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## Virtual Gibbs Multi-Axis Milling Options

As a modular suite of CNC programming tools, Virtual Gibbs has a solution for every milling requirement. When you need to move beyond 3-axis milling into rotary milling of any type, there is a Virtual Gibbs option to accommodate your requirements with speed and efficiency. Each Virtual Gibbs option has a different range of capabilities, different input requirements, and different toolpath capabilities. Selecting the best option(s) for a specific part and machine will yield the best results. All of Virtual Gibbs's rotary milling options are supported by a huge library of post processors and a staff dedicated to building and maintaining post processors.

**5-AXIS MILLING** achieves 5-axis motion with 2 rotary and 3 linear axes. It provides powerful programming tools to meet all the challenges of 3-, 4- and 5-axis simultaneous machining, without sacrificing ease of use. Input is a combination of 3D wireframe geometry, solids and surfaces. Virtual Gibbs's geometry creation and editing tools accommodate any modeling or editing required to prepare a part model for machining.

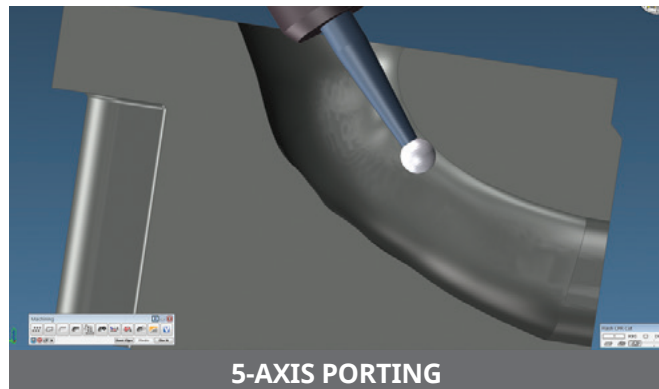
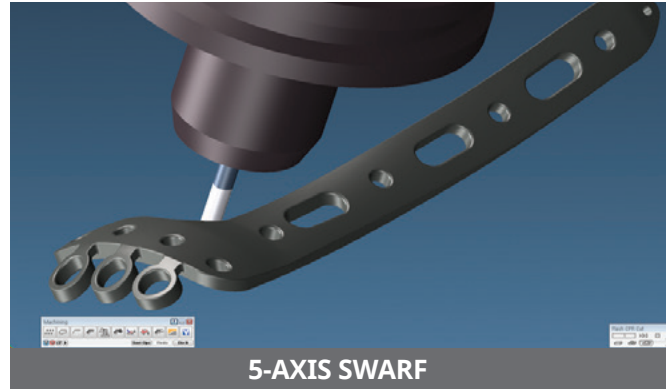
A robust set of multi-surface strategies supports machining a full range of uniquely shaped parts directly from the model's surfaces. The user has full control of tool axis tilt. Comprehensive collision control checks the tool and holder for collisions with the part and workholding devices, and automatically corrects the toolpath according to user specified



parameters.

A sophisticated and powerful programming tool for any 5-axis programmer, this option is ideal for 5-axis simultaneous capable mills, mill-turns and

MTM machines, and also a very good solution for 4-axis machines when working directly from solids and surfaces. The integration of 5-Axis Milling with Virtual Gibbs MTM options supports the most advanced multi-task machines with live tooling on articulated heads. With its breadth of capability and ease of use, Virtual Gibbs 5-Axis Milling will simplify your 5-axis programming needs and improve machining efficiency with better surface finish and faster throughput.



**5-AXIS PORTING** is an addition to the 5-Axis Milling option, optimized for machining engine ports, manifolds, throttle bodies, and parts with similar internal geometry. The Virtual Gibbs 5-Axis Porting option can be used for machining any parts with tubular openings (or ports) that change shape and curvature from one end to the other. The software can automatically detect the spine curve through the port and align the toolpath accordingly. Using available tool reach, it can split upper and lower

operations automatically by maximum tool reach, midpoint, or user selected percent of reach, and ensures proper toolpath blending between upper and lower sections. Tool tilting is automatic, and all 5-axis motion is calculated to provide smooth and gouge free toolpaths. With its condensed and specialized interface, the 5-Axis Porting option makes programming easier and faster, generating a cleaner, more efficient toolpath for faster and higher quality machining.

