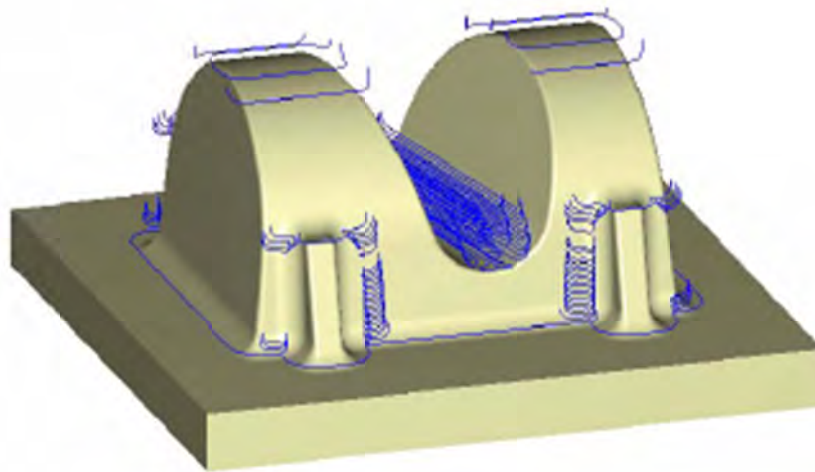


**Mastercam X<sup>5</sup>**

TRAINING  
GUIDE



SURFACE TOOLPATH OVERVIEW

**camInstructor**

# STANDARD SURFACE TOOLPATHS

## #

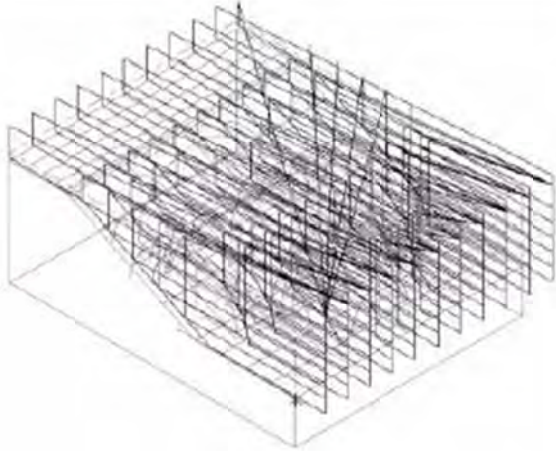
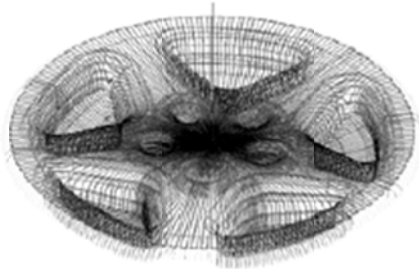
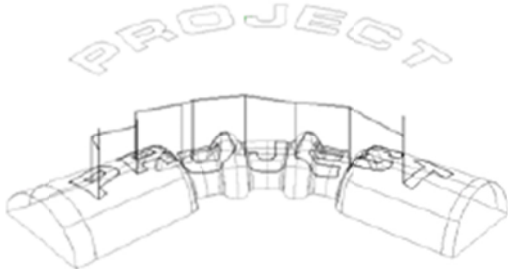
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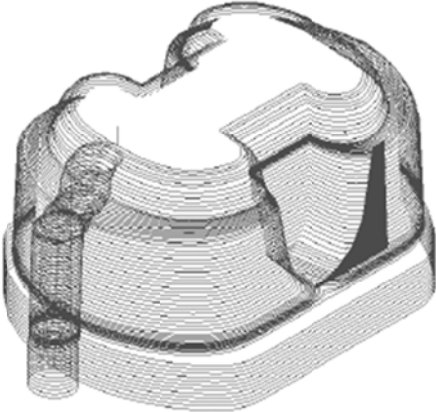
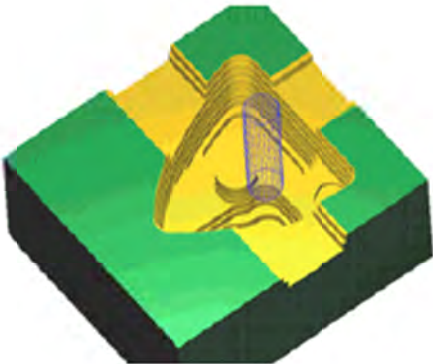
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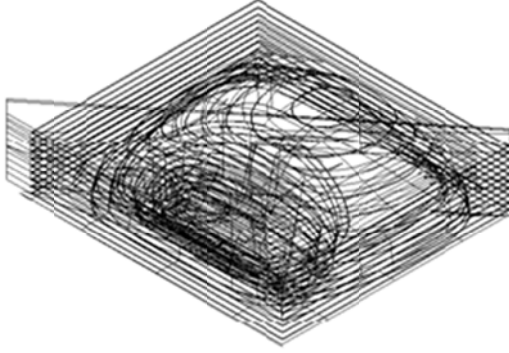
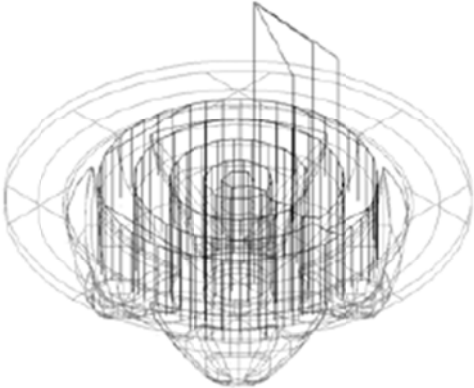
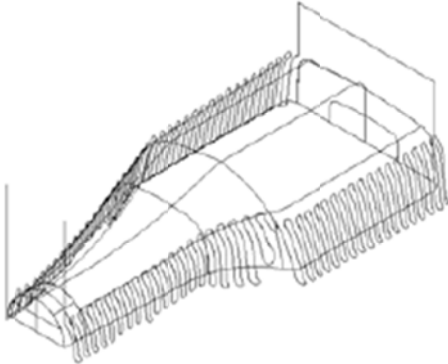
First Printing July 2005

