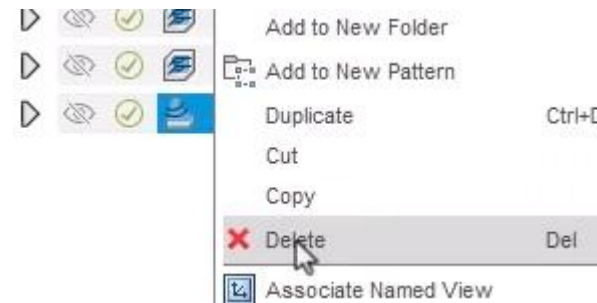


Figure 15. Delete the operation

16. Before creating another operation to machine the part's rounded geometry, a 2D Pocket operation could be used to finish the part's large flat face.

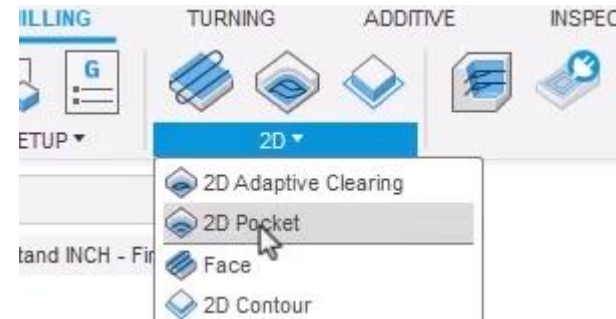


Figure 16. Create a 2D Pocket operation

17. Click the 2D Pocket dialog's Select to choose the operation's tool. Navigate to the Learn CAM 90 – INCH tool library and select Tool 7. Click the Select Tool dialog's Select.



Figure 17. Choose the operation's tool

- 18.** Navigate to the Geometry tab and select the face shown in the image on the right as the Pocket Selection.

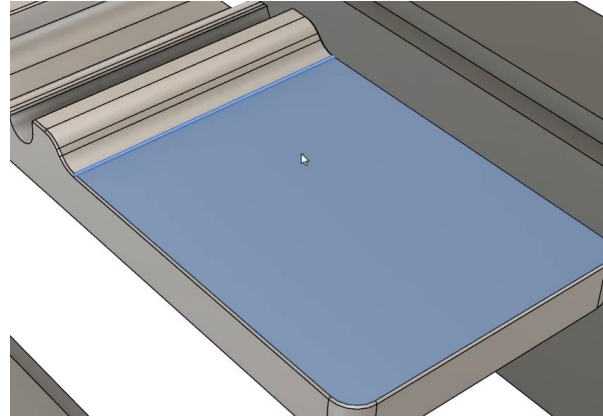


Figure 18. Select the face

- 19.** Continue to the Passes tab and deactivate the Stock to Leave option. OK the dialog.

