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Companies in manufacturing-intensive industries use Tebis software to organize their CAD/CAM process chains, thereby creating a robust and reliable platform. Tebis CAD/CAM and Viewer stations have become established as essential elements in high-efficiency manufacturing process chains, particularly in the automotive, aerospace and industrial manufacturing sectors. Tebis workstations can be smoothly integrated into design departments’ existing CAD infrastructure, and Tebis supplies the machines with safe NC programs required to manufacture the components.

The CAD interfaces let you import CAD models from almost any CAD systems. All interfaces are designed to process components of any size. Depending on the format, the system copies over geometrical information and structural information such as assembly, layer, filter, feature and color data.

The CAD analysis functions in the Tebis Base setup analyze imported data sets for manufacturing-relevant problem areas. The system helps you comfortably repair any shortcomings found. The CAD design modules in Tebis were designed for specialized manufacturing tasks. As a result, your manufacturing technology can be constructively integrated in an uncomplicated and time-saving way. That includes resources, such as dies and injection molds, as well as data control models, function models, prototypes and low-volume parts. High-quality Tebis surfaces technology can be used to create surfaces from FEM and STL meshes, optimize existing surfaces for quality and edit them for their technological objective, such as overbending for example. For more safety and higher-quality manufacturing results, use the Tebis CAD functions to generate run-off, extension and protection surfaces and structure components by milling and stop surfaces.

**Die manufacturing**

Getting to die release more quickly with Tebis CAD/CAM software: Fast and reliable processes, from surface design and NC machining of all shaping and structural parts of the die and through the try-out cycles.

**Mold manufacturing**

Mold manufacturing with optimized manufacturing processes. You stay in one system environment, from CAD design, 2.5D machining, hard tooling to electrode design and manufacture. NC programming of wire EDM machines also takes place in Tebis. Tebis Simulator systems support manufacturing planning and validation, and Tebis Viewer stations provide support for tool assembly.
Tebis CAM modules create safe and run time-optimized NC programs from users’ tested and saved strategies and input parameters. Tebis supports the manufacturing processes 2.5D drilling and milling, 3 to 5-axis roughing and finishing of surfaces, contours and tubes, 5-axis laser cutting, 5-axis trimming and 4-axis wire EDM. The integrated tool library, saved machining templates and realistic simulation options generate process-safe NC programs that are easy on your tools and require little programming work and minimal run times on the machines.

You can use the configuration options in Tebis to standardize manufacturing processes tailored to suit the customer, and thus automate them. A variety of libraries are available to manage the milling and drilling tools, electrode holders and blanks, machining features for drilling and milling and machining templates for standards and repetition parts. There are also virtual machine models and approach and retract macros for milling.

The shop floor products further tighten up and safeguard your manufacturing processes. For example, using the Tebis Viewer systems you can eliminate time-consuming 2D drawing for documentation and manufacturing purposes. Using Simulators with their virtual machine models will produce high savings potentials in NC programming and in machine manufacturing because the available target machines and their kinematics and workspace limitations can be taken into consideration right from the start.

The CAQ modules then provide computer-supported quality control in Tebis format. That enables targeted insertion of measurement points onto CAD models, such as electrodes, that can then be verified on coordinate measurement machines. That determines the mismatch compensation values that must be used when the electrode is used in the subsequent EDM process.

Modelling and prototyping

Use Tebis CAD modules to quickly develop high-quality surface models from digitized manual models. Tebis supports all subsequent design and manufacturing tasks with CAD modules for surface design and 3 to 5-axis milling.

Aerospace and industrial engineering

Feature-based NC programming saves enormous amounts of time and increases safety. For complex components, the simulation options integrated into the CAM process provide additional safety and much reduced lead times.
Tebis software helps optimize processes.

Effortless handling of surfaces and meshes in each phase of the process chain

The underlying Tebis hybrid technology lets you combine mesh surfaces (STL, FEM) and exact surfaces into any combination of element structures and further process them, for example when you have to digitize intermediate stages in the die manufacturing try-out process. Tebis makes it easy to generate exact surfaces from mesh surfaces, resulting in complete, high-quality surface models that other designers can further process.

Feature technologies enhance design standardization and manufacturing automation

Designers use features to assign technological definitions to certain geometry elements and areas such as “M12 tapped hole” and “standard pockets.” Such feature objects are either copied through an interface from a prior CAD system or automatically detected in Tebis with the aid of a geometry scanner and placed, with database support. This allows you to realize a higher level of standardization in design but also ensures significant advantages in manufacturing, as each feature includes all information needed to produce it. The feature-supported NC programming is thus automatic and takes into account all necessary tool changes, including full collision protection.
Tebis machine simulation: High process safety and minimal lead times

Manufacturing planners and NC programmers use the Tebis Simulator to clamp their components on virtual machines. They use it to image complete machining processes — long before the actual machining, and even for multiple NC machines. You can run virtual feasibility tests for your manufacturing department, provide support for job cost planning and increase process safety with visualization, testing and optimization of your manufacturing processes.

The Tebis Simulator accesses a virtual machine library containing detailed views of all NC machines in your own manufacturing department as well as your customer’s. In addition to geometric dimensions, the library also stores kinematic conditions such as axis limit switches and travel during tool changes and positioning movements. This lets manufacturing planners, NC programmers and machine operators run through the entire manufacturing process on virtual machines. If collisions and limit switch triggers are detected, the system lets you make appropriate changes to the clamping arrangement or tool and recalculate modified NC jobs.

