

SolidCAM 5 Axis Tutorial

Volume 2 – Beginner

Goals of the Tutorial

- To understand the strategy of morph between two curves
- To understand the strategy of morph between two surfaces
- To understand the strategy of parallel to curve
- To understand different side tilt definitions



IMPELLER

Post Processor

DMU-60T-MonoBlock

Machine Simulation

DMU60_NEW

Double click the **SolidWorks** Icon.

Click **File** > **Open** to open the SolidWorks part Impeller.SLDASM.

Click SolidCAM > New > Milling.

🗊 SOL	IDWORKS	File Edit \	View Inser	t Tools	Soli	dCAM Window Help 🧟	r 🖻 t 🔝 t 💰 🗞
Pr	1	쁥	T			New	Milling
Design Study	Interference	Clearance	Hole	Measure		Open	Milling-STL
beauty	Detection	Verification	Alignment	-		Save As	Turning
Assem	bly Layout	Sketch E	valuate 📑	SolidCAM		Manage Templates	Mill-Turn

Accept the default part file name and path and Click **OK**.

💩 New Milling P	art	9 X
CAM-Par CAM-Part	t/Model	
Vse Mode	el file directory	
Directory:	C:\Users\Amod\Desktop\	Browse
Name:	Impeller	
Model name:	Jsers\Amod\Desktop\Impeller.SLDASM	Browse
Units O Metr	ic 🔘 Inch	
-	OK]

Select DMU60_NEW as our post processor. Leave the fields of **Program Number** and **Subroutine number** with the default settings.

 ★ Milling Part D ✓ X CNC_Maching 	Data : IMPE ?
DMU60_NEW	
Program number:	5000
Subroutine number:	1

 γ Click **Define** button in **Coordinate System** tab to set the coordinate system for

this part.

A dialog box with the following options appears:

- Mac CoordSys number
- Position
- Coordinate system definition options

Co	ordinate Sys	stem	*
		Define	
Coor	dSys		* *
	Mac CoordSys number:	5 1	
	Position:	1	
Defi	ne CoordSys	options	*
	Sele	ct face ne ct Coordinate : nal to current :	System view
	•	111	•

Click **Select Face** option in the **Define CoordSys options** section to define the main coordinate system.

In the **Place CoordSys origin to** section, select **Top center of model box** from the drop down.



Select the face as shown in the below image.





Click **OK** to accept the default values in the **CoordSys Data** pop-up.

CoordSys D	ata				₽ 🛛
- Machine (CoordSys numb	ber: 1			
Position:	1	X: 0	Y: 0	Z: 0	
Shift					Plane
Х:	0	Y: 0	Z: 0		XY YZ
Rotatio	n around				⊚ zx
X:	0	Y: 0	Z: 0		
Front Tool	Radial Rea	r 50			1
Clear	ance level	10			
Partu	Ipper level	0			
PartL	ower level	-81.8958			
Too	l Z-level	250			
	Create planar	surface at Part	t Lower level	Cancel	

阶 Click 🗹 to return to the Milling Part Data.

Click **Target** in the Stock & Target model section.

This image appears:

Presently, the target and the fixture both are selected as the target. We will Edit this to separate the definitions of Part & Fixture.



 γ Right click Solid 2 and click **Unselect**, in the **Type** section.



The image now looks like this as we have separated the fixture from the part.



Click do return to Milling Part Data.



Right click Fixtures and select Define Fixture.



Select the highlighted part as the fixture.







Enter a value of **356.9** in the **Z** column and select clamping fixture in the **Fixture** column. This is the distance from the top face of the part to the bottom of the holding fixture. This is needed to "push" the part above the table of the machine. This will essentially be used in the machine simulation.

Name:	Setup				
Home	Fixture	Table	x	Y	Z
🕀 MAC 1 (1	1-P 🐴 clamping fix	(ture 💾 Table	0.000	0.000	356.9
4					



Morph Between 2 Curves

The Morph Between Two Curves feature creates a morph toolpath between two leading curves. Morph means that the generated toolpath gradually interpolates between the two curves and it is evenly spread over the surface. This option is very suitable to machine steep areas for mould making , blade surfaces of impeller and Turbine blades. When selecting the set of two curves, the geometry should be selected directly from the drive surfaces.

The main advantage of this strategy is that the toolpath is created on several surfaces by following a pattern created by two curves and there are no lifts. The toolpath is homogenous from start to end.

Care must be taken while using this strategy while machining Impeller surfaces as varying surface widths can cause the toolpath to "squeeze" at certain areas thereby creating a rubbing effect.

We would be discussing various tilt mechanisms available inside SolidCAM 5 Axis. An interesting tilt mechanism "Tilt through Curve" helps us to create toolpath on surfaces with blending fillets.





The Operations Manager window opens.

Select **Morph between two boundary curves** in the Technology section.



Drive surface.





Click New icon under **Start edge curve**.

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Select the three segments as shown in the image.





Click in the Chain List section.

Click ✓ to return to the Operations Manager. R

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Click New icon under End edge curve.

End eda	e curve	/	
			•
Show			

Select the four segments as shown R

in the image.



Click 🖉 in the Chain List section.

Click do return to the Operations Manager.

Select the Type as Full, start and end at exact surface edges from the drop

down list in the Area section.

Click Margins.

Area Type:
Full, start and end at exact surface edges 🔹
Area Type:
Full, start and end at exact surface edges Margins

The image.

Margins		X
Start margin:	0.5	
End margin:	0.7	
Advanced parameter for margins Additional margin to overcome surface edge inaccuracies:	0.03	
ОК	Cancel	



Click OK.

Click Tool > Select.

chnology	Operation name:		Template	
Morph between two boundary curves		•	🔒 🖻	
CoordSys	Tool Data Cool	ant Tool Change position		Show too
Tool	Tool data			
Levels	Type:			
Link	Number:	0		
Tool axis control	Diameter:	0		
Gouge check	Corner radius:	0		
Roughing and More				
Motion control				
Misc. parameters		Select		



Click 🐁 icon to add a new tool.

Select Taper Mill as our tool. R

Enter the tool parameters as shown in the image. 3

Schoosing tool for operation				
	x 🛱			
Tool Nu VID Num VIS	er-d 💌	Number	ID number	
🕅 1 TAP	PER MILL	Description		
		M Topology Tool Da Tool parameters	ta iData Holder Shape	Coolant Tool Preset Tool Message
		Mm () Diameter	(D): 12	AD
		Inch 🔘 Tip diame Corner r	adius (R): 2.5	
	•	Taper ar Arbor dia	ngle (A): 0° 5	
		Length	. 90	TL
		Inch Outside	holder (OHL): 60	
		Shoulder Cutting (length (SL): 50 'CL): 40	
		Cone len	gth: 40.0051	
		Rough Number	of flutes: 4	R TD Cone L
	+			
	•8 •9			Select <u>C</u> ancel
		_	_	
	Choosing tool	for operation		
🕎 Select Holder .	Tool Nu 💌	ID Num Viser-d V	Number ID number	
-	1	TAPER MILL	1 Description	
			👖 Topology Tool Data iData 🕑 F	lolder Shape Coolart Tool Preset Tool Message
32X60			Holders Shape Local Global	Sti Tooladaptor: BT30
32,000				Selected holder: BT40 ER 32x60
				•
Click Select.				
\bigcirc				
			Shape edit	Holder overhang length; 30
		k	Description	
	♦ 🖣	🗰 1+8 🔩	\$	Select Cancel

Click Levels.