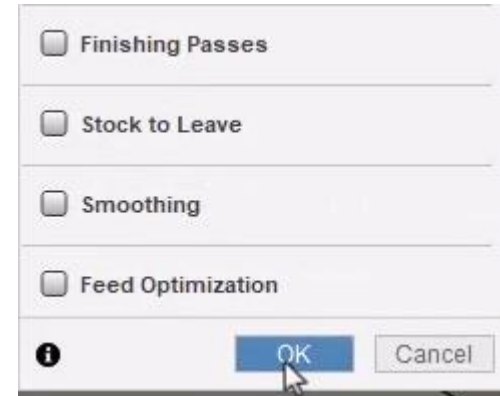


Figure 19. Deactivate the Stock to Leave option

20. Notice the operation finishes the large flat face using six passes.

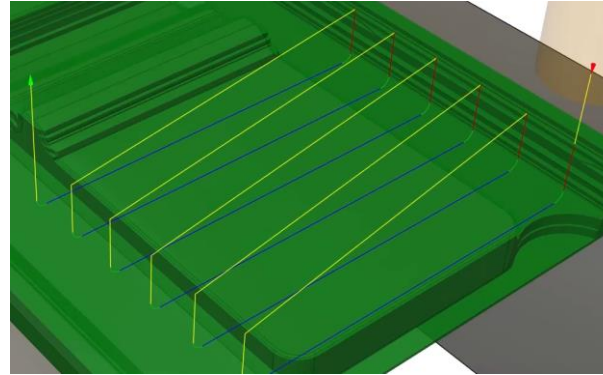


Figure 20. Inspect the toolpath preview

21. Create a Scallop operation by clicking 3D> Scallop.

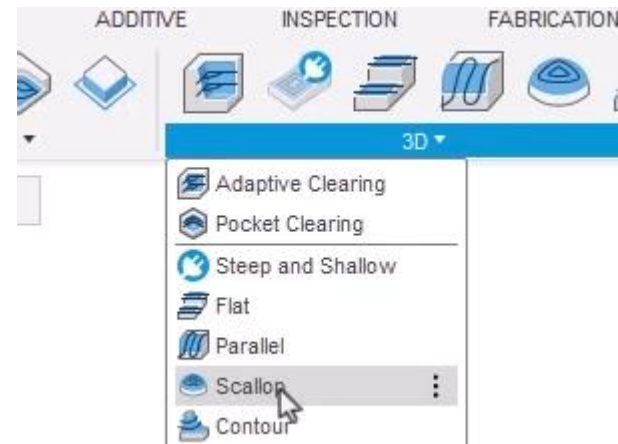


Figure 21. Create a Scallop operation

22. Click the Scallop dialog's Select to choose the operation's tool. Choose the 3/16" ball endmill (Tool 8), then click the Select Tool dialog's Select.

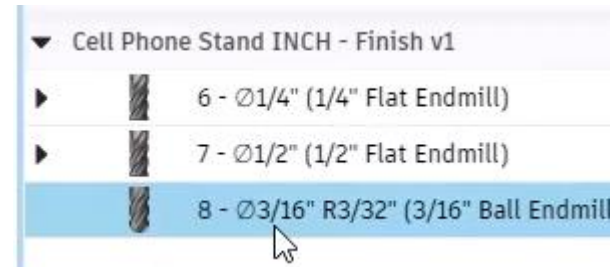


Figure 22. Choose the operation's tool

23. The Scallop operation allows you to limit the machined regions to the geometry that falls inside a defined slope range. Activate the Slope option and enter **1 degree** into the From Slope Angle box. Enter **89 degrees** into the To Slope Angle box and notice the operation will machine only the surfaces that are between 1° and 89°.

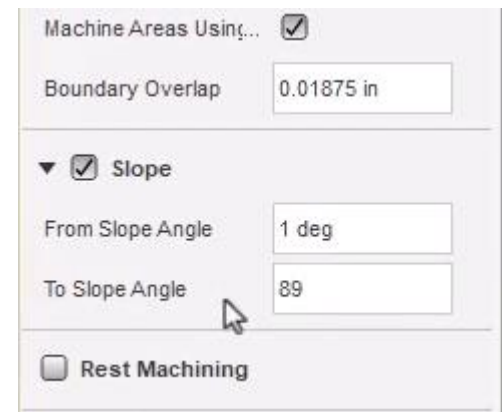


Figure 23. Configure the Slope option

24. You can temporarily increase the Stepover value to decrease the operation's calculation time. Navigate to the Passes tab and increase the Stepover value. OK the dialog.