Tebis Viewer: Paperless communication for the very latest information

Tebis process chains have eliminated the derivation of 2D drawings almost entirely for documentation and manufacturing purposes. This saves a substantial amount of the time it takes to design molds and dies. Even production planners no longer document calculated NC programs on paper, which also speeds things up a lot. At the heart of Tebis process chains are the Tebis Viewer systems, which transfer all CAD and NC information to every station along the production process chain. Everyone involved, from NC programmers and machine tool operators to installers, can view the very latest information they need right on Tebis Viewer stations. In the end, even job cost planners benefit from the powerful analysis functions available on the Tebis Viewers.
Leverage knowledge with individual configuration options

Tebis software was developed to allow processing of both unique special projects and repetitive standard jobs in a manufacturing compliant structured manner. If it turns out that certain CAD/CAM processes are repetitive, you can increase throughput time and process safety enormously if you save the methods you have tested in your CAD/CAM system and have them available as templates. Tebis will support you with individually configurable model templates, NC job lists and a variety of configuration databases.

Model templates as start models

For different component classes, you can use layers and filters to predefined structures and create entire NC job lists in advance according to a standardized process. You can also redefine which centrally saved configuration databases the actual Tebis model file should link to. Depending on the job and the customer, you can thus use different model templates to define the feature, NC set, tool and machine libraries to which the Tebis model file should be linked.
Configuration databases

In TEBIS, what are known as libraries are available for a variety of objects and processes that can provide enormous savings when used in methodical NC manufacturing:

- Feature library for putting drilling and pocket objects into CAD models
- Electrode holder and blank library for deriving electrodes for injection molding tools
- NC set library for generating NC programs fully automatically for repetitive machining sequences
- Tool library for realistic descriptions of tool assemblies and tool components
- Machine library for taking the machine and the clamping position into consideration for NC programming and machining
- Tool set library for managing tool change magazines

NC job lists

In each model file, TEBIS creates an NC job list in which all the NC machining steps are saved with all the necessary tools and all the area selections and parameter inputs. Toolpaths calculated on this basis will always retain their NC job reference and can be recalculated immediately after any changes to the parameters. Another advantage: NC job lists can be copied to components of similar type. The machining structure already worked out is thus quickly and easily copied to a different component, enormously reducing programming time.
"CAD plus CAM" technology ensures highest quality and flexibility in NC manufacturing

Efficient production planning and scheduling is possible only if NC programmers also have powerful analysis and CAD functions. Production planners use Tebis stations to analyze imported data sets for problems and repair any problem areas quickly and precisely. Add-on, extension and protection surfaces are generated to enhance reliability and improve the quality of milling results, while the parts are structured according to cutting and stop surfaces.

Tebis hybrid core supports surfaces, meshes and solids

Tebis designers work both with digitized STL surfaces and FEM meshes and with polynomial surfaces created or imported via curves and interfaces. The Tebis hybrid technology enables both. Imported solids are kept together in a structured fashion as topological composites. In principle, in Tebis all the surfaces can be machined and optimized in a targeted way that allows them to be converted to solids immediately in the target system.

Wire frame technology provides the highest surface quality with minimum work

The wire frame technology integrated into the RSC module (Rapid Surface Creation) makes the handling as easy as possible while ensuring low-segmentation surfaces with constant tangents and minimum gaps between the individual surfaces. Use the wire frame to comfortably create surfaces on predefined meshes. It also provides targeted quality optimization of surface models.

Special time-saving functions for tooling design

Tebis CAD stations provide a wide range of specialized design functions for constructively incorporating manufacturing technologies, including fillets, component partitions and draft angles in casting as well as overbends, radius reductions and trim line developments in sheet-metal working.

Tebis also has an automated solution for designing electrodes in mold manufacturing. If geometric or economic considerations make it impossible to use milling technology, EDM electrodes can be derived quickly and easily.

Tebis RS C turns digitized surfaces into high-quality surface models.

The Electrode Design module is used to derive and manage electrodes from the part geometry.

With the wire frame, you can administer your surface models with a graphically interactive user interface in Tebis.

Extremely useful automatic functions are available for deriving dies and molds from the part geometry.
Every Tebis workstation comes with a comprehensive range of useful functions and commands no matter which modules are installed:

- Wire frame model design: Do all design tasks necessary to create wire frame models. Create limiting and guide curves as well as auxiliary elements such as planes and axis systems in preparation for milling. Use edit functions to move, rotate, trim and limit existing curves and surfaces.
- Analysis: Evaluate design quality, determine modified areas with the distance analysis function, look for undercut areas with the slope analyzer and check entire components for fillet surfaces and planar areas.
- Navigation: Use the structure tree to display component areas individually or in groups, create new layers and filters and modify their contents. The toolbar lets you control component animation and determine whether to display the CAD model with shading, with the lines hidden or as a wire frame model.
- Documentation: Use the documentation functions to send views and sections to the printer or plotter and write them to files.
- System settings: The Base module provides an extensive configuration mode, where you can set individual parameters in Tebis, such as the graphic display of geometry elements, the selection performance and automatic name assignments.

**TEBIS BASE:**
Generating and modifying wire frame models. Analysis, navigation and documentation.

The curve functions are used to create all kinds of wire frame constructions, such as milling area boundaries.

Display individual component areas with the structure tree.

Display large components in “hidden line” mode for greater clarity.

Documentation functions for printing and plotting.

Analyze design quality with the quality function.

Analyze changes with the distance analysis function.

Analyze fillets with the radius analyzer.

Analyze undercut areas with the slope analyzer.
As the CAD/CAM systems available on the market become increasingly specialized, powerful interfaces are now more important than ever before. The ability to exchange data smoothly has become a central consideration in deciding who gets a contract.

Tebis provides a number of standard and direct interfaces that allow data to be exchanged efficiently in both directions. They allow the 1-on-1 transmission of both geometric and structural data, including assemblies, layers, sets, filters and color information. Data can thus be transmitted effortlessly and without losses via the Catia® and Unigraphics® native interfaces versus outputting the original data in a neutral format.