Technology	Operation name:	Template
Morph between two boundary curves	5X_MC_faces	
CoordSys	Clearance area	Levels
Tool	Type: Sphere Radius: 90	Retract distance 20
Tool path parameters	Around point	Safety distance 2
Default Lead-In/Out	X= 0	
Gouge check	Y= 0	
Roughing and More	Z= -85	
Misc, parameters		
	Angle step for rapid moves: 5	
	Angle step for rapid moves.	Rapid retract

Select the **Levels** parameters as shown in the image. 9

Click Tool path parameters.

	💩 Morph between two boundary c	urves			
🕙 Enter a	Technology Morph between two boundary curves	Operation name: 5X_MC_faces	•	Template	•
value of 0.8 in Maximum step over.	CoordSys Geometry Tool Levels Levels Link Colg path parameters Link Colge check Clearance data Roughing and More Motion control Motion control Misc. parameters	Surface quality Sorting Surface quality Cut tolerance: Distance : Maximum step over: Scallop: Surface edge merge distance @ As value: @ As % of tool diameter:	0.02 0.5 0.8 0.03221 0.1 0	Chaining tolerance: Note: The chaining tolerance. 100 times the cut tolerance. great impact on the calculat Slow and safe path creat Adaptive cuts Axial Shift O Constant from each contour Gradual for all cuts Caradual for each contour	Advanced
	Save Save & Calculate	Apply outer sharp corner(s) Outer Angle(s) along pass: Loops' radius: Simulate) 30 5 GCode	Damp SD Tool Compensation Tool Cip Tool Center Sav	ve & Copy Exit

R	Click	Link	> Links	sub-tab.
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rechnology	Operation name:		Templati	2	10
Morph between two boundary curves	5X_MC_faces	•	🖬 🖻		Q
CoordSys	Approach/Retract Lin	ks			
Tool	Gaps along cut				
Levels	Small gaps:	Direct	•	Don't use Lead-In/Out	•
	Large gaps:	Clearance area	•	Don't use Lead-In/Out	-
Default Lead-In/Out	Small gap size in %	6 of tool diameter: 20		○ as value:	
Clearance data	Links between slices				
Motion control	Small moves:	Direct	•	Don't use Lead-In/Out	_
Misc. parameters	Large moves:	Clearance area	•	Don't use Lead-In/Out	-
4	Small move as size	e in % of step over: 500		○ as value:	
<u> </u>	 Links between passes 				
	Small moves:	Direct	-	Don't use Lead-In/Out	T
	Large moves:	Clearance area	-	Don't use Lead-In/Out	Ŧ
	Small move as value:	10			

Enter a value of 500 in Small move as size in % of step over.



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Enter a value of 70 in Tilt angle at side of cutting in the Angles section.

💩 Morph between two boundary curves X Technology Operation name: Template 1 Morph between two 5X_MC_faces 🔒 🖻 • • Select Orthogoboundary curves CoordSys Output format: Interpolation Seometry nal to cut direction Tool 5 Axis Max. angle step: 3 • Levels Tool path parameters at each position 🚰 Link Tool axis direction: Angle range from the drop down, Default Lead-In/Out Limits Tilted relative to cutting direction • in the Side tilt defini-🛉 Gouge check Clearance data tion section. Roughing and More Angles Motion control Lag angle to cutting direction: 0 Misc. parameters 4 Tilt angle at side of cutting 70 Side tilt definition: Orthogonal to cut direction at each position Advanced Save Save & Calculate 🔻 GCode Save & Copy Exit Simulate

	🎄 Morph between two boundary cu	urves	
Chek Gouge check.	Technology Morph between two boundary curves	Operation name: 5X_MC_faces	Template
	CoordSys Geometry I Tool Levels Tool path parameters	Gouge 1 Gouge 2 Gouge 3 Gouge 4 Penable/Disable Tool Holder	Geometry
		 ☐ Arbor ☑ Tool shaft ☑ Tool tip 	Check surfaces
	<pre>// msc. parameters / III >></pre>	Strategy Retract along tool axis	Stock to leave: 0 Tolerance: 0.01
	Save Save & Calculate	▼ Simulate GCode	Save & Copy Exit

- Select the **Enable/Disable** check box.
- Select the **Check surfaces** check box.

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- Click New icon in **Check surfaces 1** section.
- Select the three surfaces as shown in the image.







Click **Simulate** once the tool path is calculated.



Click the Play icon.

Simulation	? X
Rest Material SolidVeri	fy RapidVerify
Machine Simulation S	SolidVerify for 3D
Host CAD 2D	3D
Show data	Show tool
Show tool frequency: 1	
Stop on next Clear Simulation speed	Colors
	· · ·

The simulated toolpath looks like this:



Pull the slider on **Move List** to 50% of the tool path.

Solution Use the down key on your keyboard and move step by step to observe the movement on the fillet.



Observe that the B angle changes drastically due to the chosen side tilt definition i.e. Orthogonal to cut direction at each position. Also observe that the tool side sticks to the fillet while rolling creating a funny situation where the head and table are trying to roll over.



Select the **Exit** icon to exit machine simulation.

Click Exit to exit Operations Manager.

ا ھ	Norph between two boundary o	curves		
	echnology Morph between two	Operation name: 5X MC faces	Template	i)
	Morph between two boundary curves	SX_MC_faces		
4				
	Save Save & Calculate	Simulate GCode]	Save & Copy Exit
Right click > Copy the	e tool path.		AM-Part (IMPELLER A Machine (DMU60 CoordSys Manage Stock (stock) Target (target) Settings fool Machining Process feometries fixtures Operations Setup MAC 1 (1-Po	ASSEMBLY-1) NEW) er bition)
		()	😫 🧶	
Right click > Paste the	tool path.		AM-Part (IMPELLER A Machine (DMU60_ CoordSys Manage Stock (stock) Target (target) Settings ool Machining Process Geometries ixtures Operations Setup MAC 1 (1- Pool Setup	ISSEMBLY-1) NEW) If sition) 1C_faces

Right click > **Edit** the pasted tool path.



The Operations Manager now opens.

Click Tool axis control.