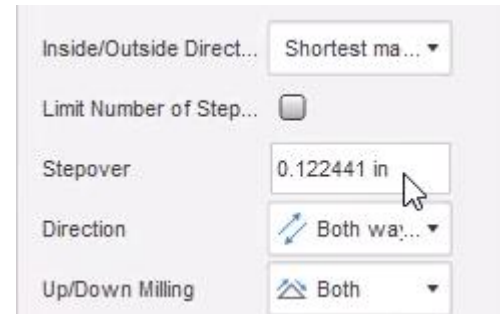


Figure 24. Temporarily increase the Stepover value

25. Inspect the toolpath preview and notice the strategy that the Scallop operation uses to machine the geometry.

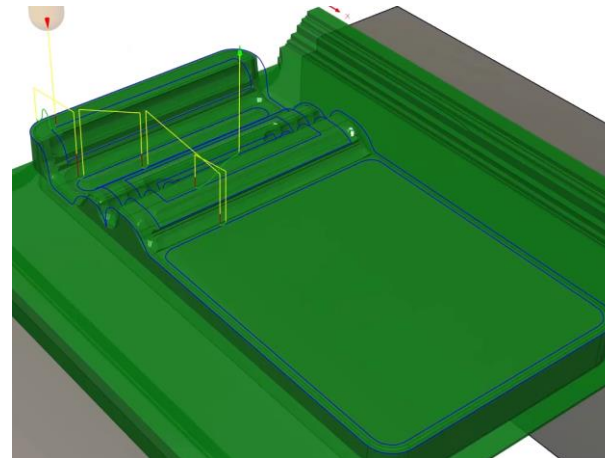


Figure 25. Inspect the toolpath preview

26. If you are satisfied with the toolpath preview, edit the Scallop operation and decrease the Stepover value. Enter **0.01 inches** into the Stepover box, then OK the dialog.



Figure 26. Decrease the Stepover value

27. The operation machines the same areas but uses a much finer Stepover value to achieve a smoother surface finish. Notice the operation does not machine the perfectly horizontal or vertical surfaces because of the Slope option values you entered in Step 23. However, some extra material is left in one of the part's valleys.

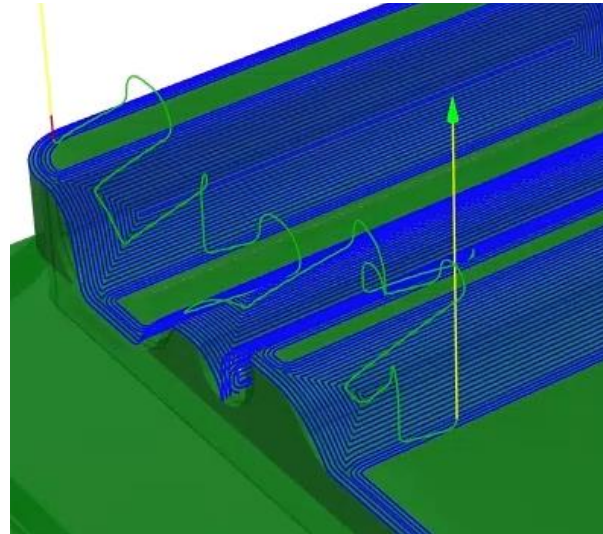


Figure 27. Inspect the updated toolpath

28. Edit the Scallop operation again and navigate to the Geometry tab. Deactivate the Slope option, then activate the Contact Point Boundary option.

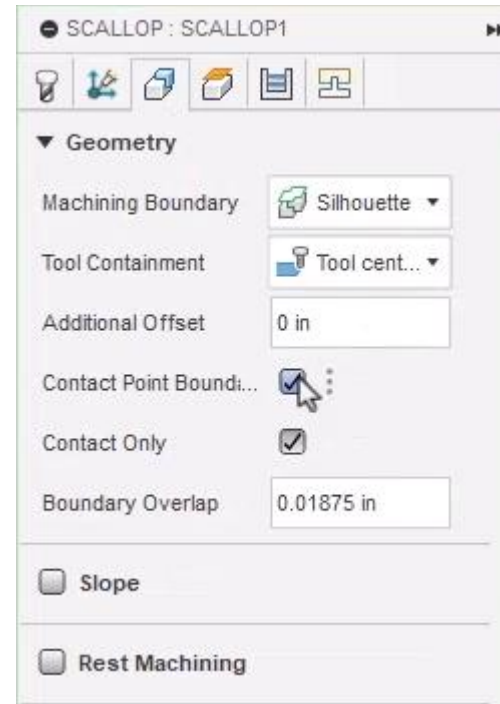


Figure 28. Edit the Scallop operation's Geometry tab

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

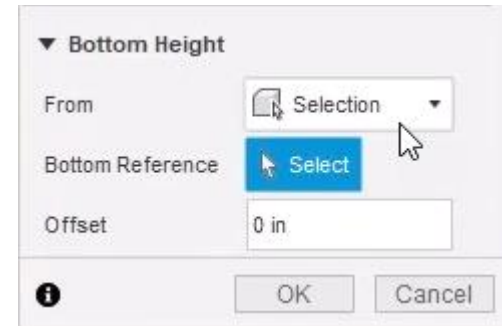


Figure 29. Adjust the bottom height

30. For the Bottom Height section's Bottom Reference selection, choose the point shown in the image on the right. OK the dialog to update the toolpath preview.