All interfaces are designed to import and export components of any size. You have the option of optimizing the original data set with intelligent filters when you import it.

The following Tebis interfaces are available:

- Catia® V4 direct interface
- Catia® V5 direct interface
- Unigraphics® direct interface
- Pro/E® direct interface
- VDAFS standard interface
- VDAIS standard interface
- DXF standard interface
- STL interface

Tebis provides a number of standard and direct interfaces for the exchange of data in both directions.

The CAD data of molds and dies of any complexity is analyzed and compressed as it is being imported. The system can handle data of any size.

CAD models that have been imported via the Catia® V4 direct interface retain their original colors and filter structures when displayed in Tebis.

Tebis imports Catia® V5 product/part structures 1:1.
The Surface Design module provides a comprehensive package of functions for generating and editing surface geometries. They can be used for creating a wide range of entities, from standard 3D surfaces (such as spheres, cylinders, cones and shift or rotation surfaces) to high-quality blending, fill, offset and fillet surfaces.

Combined with the wire frame model functions that come with the Tebis Base, this module lets you construct surfaces of any complexity that meet the strictest quality standards. Whether you want to transfer existing geometry templates from another CAD system, design from drawings or just give your creativity free rein, the Tebis Surface Design CAD module gives you all the functions you need.

Modern and intuitive commands make it easy to create models, molds and dies. You can generate 3D standard surfaces as well as shift and rotation surfaces at the press of a button and construct free surfaces from curves and intersections. Surfaces and faces can be grasped and extended interactively. Tebis gives you interactive functions to construct fill and blending surfaces as easily as fillet surfaces with constant and variable radii. Powerful topology functions let you create component-wide BREP structures that provide enormous time and quality advantages when editing solids and preparing for milling.
ADVANCED SURFACE DESIGN:
Specialized high-end functions.

Depending on the design complexity of your work, you may need the additional capabilities of Advanced Surface Design. The module comes with powerful functions that help you easily perform highly specialized design tasks in both equipment design and milling preparation. For example, method planners use them to create global overbend areas and developments in sheet metal processing. Mold-makers construct complex parting surfaces and draft angles. Milling planners create run-off surfaces and close recesses with fill surfaces.

The functions of the CAD add-on module are ideal for designing technological aspects into the component. They let you compensate for springback in sheet-metal parts and shape trim curves to prior stages of deformation. Fillet surfaces are automatically reduced up to a sharp edge to improve flow in the die.

Multiple-component surface extension functions let you quickly and easily create parting surfaces and draft angles for foundry and injection molding work. Free surfaces can be infinitely shaped and connected tangentially to adjacent areas.

The Tebis wire frame and surface design functions help you perform complex design work completely, quickly and easily without having to switch CAD systems.
DIGITIZED DATA PROCESSING:
Digitizing surfaces and optimizing STL meshes.

The Digitized Data Processing module gives you CAD tools for further processing optically or mechanically digitized surfaces. They close gaps, tighten and smooth surfaces, bend and trim them to curves and generate closed mesh models that you can scale as needed. This gives you a very powerful software for quickly transferring an existing physical object to the CAD world, modifying it there and preparing it for rapid surface design or NC programming.

Tebis imports your original digitized data from a variety of sensor systems along with any precalculated STL files, turning them into high-quality CAD mesh surfaces that you can process further as you wish, using Tebis editor functions.

The Tebis hybrid technology permits any combinations of the mesh data with polynomial surfaces. You’ll benefit from the greatest possible degree of flexibility: you design with meshes wherever these elements are useful. Wherever necessary, you can add exact surfaces via sections or using the RSC CAD module.

To convey mesh models or hybrid models consisting of meshes and polynomial surfaces to the real world quickly and precisely, just use the Tebis CAM modules, which work on mesh and hybrid models as efficiently as they do on surface data.
RAPID SURFACE CREATION (RSC):
Easy generation of high-quality surfaces.

The Rapid Surface Creation CAD module is used to quickly produce high-quality surface models from existing mesh data that you either prepare with the digitized data module or import via the STL interface. Design model makers can derive from digitized manual models CAD surface models that will meet the requirements of downstream design departments. Die makers use RSC to reintegrate try-out changes into the CAD cycle.

Tebis RSC creates and updates surface elements within the RSC topologies fully automatically. Users merely have to predefine the structures for the surfaces. They do this using the wire frame they create and optimize with various aids. After making manual changes to a part that was produced with CAD/CAM methods, the existing surface structures can be transferred to the latest mesh model from the primary CAD design. Particularly advantageous: Tebis supports trimmed surfaces, which has positive effects both on the work required to generate the surfaces and on the surface quality. Users use the wire frame and permissible offset tolerances to control the degree and segmentation of surfaces produced and their tangential conditions. Analysis functions reveal problems in the surface run, which can be quickly optimized simply by modifying the wire frame.

The edges of the wire grid are created in part automatically by evaluating the curvatures and in part using the graphic interface with the aid of the drawing functions.

Because Tebis supports trimmed surfaces, downstream designers are happy to accept its results.

After manual changes, Tebis RSC projects the original surface structures onto the digitized surface and generates an updated surface model.
The electrode design CAD module gives designers and NC programmers in mold manufacturing a software tool for deriving the necessary burn areas for EDM electrodes and turning them into complete electrodes with access to blank and holder libraries without requiring any prior specialized knowledge of design or CAD techniques.

Analysis functions show the areas requiring further erosion after milling. Libraries for electrode blanks and holders are available for electrode design. EDM simulation tools let you check critical movements and detect possible collisions with the electrode base and holder. Functions for managing parts lists and documentation enable users to maintain clarity even when working with many or complex electrodes, and to make sure that electrodes are complete.

