

Siemens PLM Software

## NX CAM 11.0.1: Tool Tilt Enhancements

New tilt rules and collision avoidance options.

## **About NX CAM**

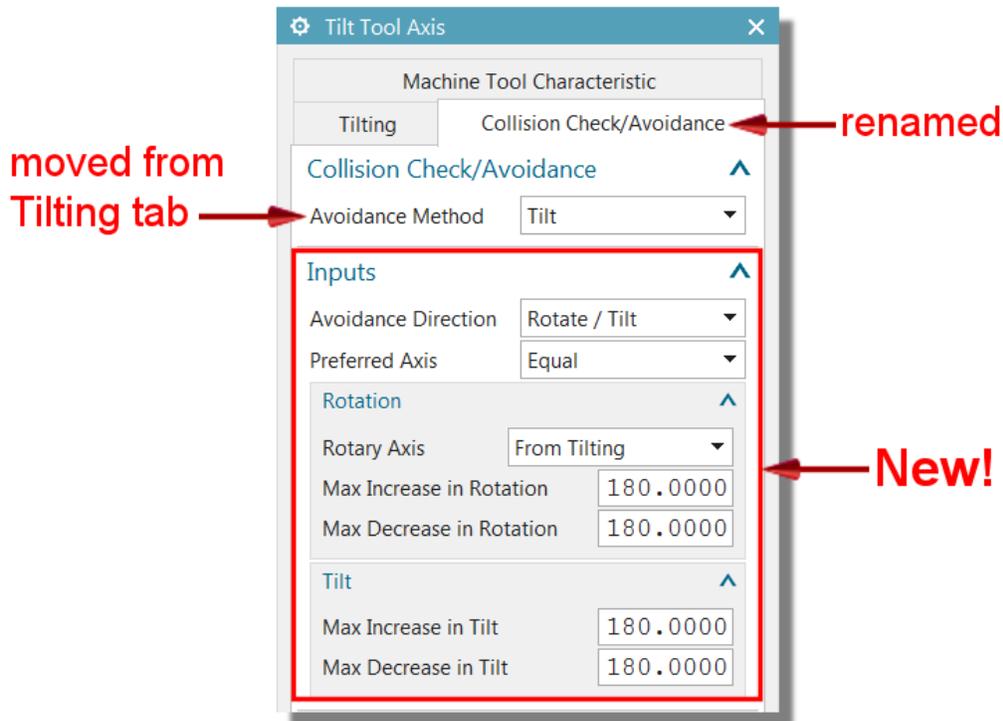
NX™ CAM software has helped many of the world's leading manufacturers and job shops produce better parts faster. You can also achieve similar benefits by making use of the unique advantages NX CAM offers.

This is one of many hands-on demonstrations designed to introduce you to the powerful capabilities in NX CAM 11.0.1. In order to run this demonstration, you will need access to NX CAM 11.0.1.

Visit the [NX Manufacturing Forum](#) to learn more, ask questions, and share comments about NX CAM.

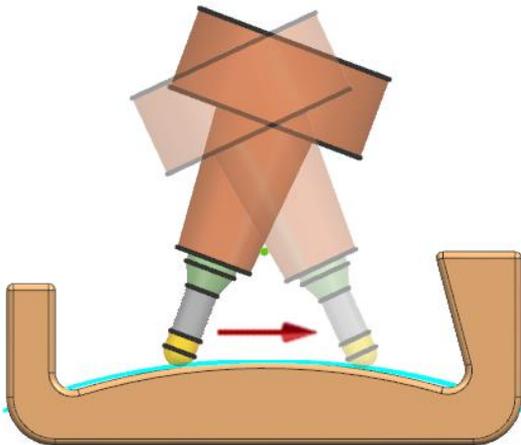
## Hands-on Demonstration: Tool Tilt Enhancements

The Clearance tab in the Tilt Tool Axis dialog box has been renamed Collision Check/Avoidance. Avoidance Method, previously located on the Tilting tab has been relocated to the Collision Check/Avoidance tab. The Inputs section contains new options that give you more control over avoiding collisions when tilting the tool axis.

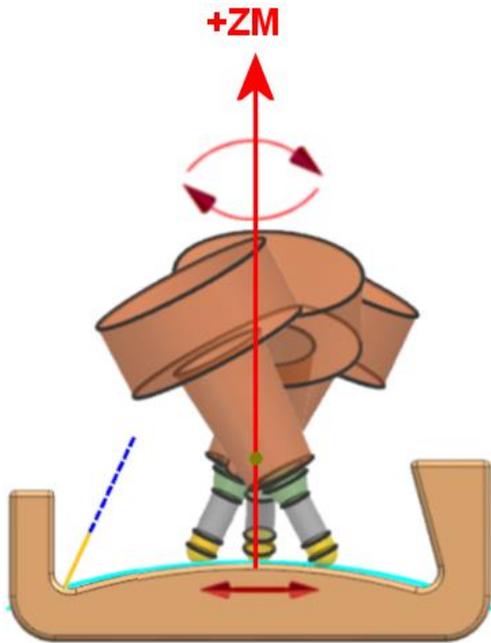


**Avoidance Direction** options determine how collisions will be avoided when tilting the tool:

**Lead/Tilt** controls the Avoidance Direction relative to the tool path. The tool “hinges” on the curve, remaining in the tilt plane until the Tilt Angle is once again reached, tilting in the opposite direction. This is the existing behavior from the previous release.