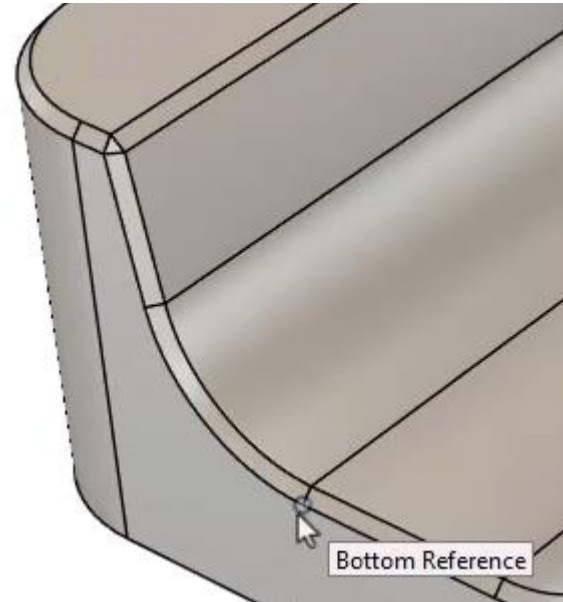


Figure 30. Select the point

31. Inspect the toolpath preview and notice that the operation does a better job machining inside the part's valleys but the operation is not as efficient as it could be. The large flat face is already finished but the operation attempts to machine that face anyway.

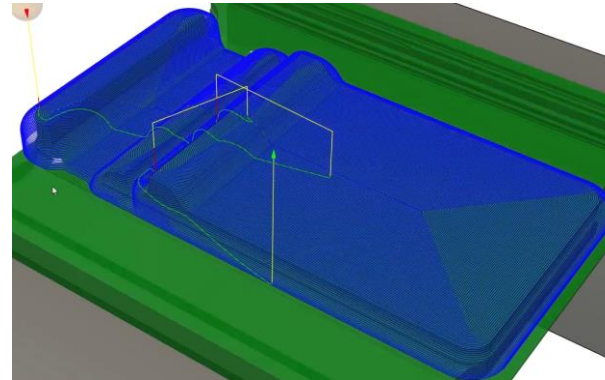


Figure 31. Inspect the updated toolpath

32. Right-click the Scallop operation and choose Machining Time from the menu.

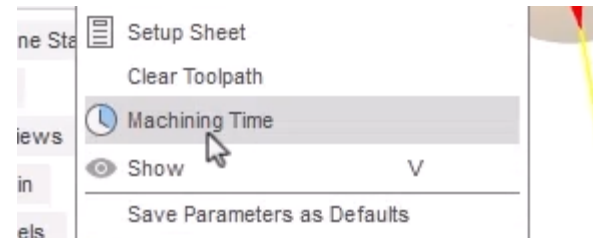


Figure 32. Inspect the operation's machining time

33. Notice the operation will take roughly 18 minutes to machine the part. Close the dialog after you finish exploring the machining Time information.

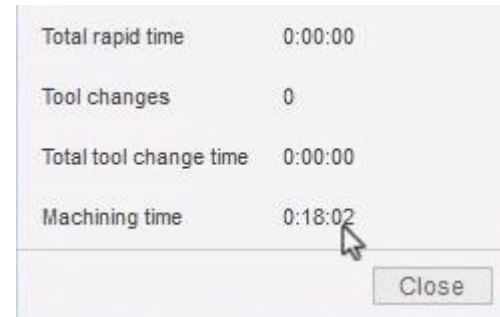


Figure 33. Inspect the machining Time information

34. Edit the Scallop operation again, then navigate to the Geometry tab. Create a new selection group by clicking the plus icon shown in the image on right.