- Roughing and rest roughing strategies
- Spiral and plunge (along) finishing
- Automatic spine detection
- Automatically calculates optimal tilt angles without need to split surfaces or create tool axis control splines
- Cut only top of port, only bottom, or both sides, in single operation

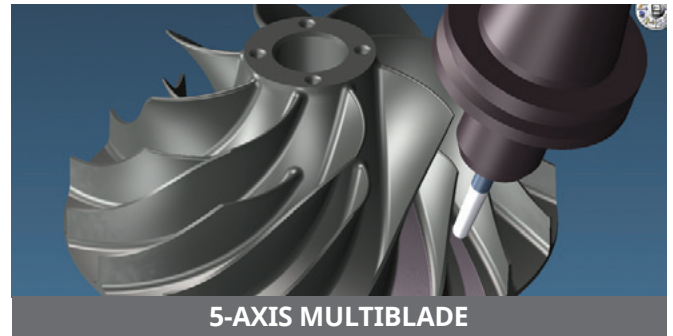
**5-AXIS MULTIBLADE LEVEL 1** is an addition to 5-Axis Milling, optimized for turbo-machinery parts. It simplifies machining of blisks, blings and impellers - parts with blades - including those with single splitters. A specialized and condensed interface allows easy selection of geometry without having to prepare the model. Toolpath strategies include 5-axis simultaneous roughing, hub finishing, and blade and splitter finishing, with automatic gouge checking on all toolpaths, plus intelligent controls for rotating toolpaths around the part.

- Roughing between blades with single splitter support
- Blade, splitter and hub finishing
- Leading- and trailing-edge extension and edge roll trimming
- Tool axis tilt controls
- Toolpath segment rotations
- Automatic axis detection
- Automatic and user definable links and clearances

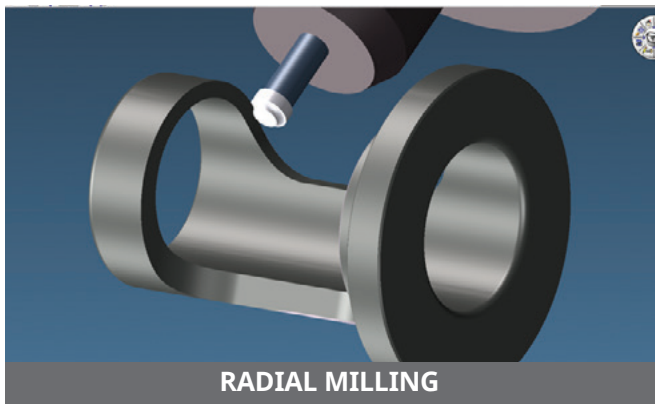


**5-AXIS MULTIBLADE LEVEL 2** provides incremental capabilities to 5-Axis MultiBlade Level 1 to machine parts that have multiple splitters and/or sub-splitters. It adds a fillet machining strategy and provides additional control for all toolpath strategies. (Requires 5-Axis MultiBlade Level 1)

- Blade fillet finishing
- Tool axis smoothing
- Splitter smoothing
- Multiple splitter support
- More control for tilt, leading & trailing edges, and all toolpath strategies
- Toolpath segment sorting
- Stock definition for rest machining



**5-AXIS MULTIBLADE**



**RADIAL MILLING**

**RADIAL MILLING** drives one rotary and three linear axes to achieve 4-axis toolpath. It provides a roughing and a finishing mill process for centerline “Y-axis” rotary machining, allowing control of wall angles and tool engagement. Input is 3D wire-frame geometry extracted from solids or created by other means, to drive and orient the tool.

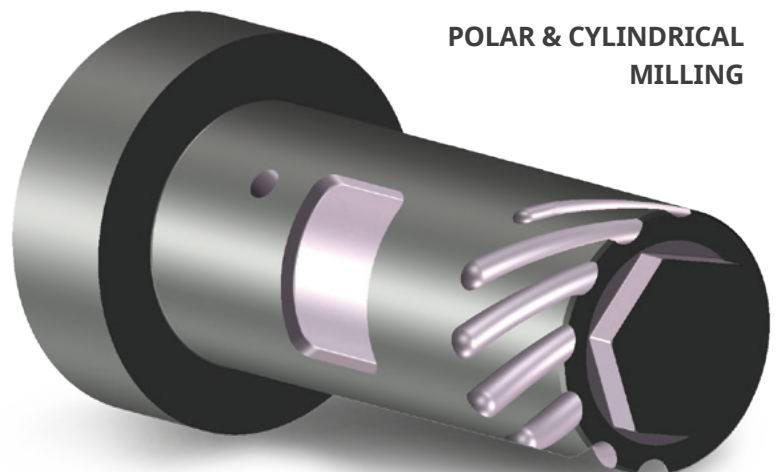
Optionally, surfaces may be used to orient the tool and limit toolpath. Tool orientation control includes cutting with the side or bottom of the tool, using a surface or two curves to control tilt, following one curve at a specified lean angle, or using progressive