A Tebis CAD/CAM workstation offers enormous advantages for the overall process in electrode design. Every step is more efficient and reliable, from design and milling to EDM itself.

The residual stock function identifies areas that need to be eroded. A color code shows the stock thickness after milling.

The electrode will automatically be designed ready for production. Blanks and holders can be taken from database libraries. The system stores all specifications for automated design, such as usage location, dimensions and holders, in the design assistant.
Use the CAD module for Feature Design to design standardized geometry objects into tools and molds. For that, Tebis provides its own feature library in which these parametric manufacturing objects are administered. Every version of each feature is described precisely, both geometrically and technologically. Helpful functions let you place features in the component and adapt them to the local conditions. When importing component geometries, Tebis automatically scans and evaluates areas that can be described by feature objects. But the greatest benefit of Tebis features is from the way they automatically transport all values and information all the way through to the NC machine.

Feature design with Tebis accelerates and simplifies CAD work. You can copy manufacturing information from prior CAD systems in the form of features. That clearly documents in the CAD model what has to be manufactured. The features contain all geometrical and technological parameters for the manufacturing task, such as: M10 threaded blind hole, 25 mm deep, or 25 x 8H7 slot, 5 mm deep. This data will no longer have to be detailed in drawings for manufacture. Tebis also quickly and reliably detects the feature-relevant geometries in any imported data and places features there. This also functions with 2D drawing data.

The feature technology is useful not only to designers, but in manufacturing as well. In subsequent NC programming work, NC programs can be automatically calculated for feature objects without any further intervention on the part of the programmer.
Calculating NC programs directly on the CAD surfaces, including mesh and mixed data

The surfaces produced with Tebis CAM modules meet high quality standards because Tebis always calculates the toolpaths on mathematically precise CAD surfaces. Tebis uses simplified mesh models only when no exact surfaces are available in which case the system calculates NC programs on the basis of mesh and hybrid models as well.

Reliable, efficient machining with integrated tool management

Each NC program generated in Tebis is calculated on the basis of the underlying tool geometry. In addition to cutting dimensions, the internal tool library in Tebis also includes all holder components. That lets you reliably avoid holder collisions and define optimum tool lengths and approaches. For each cutter, Tebis manages not only the geometric data, but also the cutter material and material-specific parameters (feed rates, speeds).

High-quality simulation technologies enhance process reliability and minimize lead times

Tebis simulation tools can predict real production sequences as early as the NC program calculation stage. For example, the selected cutting tool can work the component plane by plane on the machine. Virtual production tracking shows the blank as it gradually takes on the shape of the target geometry, always knowing where and how much stock still remains on the part. The advantages for you are less idle travel and dramatically shorter run times. Not only does this prolong tool life, it also increases process reliability.
2.5D DRILLING AND MILLING:
Fully automatic, knowledge-based NC machining.

Typical application areas for this Tebis CAM module in die manufacturing include planar surfaces, seating surfaces, and fit and tapped holes for attaching trim steels to sheet metal dies. Mold manufacturers use the module for machining all kinds of pocket and planar surfaces as well as holes, such as step or deep-drilled holes for cooling and heating systems. But industrial and aerospace engineering are also typical application fields.

Use the drilling functions to program NC programs for bore holes, threads and fits. You can use the milling functions to create individual NC programs for pockets and planar surfaces and for vertical contours and their residual stock machining. With the feature technology, the functions will copy over all the geometry information with a single click of the mouse.

Effective and safe automation

NC set technology provides special advantages for 2.5D NC programming. The system accesses old machining sequences (NC sets) that were defined in the past by milling specialists and have been saved to a central location. The NC sets bundle individual functions for standardized machining steps such as multi-stepped holes, taps and pockets, including all necessary tools and the optimum cutting parameters. If the CAD model contains features (parametric manufacturing objects), NC programming can take place completely automatically because each feature will find the NC set defined for its manufacture. This will result in enormous reductions in NC programming work while increasing safety.
The calculated intermediate geometry (left) is used as a new blank geometry for remachining. The material thickness analysis localizes the areas (red) where too much stock still remains.

Tebis roughing involves removing stock from a user-defined blank plane by plane from top to bottom, thereby approaching the desired target geometry in a terraced representation. The virtual tracking function lets you see, as early as the program calculation stage, exactly what the part will look like on the real machine.

As early as the NC program calculation stage, Tebis generates the same intermediate geometries, plane by plane, that you get when machining with the selected milling tool in the real world. By doing this, the system continuously updates the original blank geometry. As a result, Tebis always knows how much material remains and where it is located, thus dramatically reducing idle travel and therefore also run times.

Intelligent algorithms also make sure that contour characteristics are gradual and gentle on the tool, enabling you to mill at very high feed rates. Depending on the tool contact, Tebis outputs different feed rates, reducing the feed rate when making a full cut for example. As a further advantage, continuous collision protection is run on current machining states and not only the target geometry to be achieved.

Material thickness analysis for efficient remachining

The intermediate geometries calculated by Tebis also provide information about the thickness of the material remaining on the target geometry. This function quickly, reliably and precisely finds the sites in the component that still contain too much material. And that makes possible extremely efficient strategies such as machining with large milling tools and high cutting capacity, coupled with remachining programs that are applied only to the areas where material still remains.
The 3+2 Axis Finishing CAM module is ideal for semi-finishing, finishing and HSC milling of 3D surfaces as well as contouring and corner picking.

