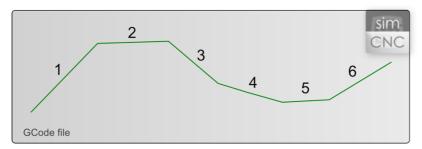


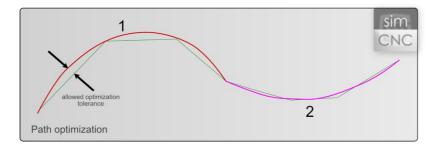
Trajectory optimization and segments joining in constant velocity mode (CV)

1. Input data, segments from a G-Code file:



In the example above, we see 6 segments of linear-type motion (G1).

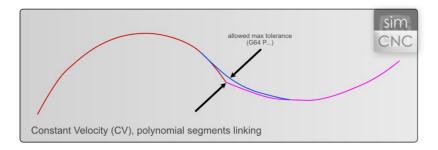
2. Initial trajectory optimization and preparation for CV mode, i.e. optimization of curves:



At the optimization stage, the 6 input segments were replaced with two arcs. The "smoothness" of the trajectory has been improved, including the maximum allowable deviation from the input data. The algorithm can create arcs in 3D space. The tolerance can be set separately for X, Y, Z and A, B, C axes.

General	MotionPla	inner S	special I	0	FRO/SRO	Homing	order	Axes	Modules	Spindle	MPG	THC	PyActions
General													
		Default	Precisi	on		1.0000				mm			
		Look Ah	head Le	ngth		200				Segments			
		CV Stop	p Angle			45.00				•			
	Γ	Curve (Optim P	recisi	on (XYZ)	0.020				mm			
		Curve C	Optim P	recisi	on (ABC)	0.020				mm			
Tangential	Avic												
Lift-up		Tangentia 35.00	al Axis E	nable	•								
	o Angle 11 o Position 5	35.00	al Axis E	nable	2								
Lift-up	o Angle 11 o Position 5	35.00		nable	•			G30					
Lift-up	o Angle 11 o Position 5	35.00					×	G30 0.0000					
Lift-up	o Angle 11 o Position 5	35.00	x	328	90		X	0.0000					
Lift-up	o Angle 11 o Position 5	35.00	x [Y [€28 0.000	0		Y	0.0000					
Lift-up	o Angle 11 o Position 5	35.00	x [y [z]	\$28 0.000 0.000	00		Y z	0.0000					
Lift-up	o Angle 11 o Position 5	35.00	X Y Z A	€28 0.000 0.000 0.000	10 10 10 10		Y Z A	0.0000 0.0000 0.0000					

3. At the connection point of the two segments that resulted from the optimization, there was a sharp point that would force the deceleration to the speed of V = 0 at this point to change the direction of movement. Constant velocity mode calculates vector curves joining the segments during machining to allow smooth movement without stopping.



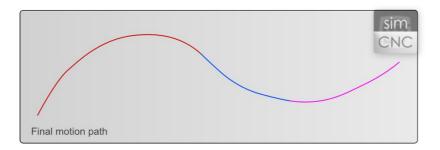
In the picture above, you can see the blue segment that connects the other two. The maximum deviation allowed when joining segments is set by the G64 P... command. For example, G64 P0.5 will allow a maximum deviation from the vertex of 0.5mm (or inch, depending on the units selected). If the machining speed and settings of drives allow it, the joining segment will be created with greater accuracy than the given maximum deviation. You can also set the default tolerance value in the simCNC settings. It will be set after starting the simCNC software. However, you should remember that if we load a file that sets a different parameter value, and then a file that does not contain the G64 command, it will be executed with the last set tolerance. Therefore, it is best if each file contains the G64 command and sets the desired tolerance.

General Motion	Planner Sp	pecial IO	FRO/SRO	Homing order	Axes	Modules	Spindle	MPG	THC	PyActions	
General											
	Default	Precisio	n	1.0000			mm				
	Look Ah	nead Len	gth	200			Segments				
	CV Stop	p Angle		45.00			•				
	Curve O	Optim Pr	ecision (XYZ)	0.020			mm				
	Curve O	Optim Pr	ecision (ABC)	0.020			mm				
Tangential Axis											
	Tangentia	al Axis Er	able								
Lift-up Angle	Tangential	al Axis Er	able								
Lift-up Angle Lift-up Position		I Axis Er	able								
		I Axis Er	able								
		al Axis Er	able								
Lift-up Position		ıl Axis Er	able								
Lift-up Position			able		G30						
Lift-up Position		G		x	G30 0.0000						
Lift-up Position		G X 0	28								
		G X 0 Y 0	28 0000	Y	0.0000						
Lift-up Position		G X 0 Y 0 Z 0	28 0000 0000	Y z	0.0000						
Lift-up Position		G X 0 Y 0 Z 0 A 0	28 0000 0000 0000	Y Z A	0.0000 0.0000 0.0000						

It is also worth paying attention to the "CV Stop Angle" parameter, which allows you to specify the angle below which the CV mode will not generate joining segments. As a result, there is an exact approach and processing of the vertex.

The angle specified in the parameter is a oblique angle, i.e. less than 180 degrees.

4. The resulting trajectory



The picture above shows the resulting motion trajectory. Curve optimization reduced the number of segments and smoothed the shape, while CV mode added a smooth transition between the segments to allow for quick and smooth movement.