tool lean. Toolpath is usually segmented, but can be optimized for helical motion.

**POLAR & CYLINDRICAL MILLING** drives one rotary and two linear axes to achieve 3-axis toolpath.

It extends Virtual Gibbs’s standard 3-axis milling functions for use on machines with a rotary axis to enable wrapped geometry, cylindrical and polar rotary milling, and rotary repeats. On mills, rotation is typically around the A or B axis, while on mill-turns C-axis motion replaces Y-axis motion. This C-axis motion can also be applied to the face of a mill-turn part. Input may be at or “wrapped” wireframe geometry. Wrapped geometry is at 2D geometry, displayed and machined as if wrapped around a cylinder. Geometry may be created in at or wrapped mode and toggled between at and wrapped representations. With this option, all 2D mill processes - contour, pocket, drill, etc. - may be applied to a cylinder. The tool is kept on the centerline of rotation; as a result, there is no control of wall angles or tool engagement. This option also adds the rotary repeat function to milling processes.

Output for long, multiple rotations is on a single line of G-code. Post processed output can support a control’s cylindrical and polar interpolation functions. This option is ideal for parts defined by at geometry, for rotary part features created by the tool’s shape, (such as simple grooves or pockets not needing wall control), and for machines without a Y axis.



**POLAR & CYLINDRICAL MILLING**

|                                  | <b>Polar &amp; Cylindrical Milling</b>   | <b>Radial Milling</b>   | <b>5-Axis Milling</b>   |
|----------------------------------|--|---|---|
| <b>Geometry definition</b>       | 2D planar wireframe geometry and wrapped geometry. 3D geometry can be converted to wrapped geometry.                             | 3D wireframe geometry extracted from solids or otherwise created, and optional surfaces. Wrapped geometry is not supported. | Solids, surfaces and 3D curve geometry, depending on specific task.   |
| <b>Part compatibility</b>        | Ideal for parts defined by flat geometry, parts with repeated patterns, and parts with tool centerline grooves. No wall control. | Ideal for parts defined by 3D geometry, and parts with radially prismatic features.   | Ideal for parts defined by solid models or surfaces requiring full 4- or 5-axis applied directly to selected model faces. |
| <b>Axes Driven</b>               | X, Z and one rotary axis.  | X, Y, Z, and one rotary axis.   | X, Y, Z, and either one or two rotary axes.   |
| <b>Cutting operations</b>        | All 2D standard mill operations on a cylinder.   | Adds radial roughing and contouring operations for wall control and cylindrical floor finish.                               | Adds 5-axis operation for 3D multi-surface machining.   |
| <b>Depth and tapers</b>          | Works well with constant depth milling. Not suitable for variable-depth floors.  | For constant or variable depths. Offers variety of variable-depth-floor options.  | Depth and taper per solid model.  |
| <b>Wall angles and Y offsets</b> | Wall angles result from tool radius, as tool is always on centerline.  | Any wall angle possible with a single axis of rotation. User-specified Y-offset and lean angles for engagement control.     | Any wall angle per solid model, with a wide range of choices for engagement control, including lead/lag angles.           |
| <b>Multi-revolution output</b>   | Multi-revolution output on a single line of G-code.  | Only simple helices become multi-revolution output, otherwise segmented output.   | Segmented output only.  |
| <b>Interpolation options</b>     | Post processed polar and cylindrical control functions   | Linear only.  | Linear only.  |
| <b>Post processors</b>           | Requires polar & cylindrical modification.   | Requires 5-axis modification.   | Requires 5-axis modification.   |
| <b>Options available</b>         | N/A  | N/A   | 5-Axis MultiBlade (L1 and L2)<br>- Requires 5-Axis Milling<br>5-Axis Porting<br>- Requires 5-Axis Milling                 |