Tebis supports all cutter types, from scriber, ball-end and torus cutters to end mills. Multiple milling strategies are available for each machining function. Tebis calculates the toolpaths either automatically or with interactive intervention. The system automatically determines the cutting zone limits and divides the component according to topological criteria. The result is a collision-checked NC program that meets the strictest quality standards. Special HSC parameters are available for calculating NC programs that are used in high-speed milling applications.

Unlimited component size and complexity

This module lets you easily produce core and cavity molds, taking material thicknesses and stock allowances into account. The components can be of any size and complexity. All NC programs – including infeed motions – are checked for collisions as early as the calculation stage.

The right machining strategy for the very best results

Tebis offers all the milling strategies that die, mold and pattern manufacturers need. Thus, NC programmers can choose the right strategy, “axis-parallel”, “curve-parallel”, “contour-parallel”, “z-profiling” and “isoparametric,” for surface finishing and HSC milling, depending on the component geometry and quality requirements. The automatic geometry analysis routines provide help in determining area and slope angle curves, taking the selected tool into account.

To improve surface quality, z-profiled toolpaths occur in steep areas of the component, while axis or contour-parallel NC programs are automatically calculated in shallow zones.

Tebis automatically calculates cutting zone limits for the selected tool. With the contour-parallel strategy, you can also use the localized zone limit as a guide element.
**3+2 AXIS RESIDUAL STOCK REMOVAL:** Field-tested strategies to reduce run times.

The combination of large milling tools and high cutting capacity, followed by small cutters for remachining, is the most effective way to mill surfaces. The Tebis 3+2 Axis Residual Stock Removal module locates the areas to be remachined and automatically calculates the necessary toolpaths.

To use this strategy the system must reliably detect the component areas that a larger milling tool was unable to reach.

This Tebis module is the ideal tool for this purpose. It helps NC programmers remachine specific fillets and other concave recesses. When determining the residual stock zones, Tebis takes the cutting-edge geometries as well as the preceding and following tools into account. The system accepts end mills as well as torus and ball-end cutters.

**The right strategy for perfect surface finish**

You can use different strategies to machine residual-stock zones, such as milling along the fillet in shallow areas and bump-cutting in steep regions. Tebis makes a distinction between flat and steep areas according to on the limit angle entered. Depending on the component steepness, an axis-parallel, contour-parallel or z-profil ing strategy can be selected for milling corners and grooves. For contour-parallel machining, the system automatically uses the previously determined area limit as the boundary contour.
3+2 AXIS TUBE MILLING:
3-axis machining of bent intake and exhaust ducts.

Tebis V3.3 was the first version to provide the Tube Milling CAM module for milling bent intake and discharge ducts. The key feature of this module is that it generates 3-axis roughing and finishing paths for key and ball-end cutters. The special geometry of these cutters enables complete processing of curved tubes.

Tubes that are particularly long with sharp bends are divided into two sides for machining purposes. The tubes can be machined either horizontally or vertically using climb cuts, conventional cuts and lacing techniques. Horizontal machining produces a helical path with the down-cutting and up-cutting strategies.
5-AXIS SIMULTANEOUS MILLING:
The fastest way to achieve smooth surfaces.

The Tebis 5-Axis Simultaneous Milling module lets you machine certain surface and curve steps faster and more accurately than with the 3-axis technology. 5-axis NC programs are no more difficult to calculate than those in the 3+2-axis modules, since they implement the same user structures. In milling surfaces, this module is a good choice for both convex components and cavities. The collision check takes into account the holder components defined in the tool library.

Advanced strategies for three-dimensional trimming, engraving and surface milling

The curve machining functions calculate 5-axis programs for etching and engraving as well as cleaning the boundary areas of 3-dimensional sculptured surfaces.

Functions and strategies for roll and face-milling are available for surfaces. You can define stop and boundary surfaces to protect adjacent surface areas against contact with the tool. Toric tools and the use of approach and departure macros help you achieve ideal surface results.

NC calculations also take head geometry and machine kinematics into account

The system takes into account the tool being used, the head geometry and machine kinematics as early as the NC program calculation stage. Immediately afterwards, every calculated 5-axis NC program can be simulated in shaded real-time mode and analyzed for holder collisions.
After you define a component, the system will automatically create the supports and base plate for a clamping arrangement that fits it exactly.

You can use the interactive graphic user interface to change the approach of the laser head. This together with the extensive online analyses creates collision-free and consistent paths.

You can also check the NC programs later on for collisions with the cavity geometry and possible obstacles, and change them if necessary.

Tebis automatically detects radii and provides NC programs with G02 and G03 flags.

5-AXIS LASER CUTTING:
For try-outs, prototypes and series.

This CAM module is used to generate 2 to 5-axis NC programs offline for laser cutting applications. Using this software, you can trim auto body sheet metal parts for prototypes and series. Die makers use Tebis laser cutting stations to test drawing operations in the try-out phase to find out how to compensate for the springback behavior of the trimmed sheet metal parts.

5-Axis Laser Cutting provides both cutting functions for machining free curves and for generating regular geometric inner contours such as circles and slots. The system automatically monitors the machine’s kinematic properties such as tilting limits or preferred starting position during toolpath calculations. Users can jump in at any time however and manually define the head position and orientation. The system supports users with its comprehensive analysis functions for the rotation angle course, normal deviations and collisions. The Tebis NC jobs administer all change statuses and define mirrored, rotated or moved machining steps.

Semi and fully automatic collision checking

When the NC programs are calculated, the part and trim areas are automatically checked for collisions, taking the entire laser head into account. These collision checks can be extended to clamping elements. Tebis automatically determines where there is a risk of collisions with the component or another element and lets the user remedy the situation graphically and interactively.

Modifications added to the NC program at the machine can be read back into the NC jobs. That lets changes be edited in Tebis.
With the Tebis CAM module for 5-Axis Trimming, you can create 3- to 5-axis NC programs for trimming in offline mode. In doing so, you will move the teach-in process for your trimming steps from the machine to the virtual world of the CAD/CAM seat thus reducing costs and downtime.