Technology	Operation name:	Template	
Morph between two boundary curves	5X_MC_faces	•	
CoordSys	Output format:	Interpolation	
Tool	5 Axis 🔻	Max. angle step:	3
Tool path parameters	- data da mar		
Default Lead-In/Ou	t	Angle range	_
Tool axis control	Tilted relative to cutting direction	Limits	
Gouge check			
Clearance data	Angles		
Motion control	Angles	_	
Misc. parameters	Lag angle to cutting direction: 0		
4	Tilt angle at side of cutting 70		
	Side tilt definition:		
	Follow surface ISO Lines direction	•	
	Advanced		
	Auvanceu		

Select Follow surface ISO Lines direction as the Side tilt definition.

\bigcirc	inter a value of 80 in the Tilt angle at side of cutting		
	it is a second to be		
	Technology Operation name: Morph between two boundary curves 5X_MC_faces	Template	

Geometry	Output format:	Interpolation Max. angle step: 3
Tool path parameters	Tool axis direction: Tilted relative to cutting direction	Angle range
Gouge Check Gearance data Roughing and More Motion control Misc. parameters	Angles Lag angle to cutting direction: 0 Tilt angle at side of cutting 80	
	Side tilt definition: Follow surface ISO Lines direction	

(

Click Save & Calculate.

 γ Click **Simulate** once the tool path is calculated.

🕎 Click the hide 😼 icon.

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Run machine simulation by clicking the play icon.





Select the **Exit** icon to exit machine simulation.

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Click Exit to exit Operations Manager.

Technology	Operation name:	Template	
Morph between two boundary curves	5X_MC_faces	• 🚽 🖻	
CoordSys Geometry Tool Levels Tool path parameters	CoordSys Define MAC 1 (1- Posit	tion) 🔻	
Tool axis control			
Roughing and More			
Π			
			~

To find out the ISO directions of this tool path, do the following:

Right	nt click	Tools	> Ske	tch Tools	> Face Curve	es.				
solidCAM	File Edit	View I	nsert To	ols SolidCAM V	Vindow Help 🖉 🗋	• 🖄	÷ +	.	R	
				🎐 Soli	dCAM File Edit View	Insert	1	Defeature	9	🗅 • 👌 • 🖬 • 🦷 🖕 • 🍋
				ी+9 Design Study	Interference Clearance	Hole		Select Invert Selection	(+)) Fillet Chamfer
					Detection vernication #	Angrimer		Format Painter	2	Offset Entities
				Assem	bly Layout Sketch Eva	luate	-	Component Selection		Convert Entities
					M-Part (IMPELLER-3) Machine (DNUG) NEW)			Component •	8 8	Intersection Curve Face Curves
				@	CoordSys Manager Stock (stock)			Sketch Entities	24	Trim
				<u>e</u>	p Target (target) p Sattings		-	Sketch Tools		Extend
					ol			Sketch Settings	1	Split Entities
					ometries			Blocks +		Jog Line
				4	dures Operations			Spline Tools	↓	Construction Geometry
				ė- 4	Setup 🖓 MAC 1 (1-Position)			Dimensions •	C	Make Path
				_	E SX_MC_faces			Relations •		
								DimXpert •	4	Mirror Dynamic Mirror
								Measure	ß	Stretch Entities
							<u>9</u> 9	Mass Properties	S.	Move
							4	Section Properties	-6	Rotate
								Check	12	Scale
						ł	2	Assembly Visualization	5	Copy
								AssemblyXpert		Linear Pattern
								MateXpert	000	Circular Pattern
							(Interference Detection		Edit Linear Pattern
							辞	Clearance Verification		Edit Circular Pattern
								Hole Alignment		Edit Polygon
								Reorganize Components	1.0	
							Σ	Equations	Ľ	Create Sketch from Selections

Select the highlighted face as shown in the image.

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Deselect the pink lines checkbox and enter a value of 15 in the blue lines check box as shown in the above image.



Right click the tool path and select **Simulate**.



Stop the **Machine Simulation**.





simulation	9	X
2D Rest Materi	al So	lidVerify
RapidVerify S	lidVerify	for 3D
Machine Simulation H	lost CAD	3D
		1
Show data	Show to	ol
Hidden lines		
Show tool frequency:	1	- I
Show toor nequency.		_
Stop on next Clear	r Col	ors
Condition		_
Simulation speed		
The second second		
	- -	
		-

Observe that the tool follows the axis of the ISO parameters. This is because of the side tilt definition we chose i.e. follow surface ISO lines direction.





Select the **Exit** icon to exit machine simulation.







Right click > **Copy** the tool path.



Right click > **Paste** the tool path.

Right click > Edit the pasted tool path.



Click Tool axis control.

b Morph between two bounda	ry curves	
Technology Morph between two	Operation name: 5X_MC_faces_2	Template
CoordSys Geometry Tool Levels Tool path parameters	Output format:	Interpolation Max. angle step: 3
Link Default Lead-In/Out Tool axis control Gouge check Clearance data Roughing and More Motion control	Tool axis direction: Tilted relative to cutting direction	Angle range
Hisc. parameters	Angles Lag angle to cutting direction: 0	
	Tilt angle at side of cutting 80 Side tilt definition:	
	Orthogonal to cut direction at each contour Advanced	
	Approximate: Smooth	
Save Save & Calculate	Simulate GCode	Save & Copy Exit

Select Orthogonal to cut direction at each contour as the Side tilt definition.

Technology	Operation name:		Template	
Morph between two boundary curves	5X_MC_faces_2	•	🖬 🚔	Q
CoordSys	Output format:		Interpolation Max. angle step:	3
Tool path parameters	Tool axis direction: Tilted relative to cutting direction	•	Angle range	its
Roughing and More	Angles Lag angle to cutting direction:	0		
	Tilt angle at side of cutting	80		
	Side tilt definition: Orthogonal to cut direction at eac Advanced	h contour 💌		
	Approximate:	•		



Select **Smooth** in the **Approximate** section.



Click Save & Calculate.

Click Simulate once the tool path
is calculated.





Click the play icon.

Click Machine Simulation.

Simulation	9	X
Rest Material SolidVerify Machine Simulation Soli Host CAD 2D	Rap dVenify 	idVerify for 3D 3D
Show data Show data Show tool frequency: 1	now too	
Stop on next Clear Simulation speed	Colo	rs
	• •	

The simulated tool path looks like this:



The tool maintains orthogonal position to each contour. This is because of the chosen side tilt definition i.e. orthogonal to cut direction at each contour. Observe the tool **"Dance"** on the front fillet as the tool is maintaining it's position orthogonal to the contour.

Select the exit icon to come out of machine simulation.





Select **Morph between two boundary curves** in the **Technology** section.

