

# SINUMERIK live: Milling of freeform surfaces with a 3-axis milling machine

Principle and application with SINUMERIK Operate



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# Freeform surface machiningDefinition

**The freeform surface** is a surface whose shape is (only roughly) defined, e.g. by control points (to be approximated) and boundary curves (to be interpolated). The term pertains to geometric data processing.

Generally, as few axes as possible should interpolate during machining (process control, risk of collision, etc.). For the machining of freeform surfaces, 5-axis simultaneous machining is not necessary in most cases. In the so-called 3+2 mode, the axes are positioned (swiveled to a defined degree position) and then 3-axis simultaneous machining is performed.

See video: SINUMERIK Live - "Multi-sided machining milling 3+2 axes"





## CAD-CAM-CNC process chain

- a matter of surface quality





#### **CAD-CAM-CNC process chain** - the output by the postprocessor (example NX)



The quality of the CAD-CAM process chain output has a significant influence on the workpiece quality when machining freeform surfaces.

#### **CAD-CAM-CNC process chain** - the best possible point distribution



#### Workpiece quality

Even the best CNC cannot compensate for a poor quality point distribution in the NC program!

High quality workpiece surfaces can only be produced with a harmonious point distribution.



#### High Speed Setting cycle - CYCLE832 - all in one

Machining / dynamic response - Top Surface / Top Speed / Top Speed Plus / contour tolerance

**The function "High Speed Settings" CYCLE832** is used to preset data for the machining of freeform surfaces so that optimum machining becomes possible.



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#### Look Ahead and CNC block compression - The two basic components of Cycle832

**Top Surface stands for intelligent motion control** for optimum workpiece surface at maximum machining speed and is made up of two basic components: the Look Ahead function and CNC block compression.



- Predictive modal speed profile at the greatest possible speed
- Definable rounding of corners

#### **CNC** compressor [COMPSURF]



- Grouping of CNC blocks (G0, G1, G2, G3) into 5th-order polynomials (NURBS) within a defined tolerance band
- Generation of smooth paths with constant curvature

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#### **Top Surface / Top Speed Plus**



- **Top Speed Plus** is an application-specific adaptation.
- Top Speed Plus is available after selecting Top Surface and must be set up by the machine manufacturer.
- With Top Speed Plus, position setpoint filters are used in the CNC SINUMERIK 828D / ONE to increase productivity.



#### **CNC** memory

- freeform surface programs on any storage media

Freeform surface programs can be stored in the CNC user memory (observe the storage limit!) as well as preferably on any external storage media.





## The SINUMERIK Program Manager

- unrestricted access to all storage locations

#### The SINUMERIK Program Manager allows unrestricted management, editing and executing of freeform surface programs on any storage media.



### Interrupt point and block search

- fast re-entry into large programs

A highlight is the so-called interrupt point.

In the event of a reset, a power failure or other program termination/failure,

work can be continued/restarted without any problems at the point where the failure occurred. This is done by means of block search mode.

This block search leads to a significantly accelerated re-entry into the machining process.

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# **I hank you very much** for your attention

 In freeform machining, mainly 3 or 5-axis milling machines are used, which usually operate in

3-axis simultaneous mode.

- An important success factor in tool and mold making is mastering the complete CAD/CAM/CNC process chain.
- With the "Top Surface" and "Top Speed Plus" options, which require a license, Sinumerik offers new functions that provide optimum technologies for machining freeform surfaces.
- With the current SINUMERIK portfolio, Siemens offers perfect solutions for CNC applications in tool and mold making.

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