The softwares’ application areas range from trimming vacuum-formed plastic parts to machining carbon and glass fiber-reinforced plastic parts and the use of robots for serial production. Tebis supports the machines of all the popular manufacturers.

**5-AXIS TRIMMING:**
For trimming components made of composite materials.

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**Graphically interactive follow-up treatment of NC paths**

Users can comfortably simulate and analyze calculated contours. The system automatically recognizes and graphically highlights areas with major rotational movements of the machine head or high lateral inclination just as it recognizes and highlights areas at risk for collisions. Powerful, graphically interactive functions are available for subsequent processing of the identified path areas.

**Switching to different machines**

Thanks to Tebis technology, the machining of components is no longer bound to certain specific machines. With the reverse processors, you can also machine jobs for which you have no CAD data on different machines. When switching machines, use the reverse processor to import already generated NC programs and export them as NC programs for a different machine type.

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The orientation of the machine head can be easily changed with the mouse. Together with the automatic analysis functions, this lets you define collision-free head orientations.

Machine head positions (yellow) are transferred into the NC program and imported into Tebis. The original approach vectors are displayed in red.

You can also re-import moved positions of shape elements that were defined as a cycle in the NC program.
The system also identifies 3D contours directly and without errors, using all their surface information.

Mold and die manufacturers already using Tebis to run their milling and who also count on Tebis when designing and manufacturing electrodes can now use the same CAD/CAM system to calculate and export their wire EDM programs.

4-AXIS WIRE EDM:
Sharp trimming of tool inserts and electrodes.

The CAM software for programming 2-axis and 4-axis wire EDM machines is a powerful technology package that specializes in the manufacturing requirements found in die and mold manufacturing. Because the application is integrated into Tebis, wire EDM programs can be calculated and output directly without extra interface runs. The interactive user interface lets even less experienced users quickly and effectively create optimum NC programs. The option of being able to access at any time a complete CAD system with fundamental design and analysis options has proven to be a considerable advantage, throughout the entire programming process.

Tebis has completely eliminated the often time-consuming task of assigning upper contours to lower contours in conical cuts and complex geometries and the sometimes associated counterfeiting of the actual design geometry. The reason: The NC paths are calculated directly on the underlying surfaces and solids, using the existing surface information.

Results in minutes thanks to intelligent template technology

A comfortable job browser helps users define their process sequences. You can select prepared standard sequences or access individual strategies for any conceivable machining task. In most cases, you will only have to assign a few parameters, such as bore hole and contour, and the Tebis software will take care of the rest by using pre-existing templates.

Fully integrated machine technology

Tebis software will manage all the technology parameters for nearly every machine currently on the market. It supports 20 NC controls with over 100 generator and software versions. If the machining process has to be switched to another machine, the system will generate the NC program for the new machine complete with all the technological parameters. In such cases, a fully automated conversion run will compute the new NC program and list any inconsistencies that may arise. Users can then eliminate them very easily using an interactive user guide.
**NC INTERFACE:**
Link between the Tebis toolpath and the NC machine.

Toolpaths that you calculate in Tebis are output to a machine and controller-specific format via the NC interface (PUT NC). CAM stations as well as NC Viewer and Simulator stations come with NC interfaces as standard equipment.

NC programmers or machine operators either define the machine-specific processor or they first export the NC program in a neutral format in which case it can be converted into a special controller format on a Tebis DNC station during subsequent transmission.

**Tool magazines and tool tables**

During NC output, the toolsets for calculated toolpaths are managed by tool magazines and tool tables. For example, a reference is established between tools from the tool library used for NC programming and the physical magazine positions of certain machines. You can then insert additional tools used for the toolpath into this magazine as needed. This enables machine-tool operators to maintain an overview of the equipment needed for their machines.

**Postprocessors**

Tebis provides a wide range of preconfigured postprocessors
- for 3+2 axis milling
- for 2.5D drilling and milling
- for 5-axis milling
- for 5-axis laser cutting

Special postprocessors are also available according to customer specifications. The “generalized” postprocessor can be used to generate any individual controller formats on the customer’s premises.
The Tebis modules for shop floor organization further tighten up and safeguard your project lead times. For example, using the Tebis Viewer systems you can eliminate time-consuming 2D drawing for documentation and manufacturing purposes. Using Tebis Simulators, with their virtual machine models, will result in extra savings potentials in NC programming and in manufacturing because the available target machines and their kinematics and workspace limitations can be taken into consideration right from the start. The Viewer and Simulator technologies also ensure that machine operators see more of their job and better understand the NC programmers’ preliminary work. They are also considerably more flexible when it comes to changes at short notice, for example when you have to switch to another machine.

Tebis shop floor solutions include four products:
- Viewer stations
- Simulator stations
- DNC stations
- Shop floor front ends

Modern process chains with paperless communications structures

Placing Viewer stations on the shop floor turns the digital model into the key information carrier. Paper blueprints and hardcopy instructions become increasingly rare as all personnel involved in the process use electronic media to share information. Tebis Viewer stations are ideally suited for studying views and cross-sections, taking measurements, simulating toolpaths and exporting them as NC programs for the suitable NC machine.

Virtual machines optimize cutting processes and minimize errors

Integrating Simulators into Tebis process chains gives you a realistic representation of all your machinery in the form of virtual machines and makes it available to NC programming and mechanical manufacturing. The Tebis Simulator makes clamping situations visible at an early phase. It also enables the realistic simulation of toolpaths with complete collision checking of all machine components, including limit switch monitoring; and thus it increases process safety. Subsequent changes to the clamping arrangement, head orientation and machining sequence, and switching tools and machines, increase your flexibility and lead time speed on the shop floor.