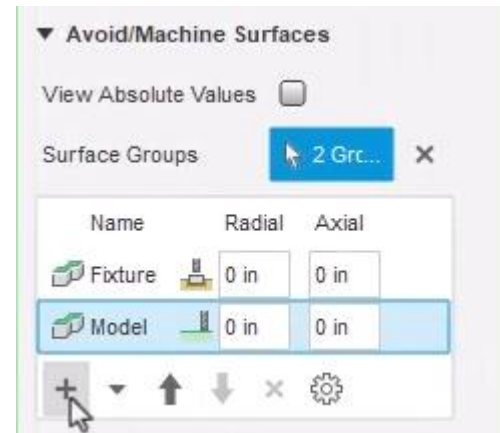


Figure 34. Create a new selection group

35. In the Faces dialog, activate the Action section's Avoid surface option.

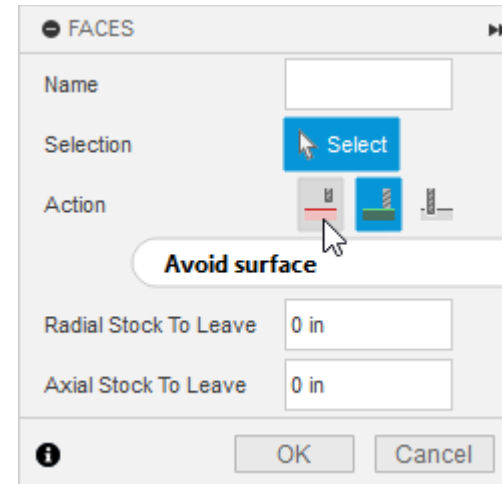


Figure 35. Choose the Avoid surface option

36. Select the large flat face, then OK the Faces dialog. OK the Scallop dialog.

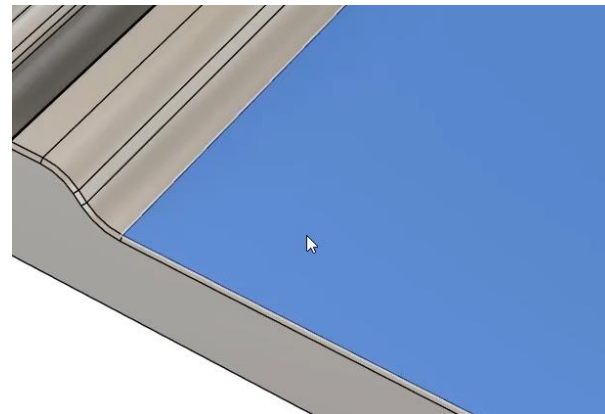


Figure 36. Select the face

37. Inspect the toolpath preview and notice that the operation no longer tries to machine the finished face. Avoiding this face removes nearly 7 minutes from the estimated machining time.

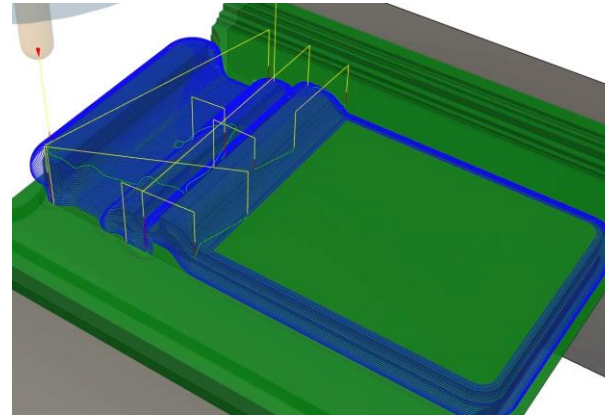


Figure 37. Inspect the toolpath preview

38. Create a new 2D Contour operation by clicking 2D> 2D Contour.

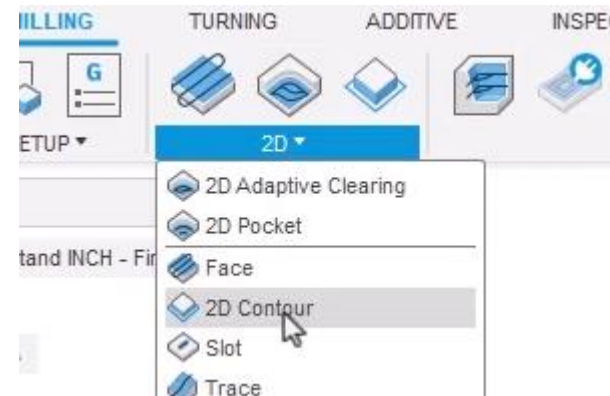


Figure 38. Create a new 2D Contour operation

- 39.** Click the dialog's Select to choose an appropriate tool for the operation. Choose Tool 6, then click the Select Tool dialog's Select.