Technology Morph between two boundary curves	Operation name:	Template
CoordSys Geometry Tool Levels Tool path parameters Link Cool path parameters Link Cool path parameters Link Cool path parameters Cool path parameters	Geometry Drive surface Show Start edge curve Show End edge curve Show	Area Type: Full, avoid cuts at exact edges Number of cuts:
	Drive surface offset: 0	Round corners

Click Geometry.

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Click the new icon in the **Drive Surface**.

Select the faces as shown in the image.





Click the new icon in **Start edge curve** section.

Technology	Operation name:	Template
Morph between two boundary curves	· ·	
CoordSys Geometry Tool Levels Tool path parameters Link Default Lead-In/Out Tool axis control Gouge check Clearance data Roughing and More Motion control Misc. parameters VIII >	Geometry Drive surface Show Start edge curve Show End edge curve Show Drive surface offset: 0	Area Type: Full, avoid cuts at exact edges Number of cuts: Extend/Trim Angle range 2D Boundary Round corners
Save Save & Calculate	▼ Simulate GCode	Save & Copy Exit







Click the new icon in the **End edge curve** section.

s Morph between two boundary	curves	- • ×
Technology Morph between two boundary curves	Operation name:	Template
CoordSys Geometry Tool Levels Tool path parameters Link Coope check Clearance data Roughing and More Motion control Misc. parameters ()))	Geometry Drive surface Show Start edge curve Show End edge curve Show Drive surface offset: 0	Area Type: Full, avoid cuts at exact edges Number of cuts: Extend/Trim Angle range 2D Boundary Round corners
Save Save & Calculate	Simulate GCode	Save & Copy Exit

Select the curves (Bottom Fillet Edges) as shown in the image.





🕎 Click 🖌

Select the Type as Full, start and end at exact surface edges in the Area sec-

log Morph between two boundary curves

tion.

Select Margins.

Technology	Operation name:	Template
Morph between two		
boundary curves	•	
CoordSys	Geometry	Area
	Geometry	Turner
Tool	Drive surface	Туре.
Levels		Full, start and end at exact surface edges 🔹
Tool path parameters		
	Show	Marging
		Pial girls
Default Lead-In/Out	Charles a service	1
I ool axis control	Start edge curve	Number of cuts:
Gouge check	Ø Contour4 ▼	
Clearance data		
	Show	
Motion control		Extend/Trim
Misc. parameters	End edge curve	
4 III +	/ Contour5 -	Angle range
	Show	2D Boundary
		<u> </u>
	Drive and the offerty 0	
	Drive surface offset:	Round corners
Save Save & Calculate	Simulate GCode	Save & Copy Evit
Save & Calculate		Save & copy
Enter the start and end margin values as shown in the image:

	Margins)
Click OK .	Start margin: 0.3	
	End margin: 0.3	
	Advanced parameter for margins	
	Additional margin to overcome 0.03	
•	Add tool radius to margins	
Click Tool and select the same tool (Taper	OK Cancel	
Mill) that was used earlier.		
Morth between two boundary curves		
	Total	-
Morph between two boundary curves	faces3	
CoordSys Tool	Data Coolant Tool Change position Show tool •	
Tool path parameters	har 1	
Default Lead-In/Out	eter: 12 mm	
	er radius: 2.5 mm	
	Select	

Save Save & Calculate Simulate GCode



Click Levels.



Select "Sphere" as the clearance type and enter the values as shown in the image.



Save & Copy Exit

Click Tool axis control.

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Technology	Operation name:	Template	
Morph between two boundary curves	5X_MC_faces3	🖬 🚔	
CoordSys	Output format:	Interpolation	
Tool	5 Axis 💌	Max. angle step:	3
Levels Tool path parameters	Televis des des		
Default Lead-In/Out	Tilted relative to cutting direction	Angle range	
Gouge check			
Roughing and More	Angles		
House Control	Lag angle to cutting direction:		
۰ III ا	Tilt angle at side of cutting 80	2	
	Side tilt definition:		
	Follow surface ISO Lines direction	•	
	Advanced		

Enter a value of 80 as the **Tilt angle at side of cutting**.

Select Follow surface ISO Lines direction as the Side tilt definition.

Click Gouge check.	so Morph between two boundary	curves	
<u> </u>	Technology Morph between two boundary curves	Operation name: 5X_MC_faces3	Template
Select the Enable/ Disable check box.	CoordSys Geometry Tool Levels Tool path parameters	Gouge 1 Gouge 2 Gouge 3 Gouge 4 Col Tool Holder	Geometry
Select the Check surfaces checkbox.	Link Link Log Default Lead-In/Out Tool axis control Gouge check Clearance data Gughting and More Mation control	Arbor Tool shaft Tool tip	Check surfaces
Click the new icon under Check surfaces 1 section.	Misc, parameters	Strategy Retract along tool axis	Stock to leave: 0 Tolerance: 0.01
	Save Save & Calculate	✓ Simulate GCode	Save & Copy Exit







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Click Save & Calculate.

Click **Simulate** once the tool path is calculated.

echnology	Operation name:	Template	
Morph between two boundary curves	5X_MC_faces3	-	
CoordSys	Gouge 1 Gouge 2 Gouge 3 Goug	e 4	
	📝 Enable/Disable		
Levels	Tool	Geometry	
Tool path parameters	I Holder	Drive surfa	ces
Default Lead-In/Out	Arbor	Check surfa	aces
Tool axis control	Tool shaft	Use STL file	
Gouge check		Charles and	
Clearance data	Tool tip	Check surface	25 1
Roughing and More			faces4 🔻
Motion control		Show	
Misc. parameters	C 1		
4 III	Strategy		
	Retract along tool axis	•	
-		Stadute lanua	0
Ä		Stock to leave	· ·
	Advanced	Tolerance:	0.01
X			
· · · · · · · · · · · · · · · · · · ·			



Click the play icon.

Simulation	2 X
2D Rest Material SolidVerify SolidVerify Machine Simulation Host CA	SolidVerify fy for 3D D 3D
Show data Show	/ tool
Stop on next Clear C	Colors
	·II 🔺

The tool path looks like this:



We can see that the toolpath really looks very bad as there are gouges , wrong retracts etc. We need to fix this issue.

Let us go back to the Operations Manager and fix the issues in the tool path.

Select the exit icon to go back to the Operations Manager.



Click Geometry.

Click Margins.

💩 Morph between two boundary	curves	
Technology Morph between two boundary curves	Operation name: 5X_MC_faces3	Template
CoordSys Geometry Tool Levels Tool path parameters Link Default Lead-In/Out Gouge check Roughing and More Motion control Motion control Misc. parameters	Geometry Drive surface Content of the dege curve Contour 1 Contour 4 Contour 5 Contou	Area Type: Full, start and end at exact surface edges Margins Number of cuts: Extend/Trim Angle range 2D Boundary Round corners
Save Save & Calculate	Simulate GCode	Save & Copy Exit



Change the start and end margins as shown in the image:

Margins	X
Start margin:	0.5
End margin:	0.5
Advanced parameter for margins Additional margin to overcome surface edge inaccuracies:	0.03
OK Ca	ncel

Click OK.