Supplying NC machines via the Viewer, Simulator and DNC stations

All Tebis software products for use on the shop floor are designed to supply NC machines with NC programs in the right format. This is made possible by the universal Tebis postprocessing concept, which is integrated into CAM workstations as well as Viewer, Simulator and DNC stations.

NC program calculation, including directly on the machine (WOP)

Equipped with CAM modules, CAM stations can be used in close proximity to the machines. Working in combination with Tebis DNC, you can directly assign such a CAM workstation to a specific NC machine, allowing you to place each toolpath directly into the controller queue, right after it is calculated.

Shop-optimized hardware

The Tebis shop floor front ends meet yet another requirement of modern communications structures by providing powerful, sturdy hardware that fit into any shop floor environment.
**VIEWER:**
Complete and up-to-date information for everyone.

Tebis Viewer systems display all information that accumulates in a CAD model during the course of product development. They transfer all CAD and NC data, including feature and tool information, to every station along the production process chain. Everyone involved in the process, from NC programmers and machine tool operators to installers, can view the latest information they need right on Tebis Viewer stations.

**Taking measurements, analyzing components, saving views and sections**

Tebis Viewers read the most common CAD formats and drawing data. Dimensioning functions let you easily determine all geometric dimensions for a component or assembly: lengths, diameters and angles. If necessary, you can generate points, lines, curves, planes, and axis systems, to a limited extent. The analysis functions check CAD models for different criteria such as holes, planes, fillet radii and slope. The distance analysis reveals changes between two different releases. Component surfaces can also be investigated in detail for design quality. Comprehensive view, drawing and text functions are available for adding text and comments.

**Different user interfaces available**

Tebis Viewer stations come with the standard Tebis user interface and a separate Windows-based interface. This lets you decide whether to coordinate your Viewer systems with your downstream Tebis CAD and CAM systems or whether standalone operation is more practical.

**NC Viewer add-on option**

The NC Viewer add-on option enables the analysis, simulation and reworking of toolpaths that have already been calculated.

This enables you to
- access virtual machine models
- orient the component on the virtual worktable
- check calculated toolpaths for collisions with the tool and compliance with the rotational and tilting limits of the machine head

To a limited extent, you can also edit toolpaths later on. In addition, the NC Viewer add-on converts toolpaths to special controller formats (postprocessing).
The Tebis NC Simulator accesses a virtual machine library containing detailed views of all NC machines in your own manufacturing department and in your customer’s. In addition to geometric dimensions, the library also stores kinematic conditions such as axis limit switches and travel during tool changes and infeed.

The Tebis NC Simulator thus realistically simulates toolpaths and provides complete collision checking of all machine components, including travel-limit switch monitoring. Subsequent modification of clamping positions, head orientation and machining sequence as well as tool replacement and editing give machine operators extensive optimization tools. The NC programs are output in the controller format (postprocessing) after all toolpaths have been successfully tested.

Creating NC lists from simulated and tested toolpaths

Based on the CAD model file and the virtual machine model, users first determine the optimum clamping position before setting up and completing the NC list. They set the order in which the individual toolpaths are processed and link them together using machine and user macros. Each toolpath is simulated in relation to the component clamping position and tools being used, then checked for possible collisions and compliance with the complete machine’s rotational, tilting and travel limits (limit switch).

Correcting detected collisions and limit switch problems

Tebis provides different options for correcting detected collision and limit switch problems, allowing the user to:

- assign a different tool from the tool library to the toolpath
- change the clamping position
- change the behavior of freely rotating axes
- change machines, for example to one with a larger machining zone or better kinematics
- on suitably configured CAM stations, change individual parameters in the NC jobs that were used to calculate the toolpaths and repeat the calculation

Useful calculation and NC programming functions

The NC Simulator is used as early as the bidding stage to improve cost estimates. Approximating the clamping arrangements required makes it possible to quickly assess feasibility on the available machines. In NC programming, the software is used to generate optimum approach axis systems and select or define suitable tools.
All Tebis software products for CAM and shop floor applications are designed to supply NC machines with NC programs in the right format. This is made possible by the universal Tebis post-processing concept, which is integrated into CAM workstations as well as Viewer, Simulator and WOP stations. The Tebis DNC software can also be installed as an add-on module on these stations, providing a direct machine connection with queue management and online format conversion. Stand-alone DNC stations can also be integrated into shop floor workflows to supply data to one or more milling machines via serial interfaces.

**Standardized user interface**

Tebis DNC has a modern graphic user interface that is fully compliant with the Windows standard. The work areas are well organized, divided into machine connection, file management, tool data and transmission progress sections. All elements have a context menu that is accessible by clicking the right mouse button. You can drag and drop NC programs, just like in Windows Explorer. The program was developed for the Windows 2000 and XP operating systems.

**Different transmission paths**

If necessary, you can supply NC programs to multiple milling machines from the same Tebis DNC workstation. NC controllers can be connected in series or via the network. There are two ways to transmit NC programs:

- transfer the NC data 1:1 without changing the format
- convert the NC data during transmission to a different format that is compatible with the NC controllers.

**WOP (workshop-oriented programming)**

If you connect a Tebis CAM station to the DNC module, it becomes a WOP station. After calculation toolpaths can be transmitted directly to the linked machine.

 Batch processing lets you combine multiple NC files into a single NC program. Separate coordinate transformations for each NC file then allow you to use them multiple times, in different clamping positions for example.

 Tool properties like tool number, speed, feed rates, coolant and spindle rotation can be displayed and edited graphically.