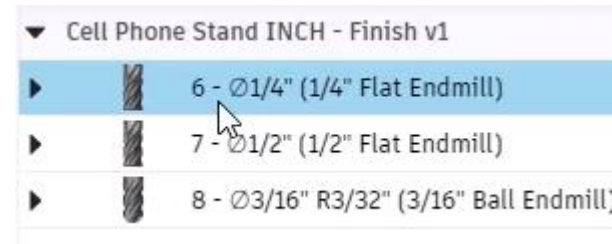


Figure 39. Select the operation's tool

- 40.** Navigate to the Geometry tab and select the bottom edge shown in the image on the right as the Contour Selection.

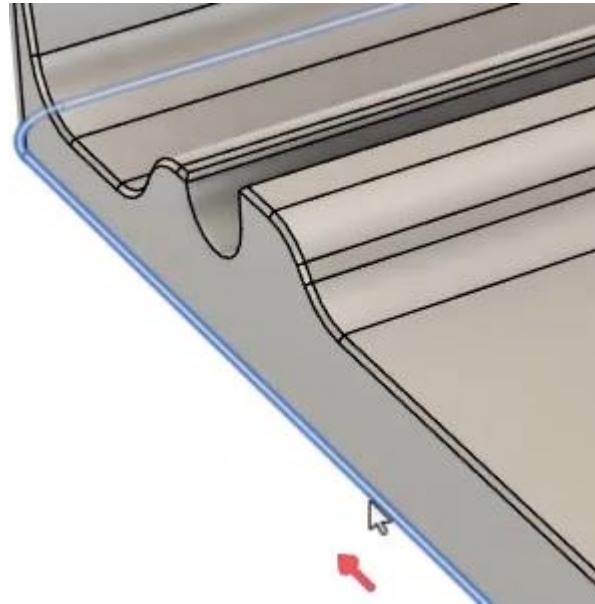


Figure 40. Select the edge

41. Activate the Tabs option, then enter **4 inches** into the Tab Distance box.

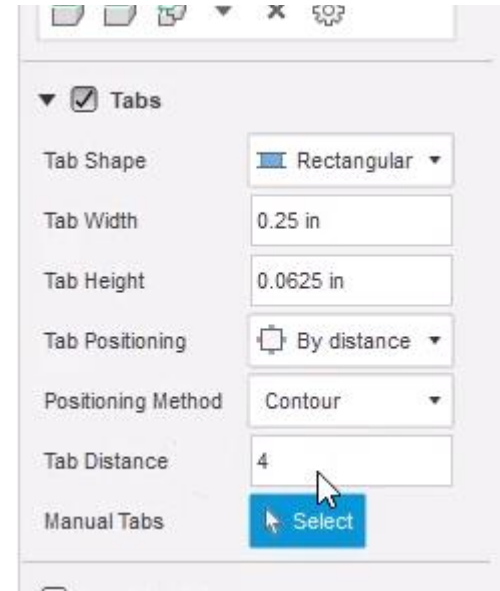


Figure 41. Configure the Tabs option

42. For the dialog's Manual Tabs option, click the model's perimeter to place two additional tabs. The model should now have four tabs total. OK the dialog to generate the toolpath.

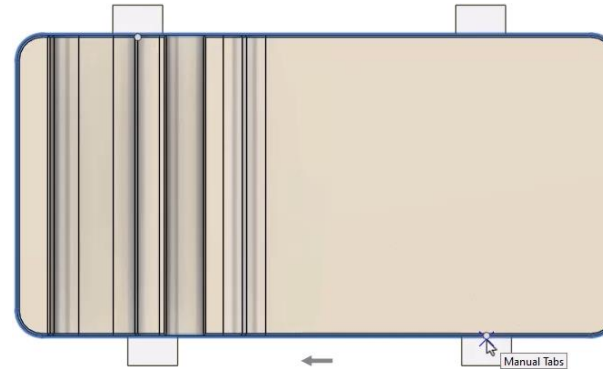


Figure 42. Manually add tabs

43. You can customize the tabs' geometry by specifying the width and height. Enter **0.375 inches** into the Tab width box, then enter **0.08 inches** into the Tab Height box OK the dialog.

