RobotStudio® Machining PowerPac
Increased engineering efficiency
Agenda

- Introduction
- RobotStudio Machining PowerPac
  - CAM Converter
  - Machining
- Benefits
- Summary
Introduction
40 years of robotized machining

- The world’s first electrical robot, sold in 1974, was for grinding and polishing of stainless steel tubes
- ABB was an innovator and has become #1 in robotized finishing
- We intend to remain the leader

IRB 6 sold by ABB in 1974 to Magnusson in Genarp, Sweden
Introduction
Benefits of robot-based machining

- Consistent high product quality
- Reduced tooling costs
- High availability
- Safe environment with less injuries
- Attractive and rewarding workplace
- Positive, high-tech image
- Improved recruitment possibilities
- Long-term profitability
Introduction
Challenges for robotized machining

- Short production batches
  - Quick change over time is required
- Traditional programming is time consuming
- Traditional programming is difficult to handle complex geometry surface
- Many parameters affecting the process result
- Accuracy requirements in the process
RobotStudio Machining PowerPac

Outline: a superior offline programming tool for machining applications

- Software for offline programming of machining applications
- Contains functions for
  - Transform CNC code to RAPID
  - Generate robot path based on CAD model
  - Path & target adjust and optimization
  - Tool posture controller
  - Customized export
  - VC simulation
Features
Outline

- CAM Converter
  - Convert CAM G-code to robot RAPID language
  - Support G-code ISO 6983, DIN 66025 and APT-CL
- Machining
  - Create tool model and specify contact information
  - Create path curve based on CAD model
  - Create path based on path curve and set target configuration
- Path and target optimization
- Path and target modification
- Path simulation (Quick simulation & VC simulation)
- Template based program export to RAPID or RW Machining FC
- Calibration
CAM Converter

Key functions

- Import standard APT/ISO G-Code
  - Fully support 5-axis G-code
  - Extendable with template
- Station setup
  - Support external axis (both positioner and linear track)
  - Optimize the workpiece/wobj location
- Convert tool path to robot path
  - 3 strategies of target configuration and external axis interpolations (both positioner and linear track)
- Simulation
  - New quick simulation and collision check in RS
- Export RAPID
  - Extendable with template
- Performance
  - Support >500K point, much faster than the benchmark software
CAM Converter
Convert CNC Toolpath to RAPID

- Strong Parser
  - Support both ISO G-code and APT file
  - Based on ISO CNC code, handle different CAM export
  - Support 5 axis G-code with easy settings

- Advanced Functions
  - CAM style post tree
  - Modify targets manually
  - Create cutter and tool data
CAM Converter
Convert CNC Toolpath to RAPID

- Multi-strategies
  - Based on the imported CNC point and robot system layout, to calculate target configuration.
  - Movement interpolation between robot and positioner.

- 3D preview
  - Show target configuration based on user settings.

- Estimated result
  - An estimated converter result can show how many targets can succeed based on the current user settings.
CAM Converter
Simulation and Path Editor

- Quick and accurate Simulation
  - Interpolation targets check
  - Collision check
  - Virtual controller simulation
  - Less than 3 min to simulate >100 000 targets

- Powerful Path Editor
  - Insert, delete & set positions
  - Show detailed information as tool-tip
  - Dynamically update path in 3D view

- Flexible Export
  - Auto-split RAPID program
  - Edit and modify template for customized needs
CAM Converter
Summary

- Parse G-code to RAPID based on different machine setup
- Easy learning for CAM users with the CAM-style post tree
- Accurate and quick simulation
- Support multi-tool in the same station
- Easily set target configuration and create Robot path
- Powerful export functionality based on user-defined template
- Easy to reuse the best practice since the auto-load/save function
Overview Machining
Machining
Key functions