R

Click Save & Calculate.

Click **Simulate** once the tool path is calculated.

Technology	Operation name:	Template
Morph between two boundary curves	5X_MC_faces3	
CoordSys	Geometry	Area Type:
Tool ↓ Levels Tool path parameters	Drive surface	Full, start and end at exact surface edges
Link	Show	Margins
Gouge check	start edge curve	Number of cuts:
	End edge curve	Extend/Trim
•	Contour5 ▼	Angle range
B	Show	2D Boundary
	Drive surface offset: 0	Round corners

The simulated tool path looks the same as there is not much change in the quality

of the toolpath. We need to SolidCAM Operations J understand as to what is causing these issues.



Ð

Click the exit icon to return to the Operations Manager.



Minimize the Operations Manager.

The tool path is fine till the fillet comes up. To understand and evaluate it better, let us create a sketch.



Click Sketch.



Click Insert > Reference Geometry > Plane.



Select the highlighted points.





Let us make a sketch as shown in the image:



The lines in the sketch must be created nearly normal to the edge and the fillet as marked with the arrows. These lines represent the normal direction of the surfaces. You can see that the normal angle changes according to the curvature of the surface. Since we had kept the tool axis control at 80 degrees, the tool will always maintain 80 degrees to the lines that we just created, which is resulting in a bad toolpath. Thus, we need to use a different tilt axis control. Whenever we get a blade with a bottom fillet, the below mentioned tilt strategy holds good.



Click the feature manager design tree icon.





🕙 Switch on the surface by clicking 🧉

3

Go back to the SolidCAM Manager to edit the tool path.

Assembly Layout Sketch Evaluate	SolidCAM Part SolidCAM Opera	tions @	ⓐ \★ m ∰ · M · m · m · m · m · m · m · m · m · m
9 😭 😫 😬 🍉	- 💩 Morph between two boundar	y curves	
Advine (DMU50_NEW) CoordSys Manager Stok (stock) Gor Target (target) Settings	Technology Morph between two boundary curves	Operation name: 5X_MC_faces3	Template
Trol Maching Process Genetics Traines Operations Operations Operations Operations Operations Operations	CoordSys Secometry Tool Levels	Output format:	Interpolation Max. angle step: 3
	Tool path parameters	Tool axis direction: Tilted through curve	Angle range
	Roughing and More Subscription Control Motion control Misc. parameters	Curve tilt type: Angle from curve	Tilt curve
		Angles Fixed tilt angle: 0	
	Save Save & Calcula	te 🗸 Simulate GCode	Save & Copy Exit

Select Tilted through curve as the Tool axis direction.

Click new icon in the **Tilt curve** section.

R

) Select the curves as shown in the image:



Note: For information on how to create the surface, refer to the movie attached with this tutorial.



R

Click 🖌

In Tool axis control, select Closest point as the Curve tilt type.

T	0	Taurista
Morph between two boundary curves	5X_MC_faces3	
Geometry	Output format:	Interpolation Max. angle step: 3
Tool path parameters	Tool axis direction: Tilted through curve	Angle range
Clearance data Roughing and More Motion control Misc. parameters	Curve tilt type: Closest point Advanced	Tilt curve
	Angles Fixed tilt angle: 0	

Click Save & Calculate.

Click **Simulate** once the tool path is calculated.

Click the play icon.

P

Simulation	2	X
Rest Material SolidVerify Machine Simulation Sol Host CAD 3D	Rapi idVerify	dVerify for 3D 2D
Show data S Hidden lines Show tool frequency: 1 Stop on next Clear	Color	3
		<u>_</u>

0 48 27 200 -

The simulated tool path looks much smoother now:

Go to the feature manager design tree and hide the created surface by clicking



Click the play icon 👂



The machine simulation is much smoother now as the tool negotiates the blade surfaces & the fillet below smoothly. This type of tool tilting is very useful when negotiating surfaces with fillets or surfaces with varying curvatures which cause the normal's of the surface to change drastically.



Observe that the final 5-6 passes are gouging the part as seen below in the machine simulation. We

need to fix this.

The gouge is a result of an angle change within a very short travel of the tool which is causing the tool to "touch" the part thereby causing this gouge.



In order to fix this gouge we will now open a new parameter box and study the effect of the same.

This parameter can be found in the tool axis control tab and more than often kept as default. However this parameter can have a great degree of effect in smoothing tilt motions and thereby avoiding gouges in this case.

This parameter is called "Side Tilt Fanning Distance".



- Click Save & Calculate button and after the calculation is completed click on Simulate button & select Machine Simulation (if the previous simulation was set to HostCAD). Click play and observe that there are no gouges now.
- What the "Side Tilt Fanning distance" does is to evenly distribute the changes in the tilt angles over a larger distance (25mm in our case) thereby smoothing the tilt. Thus gouges are now avoided and we get a much better tilting motion.



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 $\langle \! \! \! \rangle$

Click Exit to exit the Operations Manager.

echnology	Operation name:	Template
Morph between two boundary curves	5X_MC_faces3	- 🖬 🚔
CoordSys 🔶 Geometry	Output format:	Interpolation
<mark>∲</mark> Tool <u>↓</u> Levels	5 Axis	Max. angle step: 3
Tool path parameters	Tool axis direction:	Angle range
Gouge check		
Motion control	Closest point	▼ Contour6 ▼
	Angles	
	Fixed tilt angle: U	

52

Parallel to Curve

The Parallel to Multiple Curves feature creates toolpath segments parallel to a leading curve. The neighbouring toolpath segments are parallel to each other. An important point here is that the cuts are not simply copied next to each other; every new cut is an offset of the previous cut. When selecting the curve geometry, select the curves directly from the part. When using a single drive surface, you can only select one curve from which to create a parallel toolpath. When using multiple drive surfaces, you can then select multiple curves to use. Each curve is only used for the drive surface nearest to that curve.

This type of strategy is very useful in machining impeller blades as it provides uniform spacing of cuts.

Right click > **Copy** the tool path.





Right click > **Edit** the pasted tool path.



Select **Parallel to curves** in the **Technology** section. We will now study another strategy which is

popular when machining these types of parts.

Technology Parallel to curves	Operation name:	Template
CoordSys Geometry Tool Levels Tool path parameters Link Default Lead-In/Out	Geometry Drive surface faces3 •	Area Type: Full, start and end at exact surface edges Margins
Gouge check Gouge check Clearance data Roughing and More Motion control Misc. parameters	Edge curve	Extend/Trim Angle range 2D Boundary
//		Round corners
Save Save & Calculate	Simulate GCode	Save & Copy Exit

Click Geometry.

Click the new icon in the **Edge curve** section.