Toolpath Type	Image	Uses
<b>Parallel Toolpath</b>		<b>Surface Rough Parallel</b> Remove the bulk of material quickly.  <b>Surface Finish Parallel</b> Machine over all the surfaces in parallel passes.
<b>Radial Toolpath</b>		<b>Surface Rough and Finish Radial</b> Cut from the center point outward, creating cuts like the spoke of a wheel.
<b>Project Toolpath</b>		<b>Surface Rough and Finish Project</b> Project either geometry or a toolpath from an earlier operation onto surfaces.

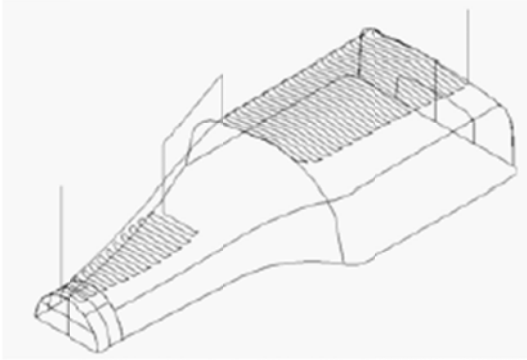
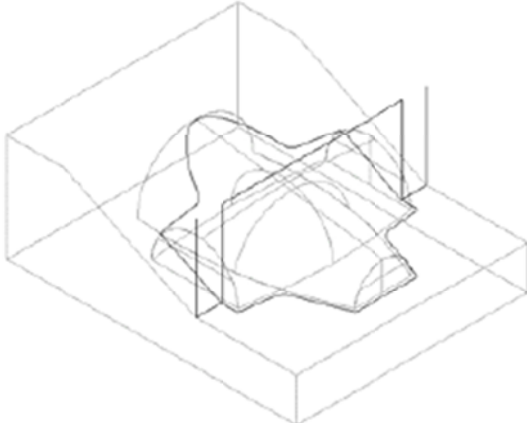
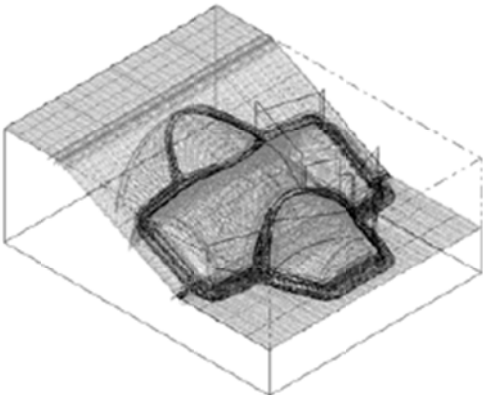
## STANDARD SURFACE TOOLPATHS