- Use common tools from library
  - Support user-defined contact points
- 5 strategies to create path curves based on the CAD model
- Tool axis control
- Flexible non-process move setting strategies
- Create WAVE paths to reduce tool wear
- Path Edit
  - 2 strategies to do smooth tool axis interpolation
  - Support smooth tool contact point adjustment
- Simulation
  - Quick simulation and collision check
  - Precise virtual controller simulation
- Export RAPID via customized templates
- Flexible programming steps
Create tools out of most common machining tools library

- Use different tool shapes as templates
- Export/Import tool definitions to library for reuse
- Define tool contact point independent from TCP
Machining
Path Curves by Projection Geometry

Generate path curves from projection

- Use predefined or individual patterns
  - Polyline
  - Spline
  - Parallel lines
- Define pattern intervals, angles etc.
Machining
Path Curves by Intersection and ISO Geometry

Generate path curves from intersection planes
- Parallel planes
- Cylinder planes

Generate path curves directly from the iso-parametric curve
- Customize by setting range and count of curves
Machining
Path Curves by Surface Edges and Customizing

Generate path curves from surface edges
- Single Edge
- Tangent Edge
- Boundary

Generate customized path curves in demanding applications
- Pick user specific targets on surface to generate highly individual path
Machining
Customized Path Curves

Edit feature curves to flexible customize path curves

- Split feature curve
- Reverse feature curve
- Delete feature curve
- Re-Order
Machining Path Editor

- Advanced path editor
  - Modify/add/delete target(s)
  - Change contact point of tool for target(s)
  - Change tilt angle of tool for target(s)
  - Support smoothly change for above functions
  - Support smooth tool axis
  - Modify speed for target(s)
Machining Contact Point Adjustment

- Fixed Contact Point
- Smooth Interpolated Contact Point

Specify different contact points on tool along the path
- Avoid collisions
- Smoothly change contact point
Machining
Lead - Tilt Angle

Without tilt - lead angle

With tilt - lead angle

Control tool axis settings and keep specified tool posture to the part surface

- Lead angle
- Tilt angle
Machining WAVE Paths

WAVE path function makes the tool machine a part with a defined area instead of a single contact point during the whole process

- Reduce tool wear and extend tool life time
- Define different contact points on tool for different processes
Tool Axis Interpolation generates a path with smooth tool axis changes along the specified path.
Machining Transfer Paths

Create flexible transfer strategies to support different machining process requirements

- Approach or Depart
- Lift Safe Height
- Direct
Utilize templates to reuse process data and customize export of RAPID program to save programming time

- Export and Import Geometry parameters
- Export and Import Tool parameters
- Export and Import Operation parameters
- Select and customize RAPID code to be exported
Utilize libraries to reuse common tools and non-process movements to save programming time

- Add, Delete or Edit Tools

- Add, Delete or Edit non-process move settings
Enable collision check to supervise tool and workpiece and foresee collision during processing

- For soft tools e.g. in polishing applications user can set a certain amount of collision that is required before exposing the alarm.
Summary
Benefits
Reduced programming time

- Flexible programming steps based on CAM style navigation tree
- Robot path generated directly from CAD model
- Parse G-code to RAPID based on different machine setups
- Easily set target configuration and create robot path
- Quick simulation to verify the robot path
- Powerful export functionality of process parameters based on user-defined templates
Benefits
Precise Machining Paths

- Generate precise paths from CAD model in particular for freeform surfaces
- Generate precise paths out of G-code
- Dynamically preview the path
- Customize robot path/target
- Find the best robot posture and corresponding configuration
- Regenerated paths based on editable processes parameters
- Optimize robot path
Extend the life time of machining tools
- Efficiently utilize tooling
- Reduce tool wear and changeover time
- Create flexible contact points or areas
Summary

- Reduce programming time
  - Engineering and commissioning efficiency
  - More cost efficient handling of short batches
- In control of the process parameters
  - Easy to create and modify parameters
- Extended tool lifetime
- Improved path accuracy
- Improve product quality
- Seamless integration with RobotWare and RobotStudio