Select the curves as shown in the image.





Click **Tool** and select the same tool that has been defined already.

Click Tool path parameters.

by Parallel to curves		
Technology Parallel to curves	Operation name:	Template
CoordSys Geometry Tool Levels Tool path parameters Link Tool path parameters Link Colarance data Couge check Clearance data Roughing and More Motion control Motion control	Surface quality Sorting Sorting Cutting method: One way Direction of machining: Climb Cut order: Standard Machine by: Lanes Flip step over Start point	Advanced
Save Save & Calculate	▼ Simulate GCode	Save & Copy Exit

Click the **Sorting** sub-tab.

Select **One way** as the **Cutting method**.

Click Link.

Select **Use Lead-In** in the **First entry** section.

	-	`
Approach/Retract Links		
First entry		
From clearance area	▼ Use Lead-In	▼
Start from home position		1
Last exit		
Back to clearance area	▼ Use Lead-Out	▼
Return to home position		
Home position		
X 0 Y 0 Z (250	
	Approach/Retract Links First entry From clearance area Start from home position Last exit Back to clearance area Return to home position Home position X Y Q Y Z	Approach/Retract Links First entry From clearance area Use Lead-In Start from home position Last exit Back to clearance area Use Lead-Out Return to home position Home position X 0 Y 0 Z 250

Select Use Lead-Out in the Last exit section.

🐑 Click 🔜

9

The Lead-In window opens.	Lead-In	Template	
	🔲 Use default Lead-I	'n	
-	Lead parameters		-
Deselect the Use default	Type:	Tangential arc 🔹	
C		E Flip	Y
Lead-In check box.	Tool axis orientation:	Fixed	
	Max. angle change:	4	
Make the changes as	Use the	Length	
	20	20	
shown in the image.			
	Arc sweep	Arc diameter/Tool diameter %:	
	90	100	
	Height:	1	Creat
	Food asks N		Cancel
	Feed rate %	100	

	Parallel to curves		
Click —	Tarbaslasy	One of the second	T
\mathcal{V}	Parallel to curves	Operation name:	
		•	
	CoordSys	Approach/Retract Links	
	Tool	First entry	
	Levels	From dearance area	Use Lead-In 💌
		Start from home position	
	Default Lead-In/Out		
	Gouge check		
	Clearance data	Last exit	
	Motion control	Back to dearance area 💌	Use Lead-Out
	Misc. parameters	Return to home position	
		1	
		Home position	
		X 0 Y 0 Z 250	
	Save & Calculate		Save & Copy Exit
			52
	Lead-Out	Template	
	Use default Lead-C	Dut	
S Use the same parame-	Lead parameters		
	Type:	Tangential arc 💌	
	Type:		-
ters for Lead– Out also.		🔲 Flip	
	Tool axis orientation:	Fixed -	
	Max. angle change:	4	
	Use the		
	Width	Length:	
	20	20	
	<u></u>		
	Arc sweep	Arc diameter/ 1001 diameter %:	
	90	100	
	Height:	1	OK Cancel
	Feed rate %	100	

Click OK.

Click the Links sub-tab.

echnology	Operation name:		Templa	te	
Parallel to curves		•		;	`
CoordSys	Approach/Retract Links				
	Gaps along cut				
Levels	Small gaps:	Direct	•	Don't use Lead	-In/Out 🔻
	Large gaps:	Clearance area	-	Don't use Lead	-In/Out 🔻
Pefault Lead-In/Out	Small gap size in %	of tool diameter:	20	🔘 as value:	0
Gouge check	Links between slices				
Roughing and More	Small moves:	Direct	•	Don't use Lead	-In/Out 🔻
Misc. parameters	Large moves:	Clearance area	•	Use Lead-In/O	ut 🔹 🛄
4	Small move as size in the size of the s	n % of step over:	110	i as value:	0
	Links between passes				
	Small moves:	Direct	~	Don't use Lead	-In/Out 👻
	Large moves:	Clearance area	-	Don't use Lead	-In/Out 👻
	Small move as value:	[10		

Select Use Lead-In/Out in Large moves.

Click						
i	b Parallel to curves					X
🐑 Make	Lead-In / Lead-Out	Operation name		Template		X
the	Use default Lead-	In/Lead-Out		land 0.4		
changes as	Lead-In			Same as Lead-In		
shown in the	Туре:	Tangential arc 🔹		Type:	Tangential arc	-
image.		Flip			Flip	
	Tool axis orientation:	Fixed •		Tool axis orientation:	Fixed	-
Click OK.	Max, angle change;	4		Max, angle change;	4	
\bigcirc	Use the	Length		Use the	Leasth	
	20	20		20	20	
	Arc sweep	Arc diameter/ Tool diameter %:		Arc sweep	Arc diameter/ Tool diameter %;	
	90	100		90	100	
	Height:	1		Height:	1	
	Feed rate %	100	OK Cancel	Feed rate %	100	

Technology Parallel to curves	Operation name:	Template
CoordSys Geometry Tool Levels Tool path parameters Default Lead-In/Out Gouge check Clearance data Roughing and More Motion control Motion control Misc. parameters	Approach/Retract Links Gaps along cut Direct Small gaps: Direct Large gaps: Clearance area (a) Small gap size in % of tool diameter: 20 Links between slices Small moves: Small moves: Direct Large moves: Clearance area (a) Small move as size in % of step over: 110	 Don't use Lead-In/Out Don't use Lead-In/Out as value: Don't use Lead-In/Out Use Lead-In/Out Use Lead-In/Out as value:
Save Save & Calculate	Links between passes Small moves: Direct Large moves: Clearance area Small move as value: 10	Don't use Lead-In/Out Don't use Lead-In/Out Don't use Lead-In/Out

Click **Simulate** once the tool path is calculated.

The simulated tool path looks like this. The parallel to curve strategy gives a uniform spacing between passes on the entire set of surfaces unlike the morph between curves which cause passes to converge thereby creating a rubbing action.





You can see that the tool is performing one way cutting. This is a very effective strategy for cutting impeller blades as explained in the previous page.

Select the exit icon to return to the Operations Manager.

Simulation	? X
Rest Material SolidVe Machine Simulation Host CAD	erify RapidVerify SolidVerify For 3D
Show data Hidden lines Show tool frequency:	Show tool
Stop on next Clea	
▶ ▶ = ■	

Click Exit to close Operations Manager.