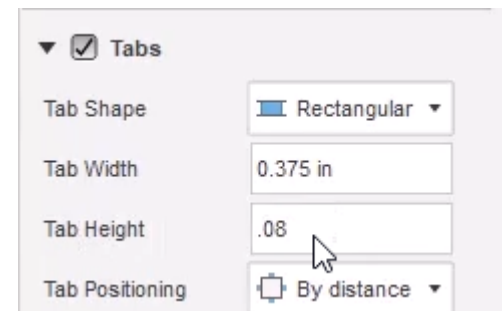


Figure 43. Customize the tabs' geometry

44. Notice the operation leaves a fine finish that closely matches the modeled geometry. However, notice that the tool might chatter because it cuts the entire perimeter in a single pass.

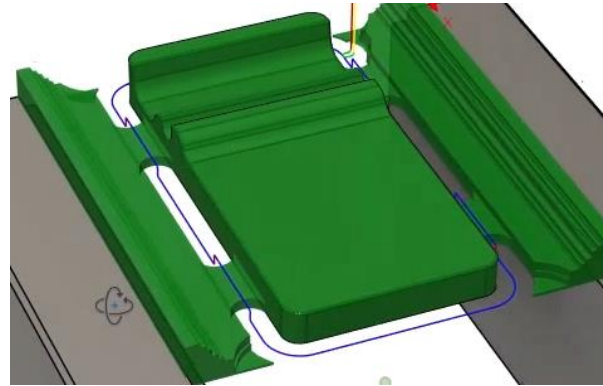


Figure 44. Inspect the toolpath preview

45. Edit the 2D Contour operation and navigate to the Passes tab and activate the Multiple Finishing Passes option. OK the dialog to update the toolpath preview.

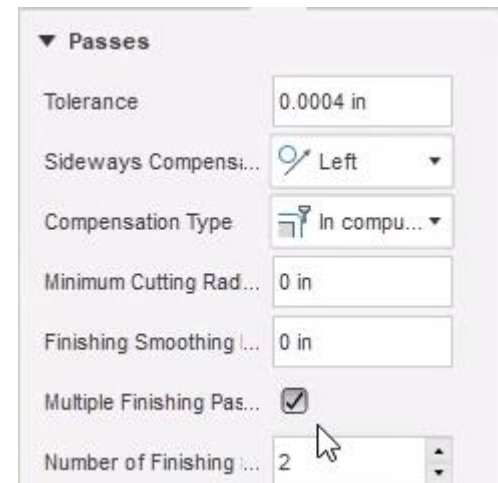


Figure 45. Add a finishing pass to the operation

- 46.** The operation now adds a finishing pass to improve the final surface finish. Save the file.

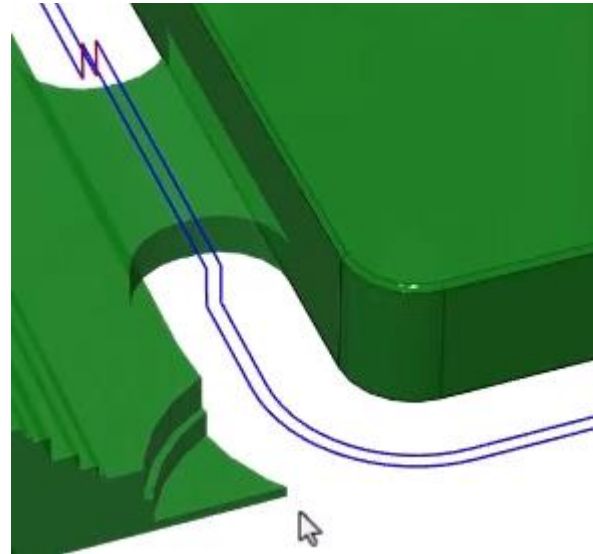


Figure 46. Inspect the toolpath preview