Toolpath Type	Image	Uses
Flowline Toolpath	 A 3D wireframe model of a curved surface with a toolpath that follows the contour of the surface, creating a smooth, flowing motion.	<b>Surface Rough and Finish Flowline</b> Follows the shape and direction of the surfaces and creates a smooth and flowing toolpath motion.
Contour Toolpath	 A 3D wireframe model of a complex, multi-faceted part with a toolpath that follows the contours of the surface, allowing for gradual stepping down in the Z-axis.	<b>Surface Rough and Finish Contour</b> Works well for parts that have steep walls. Allows the tool to step down gradually in the Z axis instead of stepping over in the X and Y axes.
Restmill Toolpath	 A 3D solid model of a part with a toolpath that cleans up remaining stock with a constant Z motion, shown in yellow and green.	<b>Surface Rough Restmill</b> A roughing toolpath that cleans up remaining stock with a constant Z motion.

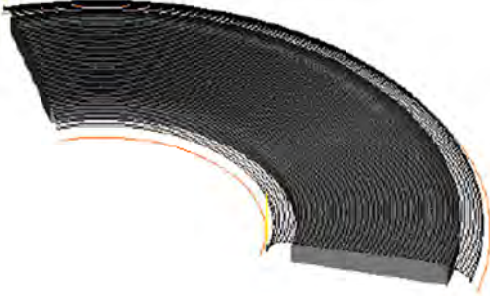
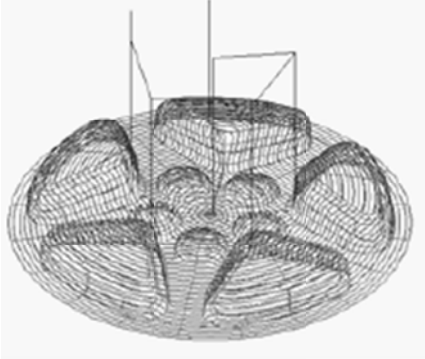
# STANDARD SURFACE TOOLPATHS

Toolpath Type	Image	Uses
<b>Rough Pocket Toolpath</b>		<b>Surface Rough Pocket</b> Removes a lot of stock quickly and creates a series of constant Z cuts.
<b>Rough Plunge Toolpath</b>		<b>Surface Rough Plunge</b> Requires a special Plunge Roughing Tool as it uses a drilling-type motion to remove large quantities of material very quickly.
<b>Finish Parallel Steep Toolpath</b>		<b>Surface Finish Parallel Steep</b> Removes material from surfaces that fall between two slope angles. This toolpath is usually used after a finish parallel toolpath.

## STANDARD SURFACE TOOLPATHS

Toolpath Type	Image	Uses
Finish Shallow Toolpath		<b>Surface Finish Shallow</b> Removes material from surfaces that fall between two slope angles.
Finish Pencil Toolpath		<b>Surface Finish Pencil</b> Follows the path where two surfaces meet. It cleans out material by driving the cutter tangent to two surfaces at a time.
Finish Leftover Toolpaths		<b>Surface Finish Leftover</b> Removes material left behind by the larger tool from a previous operation. It calculates how much stock is left over and uses the information to create tool motions.

# STANDARD SURFACE TOOLPATHS

Toolpath Type	Image	Uses
<b>Finish Blend Toolpath</b>		<b>Surface Finish Blend</b> Creates motion that is defined by curves that were created along the drive geometry.
<b>Finish Scallop Toolpath</b>		<b>Surface Finish Scallop</b> Creates a constant toolpath over the entire surface regardless of whether the surface becomes steep or shallow.

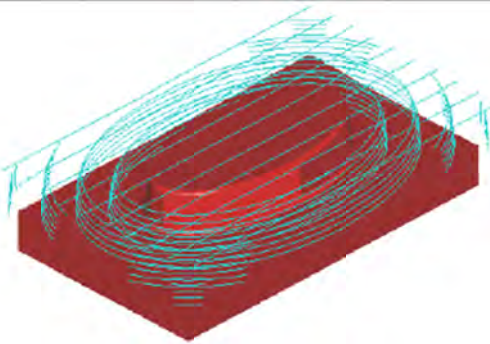
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## SURFACE HIGH SPEED TOOLPATHS