Parallel to curves	Operation name:		Templa	
CoordSys CoordSys Geometry Levels Tool Tool Tool path parameters Link	Approach/Retract Links Gaps along cut Small gaps: Large gaps:	Direct Clearance area	- - -	Don't use Lead-In/Out ▼ Don't use Lead-In/Out ▼
Default Lead-In/Out Tool axis control Gouge check Guge check Roughing and More	Small gap size in % of Links between slices Small moves:	of tool diameter:	20	as value: 0 Don't use Lead-In/Out
Motion control	Large moves: O Small move as size in	Clearance area	▼ 110	Use Lead-In/Out
•	Links between passes Small moves: Large moves:	Direct Clearance area		Don't use Lead-In/Out
	Small move as value:	[10	

Morph Between 2 Surfaces

The Morph Between Two Surfaces feature creates a morph toolpath on the drive surface. The drive surface is enclosed by two check surfaces. Morph means that the generated toolpath is approximated between the check surfaces and evenly spread over the drive surface. This is great for impeller machining with twisted turbine blades. The main advantage is the possibility to compensate the tool to the drive surface and check surface in the left and right corner of the work piece. All you need is the tool radius which is the distance (Margin) between the tool center and the surfaces.

We would also be discussing couple of side tilt definations while using the above strategy.

Right click the tool path > Add Milling Operation > Multi Axis Milling.

b SolidCAM 🛛 File Edit View Inse		A		9	& • <mark>>_{}</mark> 8 🖆 🗉 •
👻 🛷 iMachining 🔹 🚗 3D Drilli		Add Probe			C T L C01
Probe 🙃 2.5D 🔹 🛋 Engravit		Add Milling Operation	•		iMachining
Recognition • 29 3D Millin		Add Machine Control			Face
Assembly Layout Sketch Evaluate		Add Operation from Template			Profile
🕫 🖆 😫 🎃		Add Operations from Process Template			Contour 3D
CAM-Part (IMPELLER-3)		Add Machining Process			Pocket
🖓 CoordSys Manager		Add Midelining Process			Drilling
Stock (stock)		Create Template			Thread Milling
······································		Edit			Slot
Machining Process	G01	GCode	•		500
		Calculate			I-Slot
🚊 - 💭 Operations	:::				Translated Surface
A MAC 1 (1- Position)		Calculate in parallel			ToolBox Cycles
		Calculate & GCode			Packet Perception
		Tool Sheet			
ST. M. SX_MC_faces3					Drill Recognition
		Synchronize			3D Drilling
		Tool path	•		Engraving
-	_	Condition			2D Milling
		Simulate			SD Winning
		GCode Simulators	•	3D iMachining.	3D iMachining
		Transform			HSR
		Split			HSS
		File			HSM
		Info			
		1110			Multi Axis Milling
		Operation Group	•		SWARF Machining
		Documentation (DPP)	•		Multi-Axis Drilling
	≞	Machine Setup	•		Convert HSS-HSM To Multi Axis Milling
		Change Submachine to			
		Change Submidenine to	,		
		Change Tool			
		Change Tool Data			
		Rename			
		Cut			
		Сору		F	
		_		1	
1 L					

Select **Morph between two adjacent surfaces** in the **Technology** section.

echnology Morph between two adjacent surfaces	Operation name:	Template
CoordSys Geometry Tool Tool path parameters Link Tool path parameters Link Tool axis control Gouge check Clearance data Roughing and More	Geometry Drive surface Show Start edge surfaces Start edge surfaces Show	Area Type: Full, avoid cuts at exact edges
Motion control	End edge surfaces	Extend/Trim Angle range 20 Recorder:
	Advanced	Round corners

Click Geometry.

R

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Select the new icon under **Drive surface**.

Select the faces as shown in the image:





Select the new icon under **Start edge surfaces** section.

Adjacent surfaces	Operation name:	Template
CoordSys CoordSys CoordSys CoordSys CoordSys Coor	Geometry Drive surface	Area Type: Full, avoid cuts at exact edges
Tool axis control	Start edge surfaces	Number of cuts:
Misc. parameters	End edge surfaces	Extend/Trim Angle range
k	Drive surface offset: 0 Advanced	20 Boundary Round corners

Select the highlighted face.





Select the new icon under **End edge surfaces**.

A morph between two	Operation name:	Template
adjacent surfaces		
CoordSys	Geometry	Area
	Drive surface	Туре:
		Full, avoid cuts at exact edges
Tool path parameters		
Link	Show	
Default Lead-In/Out		
Tool axis control	Start edge surfaces	Number of cuts:
Gouge check	Image:	
Clearance data	Show	
Kougning and More	SHOW	
Misc, parameters	End edge surfaces	
4 111		Extend/Trim
	Show	Angle range
	Drive surface offset:	2D Boundary
	Advanced	Round corners
×		

Select the highlighted face.





Select Add tool radius to margins check box.	M	argins	X	2
		Start margin:	0	
Click OK .		End margin:	0	
		Advanced parameter for margins Additional margin to overcome surface edge inaccuracies: Add tool radius to margins	0.03	
		ОК	Cancel	

Click **Tool** and select the same tool that has already been defined.

Click Levels and enter the parameters as shown in the image.

	string the setween two adjacent s	urfaces				X
[Technology	Operation name:		Template		
	Morph between two adjacent surfaces	5X_MS_faces5	- 1			(į)
	CoordSys Geometry Tool	Clearance area	adius: 125	evels Retract distance	20	
	Tool path parameters Link Link Tool axis control Gouge check Clearance data Clearance data Motion control Misc. parameters	Around point X= 0 Y= 0 Z= -100		Safety distance	2	
		Angle step for rapid mov	ves: 5	Rapid retract		
	Save Save & Calculate	Simulate	GCode	s	ave & Copy	Exit
Click Link	Morph between two ad Technology Morph between two adsets or forces	jacent surfaces Operation name: SX_MS_faces5	•	Template		x
			-			
Click Link sub-tab.	S Geometry Geometry Tool Levels Tool path parame W Unk Default Lead	Approach/Retract Lini Gaps along cut Small gaps: Large gaps: -In/Out () Small gap size in %	Direct Clearance area 6 of tool diameter: 20	 Don't use Lease Don't use Lease as value: 	d-In/Out d-In/Out 0	
	Gouge check	Links between slices re Small moves: Large moves:	Direct Clearance area	Don't use Lea Don't use Lea	d-In/Out 🔹 d-In/Out 💌	
		Small move as size	in % of step over: 800	◯ as value:	0	
		Links between passes Small moves: Large moves: Small move as value:	Direct Clearance area	Don't use Lea Don't use Lea	d-In/Out v d-In/Out v	
	Save Save & C	Calculate V Simulate	GCode	[Save & Copy	Exit

Ther a value of 800 in Small move as size in % of step over.

Technology Morph between two adjacent surfaces ✓	Operation name: 5X_MS_faces5	Template	
CoordSys Geometry Tool Levels Tool path parameters	Gouge 1 Gouge 2 Gouge 3 Gouge 4		
Link Default Lead-In/Out Tool axis control Gouge check Clearance data Roughing and More Motion control Misc. parameters K	 ☐ Holder ☐ Arbor ☑ Tool shaft ☑ Tool tip Strategy Tilting tool away with max. angle: Use side tilt angle ☐ Advanced Smoothing 	Geometry Drive surfaces Check surfaces Use STL file Check surfaces 1 Show Show Stock to leave: Tolerance:	• 0.01

- Make the changes as shown in the image.
- Click new icon under **Check surfaces 1**.
 - Select the highlighted faces.