 The integrated NC editor handles NC files of any size and lets you edit them through direct input as well as NC program search and replace functions.
FRONT ENDS:
Powerful hardware for paperless manufacturing.

Tebis front ends were developed specifically to meet the high demands of the modern workshop. They are ideal for operating CAM and Viewer, Simulator and DNC stations.

Powerful graphics, ergonomic handling and a sturdy design make Tebis front ends extremely useful tools for gathering, processing and distributing information quickly, whether installed right next to your milling machines or in the workbench zone.

Different designs for custom requirements

Tebis front ends are resistant to dirt, liquid and sparks. Tested by the German Technical Inspectorate (TÜV), they come in different designs for nearly any requirement: With space-saving TFT display, stand or wall-mounted, with built-in PC or remote connection, with or without height adjustment. No matter which version is right for your workshop: Tebis workshop front ends will help you make the move to paperless manufacturing.

And they are impressive proof of the importance that your company attaches to quality and high-performance equipment.
Tebis offers two modules for computer-aided quality control. E.g. on internal and external cubings for model-making or inspection and mounting fixtures for manufacturing jigs and fixtures:

- Measuring Point Generator as an add-on for CAD/CAM workstations.
- Surface Measuring: a stand-alone CAQ measuring workstation that connects directly to a coordinate measuring machine and reports deviations between the finished component and CAD model during online operation.

Preparing quality inspections right in the CAD/CAM environment

The Tebis Measuring Point Generator CAQ module is an add-on software package for CAD/CAM workstations that lets you select specific positions on the component as measuring points and output them in the form of a NC measuring program or configurable measuring log.

Measuring deviations between the virtual model and real part

Ever stricter quality standards require high-quality test methods that are also precise and reliable. The Tebis Surface Measuring module is a software package that lets you directly analyze signals from a connected coordinate inspection machine, enabling you to compare measurements of the real component on the inspection machine with the virtual component in the CAD environment.

Just position the probe on a position to be measured and watch the schematic probe representation move synchronously and in real time along with it on the Tebis monitor. During the measurement, the system compares the acquired actual values to the corresponding setpoints on the CAD model and logs them in real time, thereby ensuring quality.
You can construct measuring points and convert them to constraints (point-vector sequences).

Approach the points on the machine manually or with an NC program and determine the precise spatial coordinates.

Constraints can then be edited. For example, you can change their order.

Output and set-point/actual value comparison in a measuring log.

The Measuring Point Generator CAQ module lets you generate measuring points in the CAD module and convert them to constraints (point-vector sequences).

In addition to commands for editing the measuring points, you also get functions for transferring them to an NC measuring program and a measuring log. You can then approach these measuring points by hand on the milling machine or a coordinate inspection machine and measure their actual positions.

The Measuring Point Generator module can be added to any Tebis CAD/CAM or CAM workstation.
Tebis Surface Measuring is a stand-alone software package that provides direct comparisons between a real component and its counterpart in the CAD environment. The basic functions and measuring workstation operations closely resemble those of Tebis CAD/CAM stations, which makes it easy to integrate them into existing processes.

The system provides a direct comparison between any determined measuring points and the CAD model, which was also the basis for the component during NC programming. This gives you a direct setpoint/actual value comparison between the finished component surface and the corresponding CAD data model.

User-friendly alignment functions

Before you take any actual measurements, easy-to-use functions help you align the component and probe. The calibration routines that come with the system let you clamp the component in any position on the measuring table. You then scan the desired component position to determine the coordinate transformation values needed for the setpoint/actual value comparison. You can also determine the component position on standard entities, base plates or by applying iterative alignment procedures to the free-form geometry.

Measuring with point-vector sequences

You can also set point-vector sequences for carrying out measurements. The results are then entered in a user-defined inspection log that can serve as an inspection document according to your internal quality assurance guidelines.

A result window displays the coordinate values that represent the deviation between the scanned surface point and the CAD surface on which it is based. This lets you check the spatial position of all component areas that are critical to the rest of the process.
Software, hardware, consulting, training and hotline, all from one source.

Tebis customers can be found anywhere in the world where manufacturers design and develop complex products and design and build molds, dies and patterns. Tebis is being used successfully at nearly every automobile manufacturer around the world, and at more than 1500 vendor firms. Based on modern company structures, Tebis can offer much more than just software.

We are an important competence partner for all these firms:
For the state-of-the-art CAD/CAM technology and optimized process chains. For shoulder-to-shoulder design and manufacturing.
For the successful combination of virtual CAD technology and real-life machine tools.

Together with its subsidiaries, Tebis AG is a conscientious technology partner, providing a complete product and service package that helps you feel completely comfortable with this partnership:

- Process and investment consulting
- Implementation of field tests
- Delivery and installation of tool assemblies
- Implementation of Tebis process solutions
- User training programs
- Service hotline for software, hardware and networking
- Regular software updates
- Digitization of any components
- Reverse engineering services
Tebis software service

To ensure that your work proceeds with as few interruptions as possible, Tebis provides its customers with a variety of different service and maintenance models to choose from. They range from the basic telephone hotline and regular software updates to on-site service in which a Tebis systems specialist solves problems right on the customer’s premises.

International consultants

Users of Tebis CAD/CAM technologies are located in nearly every European country as well as a large number of other nations around the world, from the United States and Canada to India, South Korea and China.

To provide regular and timely support to local and international companies worldwide, Tebis has opened branch offices and established agencies in different countries. Tebis subsidiaries operate in the United States, Italy, England, France and Sweden. Independent Tebis representatives are active in other countries, including Spain, Portugal, Turkey, Japan, China, South Korea, India and Mexico.

Wherever you want to solve challenging tasks in model, mold and die making – Tebis is pleased to support you throughout the whole CAD/CAM sector with high-end solutions.
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