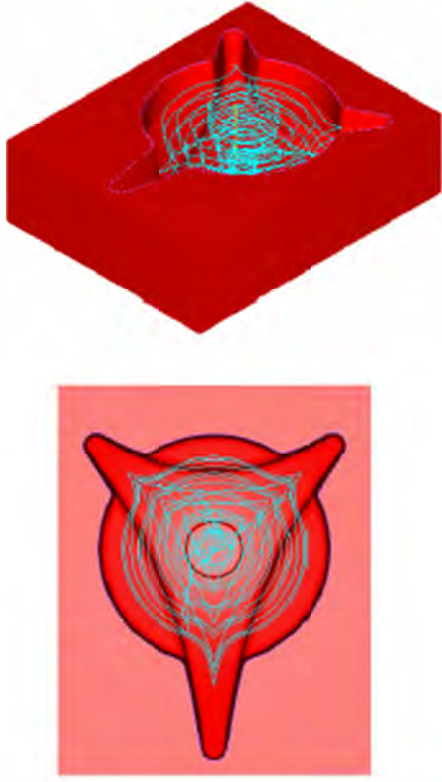
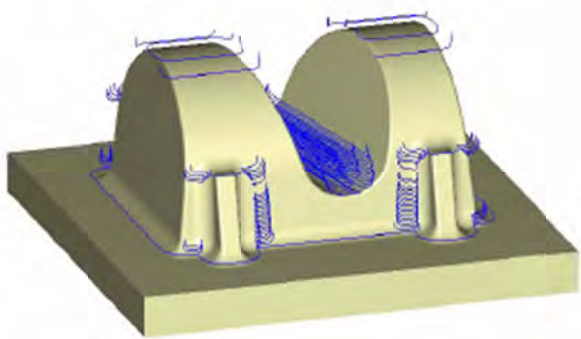
“Surface high speed toolpaths are a set of machining strategies that are specifically designed to produce the smoothest, most efficient tool motions when machining surface models (or solid faces).”

“If your application (or your machine tool) is not appropriate for the higher feed rates associated with high speed toolpaths, you might achieve better results with Mastercam’s standard toolpaths. The surface high speed toolpaths will tend to create more retract moves, for example.

Please refer to Chapter 7 of the Mastercam Reference Guide for detailed information on Surface High Speed toolpaths.

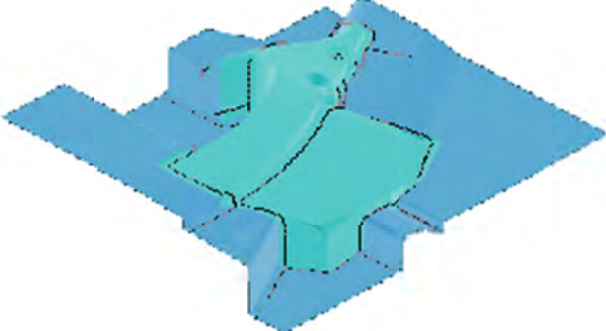
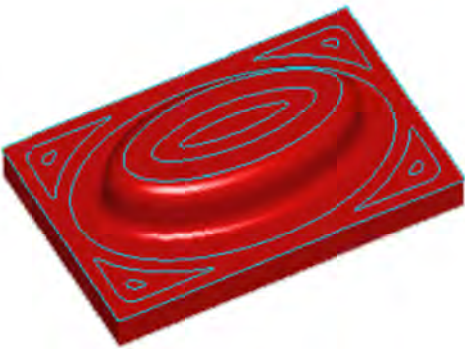
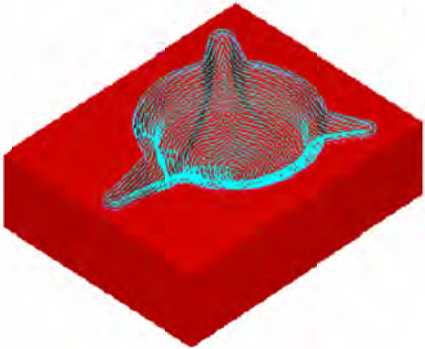
Toolpath Type	Example	Uses
<b>Core Roughing</b>		<b>Core Roughing</b> Ideal for boss-type parts. On each Z level, the tool approaches the part from the outside with multiple offsets.