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Click Misc. parameters.

echnology	Operation name:	Template	
Morph between two adjacent surfaces	5X_MS_faces5	- 🔒 🖻	Ú,
CoordSys	Message		
Tool		*	
Tool path parameters		Ŧ	
Tool axis control	Extra parameters		
Clearance data	Parameters list		
Motion control Misc. parameters	Smooth surface normals Smoothing threshold (degree/distance):		
	☑ Tool Center based Calculation		

Select the **Tool Center based Calculation** check box.



Click Simulate once the tool path is calculated.

The simulated tool path looks like this again a bad toolpath, we need to fix this.



You can see that apart from the area to be machined, some other areas are also getting machined.

Select the exit icon to return to Operations Manager.

simulation	ي ب	2 🕅
2D Rest Ma RapidVerify Machine Simulation	terial SolidVerif Host CA	SolidVerify y for 3D D 3D
Show data Hidden lines Show tool frequency	Show	tool
Simulation speed		· ·
▶ ▶		

We can fix this issue by going back to Geometry.

Technology	Operation name:	Advanced Options of Surface Paths Pattern	
Morph between two adjacent surfaces	5X_MS_faces5	Generate tool path front side	
CoordSys Geometry	Geometry	First surface tool path tangent angle: Second surface tool path tangent angle:	0
	faces5		Cancel
Tool axis control Gouge check Gouge check Roughing and More Motion control	Start edge surfaces	Number of cuts:	1
Misc. parameters	End edge surfaces faces7 • . Show	Extend/Trim	
n	Drive surface offset: 0	D Boundary	
	Advanced	Round corners	



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Click Advanced.

Select the Generate tool path front side.

Click OK.
Click Save & Calculate.

echnology	Operation name:	Template
Morph between two	5X_MC_faces3	🗖 🛱 📃 🛄
boundary curves		
🕀 CoordSys	Commenter	A
Seometry	Geometry	Area
Tool	Drive surface	· / // .
		Full, start and end at exact surface edges 🔹
Tool path parameters		
	Show	Margins
Default Lead-In/Out		
Tool axis control	Start edge curve	Number of cuts: 1
Gouge check		
Clearance data		
Roughing and More	Show	
Motion control		Extend/Trim
🕂 Misc. parameters	End edge curve	
4	🖉 🔲 contour5 🔻	Angle range
	Show	D Boundary
	Drive surface offset: 0	Round corners
Save Save & Calculate	Simulata CCodo	Cove & Coov

Click **Simulate** once the tool path is calculated.

The simulated tool path looks like this:

A lot of unwanted areas can still be seen in the tool path.



Click the exit icon to return to the Operations Manager.



Click Margins.

echnology	Operation name:	Template	ividi gili s
Morph between two adjacent surfaces	5X_MS_faces5	🖬 🚔	Start margin: 0.5
CoordSys CoordS	Geometry Drive surface faces5 Show Start edge surfaces faces6 Start edge surfaces	Area Type: Full, start and end a Margins Number of cuts:	End margin: 0.5 Advanced parameter for margins Additional margin to overcome surface edge inaccuracies: 0.03 Ø Add tool radius to margins OK Cancel
Roughing and More Roughing and More Motion control Misc. parameters	Show End edge surfaces Show	Extend/T Angle ran	Trim 19e
k	Drive surface offset: 0 Advanced	2D Bound Round corr	ners



Click OK.

Click Save & Calculate.

Click **Simulate** once the tool path is calculated.

The simulated tool path looks like this:



The tool path still has some problems which we must fix.

Click the exit icon to return to the Operations Manager.

simulation		9	X	
2D Rest Ma	terial	Soli	dVerify	1
RapidVerify	Solid	erify fo	or 3D	ĺ
Machine Simulation	Host	CAD	3D	į
Show data	Sh	iow to	ol	
Hidden lines				
Show tool frequency	: 1			
Stop on next	lear	Colo	rs	
Simulation speed				
	1 1	1 1	Ó	
⊪ ► =	M	► I	A	
		-		-

This problem is the result of a wrong tool axis control & we need to change the type of tool axis control to fix this issue.

🐑 C

Click Tool axis control.

echnology	Operation name:	Template
Morph between two adjacent surfaces	5X_MS_faces5	🖬 🖻 📃 🔍
CoordSys	Output format:	Interpolation
Levels	JANS V	Max. angle step: 3
Tool axis control	Tool axis direction: Tilted through curve	Angle range
Clearance data	Curve tilt type:	Tilt curve
Motion control Misc. parameters	Angle from curve Advanced	▼
	Angles	
	Fixed tilt angle: 0	

Select Tilted through curve as the Tool axis direction.

 \uparrow Select the feature manager design tree.

- Select Tilt Curve—Morph 2 Srf.
 - 🕥 Click 🧉 to unhide the surface.





 \bigcirc

Select Closest point as the Curve tilt type.

Click the new icon under **Tilt curve**.

echnology	Operation name:	Template
Morph between two adjacent surfaces	5X_MS_faces5	. ÷
CoordSys Geometry Tool	Output format: 5 Axis	Interpolation Max. angle step: 3
Tool path parameters	Tool axis direction:	Angle range
Gearance data Roughing and More Motion control Misc. parameters	Curve tilt type: Closest point Advanced	Tilt curve
	Angles Fixed tilt angle: 0	

Select the highlighted curve. P





Click Save & Calculate.

The following error displays:



This is because the tilted through curve strategy does not allow gouge check using the tilt tool as the tilt is being generated by the curve and cannot be changed by the gouge check strategy.

To fix this issue, click **Gouge check**.

Deselect the **Enable/Disable** check box on the Gouge 1 (Which is using the Tilting tool with max angle).

echnology	Operation name:	Template	
Morph between two adjacent surfaces	5X_MS_faces5	-	
🖓 CoordSys	Gouge 1 Gouge 2 Gouge 3 Gou	uae 4	
Seometry		-31	
		Geometry	
Levels	Holder		aces
Tool path parameters			
	Arbor	√ Check sur	faces
Default Lead-In/Out			1-
I ool axis control	✓ Tool shaft	Use STL f	le
Gouge check	√ Tool tip	Check surfa	ces 1
			faces8 👻
		C Chow	
Misc. parameters		Show	
	Strategy		
	Tilting tool away with max. angle	. •	
		Charle ha la su	0
		Stock to leav	B;
		Tolerance:	0.01



The simulated tool path looks like this:



You can see that the tool path is much better with this strategy now. Let us now run the machine simulation.





End of tutorial