## SURFACE HIGH SPEED TOOLPATHS

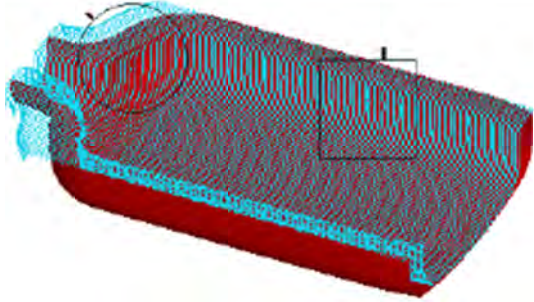
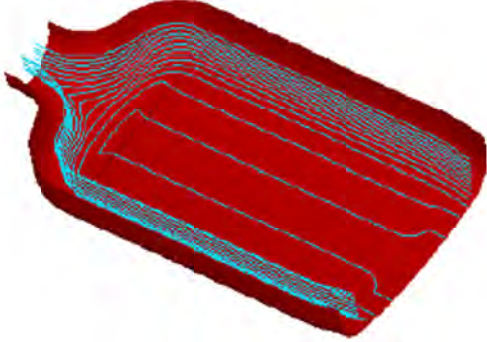
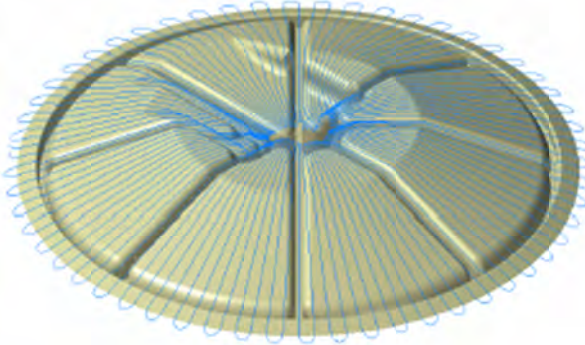
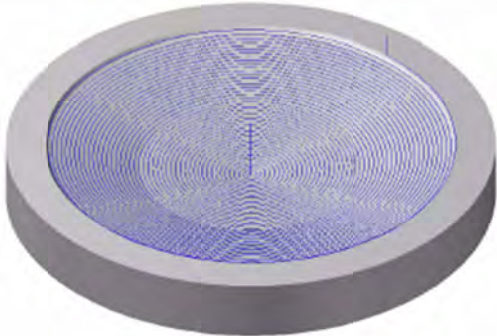
Toolpath Type	Example	Uses
<b>Area Clearance</b>		<b>Area Clearance</b> Good for parts that need to be machined from the inside out, such as pockets, cavities and molds.
<b>Rest Roughing</b>		<b>Rest Roughing</b> Cleans out enough stock in required areas so that a finish tool will NOT encounter an excessive amount of material.



## SURFACE HIGH SPEED TOOLPATHS

Toolpath Type	Example	Uses
<b>Pencil</b>		<b>Pencil</b> Used to clean out corners and boundaries between surfaces.
<b>Horizontal Area</b>		<b>Horizontal Area</b> Good to finish flat areas.
<b>Scallop</b>		<b>Scallop</b> Also known as constant stepover toolpath. Produces a constant scallop height across the surface.

## SURFACE HIGH SPEED TOOLPATHS

Toolpath Type	Example	Uses
Raster		<b>Raster</b> Creates parallel cutting passes across the surface. The angle the cutter passes the surface can be adjusted depending on the part features.
Waterline		<b>Waterline</b> Best for steep areas, like walls of molds or cavities.
Radial		<b>Radial</b> Best used when requiring a toolpath that radiates outward from a central point.
Spiral		<b>Spiral</b> Used to create a toolpath that feeds into the part in a continuous spiral.

# Mastercam X<sup>5</sup>

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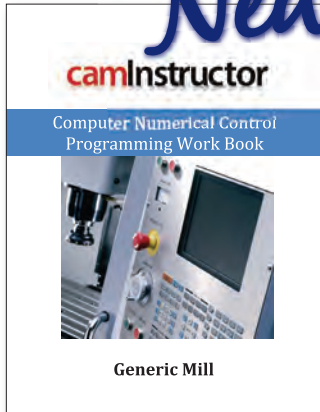
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## Our Authors

**Matthew Manton, B.Ed.** is a licensed Tool & Die Maker with over 15 years experience and has been a Teacher of Tool & Die and CAD/CAM at the College level for over 20 years. He is also a Certified Distance Education Instructor and has taught Mastercam for the past 8 years.

**Duane Weidinger** is a licensed Machinist with 20 years experience and holds a Teaching Degree in Manufacturing. An experienced High School Machine Shop Teacher, he also has authored a variety of Mastercam Books over the past ten years.

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