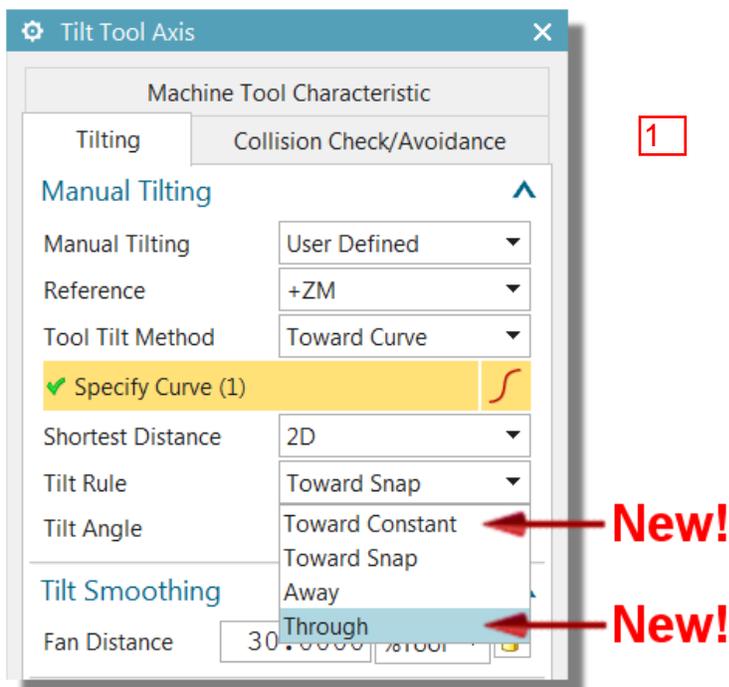


**Rotate/Tilt** swivels the tool about the specified Reference axis to maintain a constant angle relative to axis. This behavior is new.

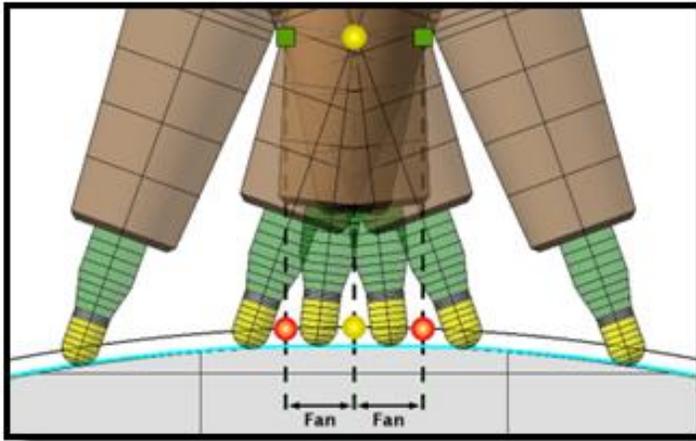


The remaining options in the Inputs section of the dialog box determine how to control the specified Avoidance Direction.

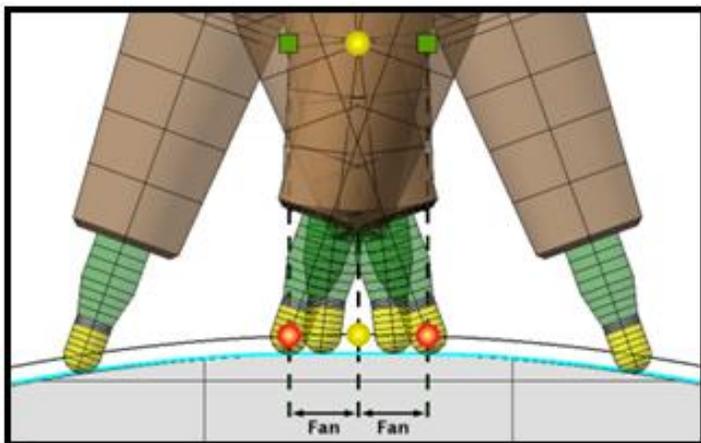
The Tilt Rule options control how NX measures the tilt angle inside the tilt plane. The tilt plane is defined by the +ZM axis and a line through the tool position that intersects the reference point on the selected guiding curve. Toward Constant and Through are new tilt rules.



The easiest way to understand the behavior of Toward Constant is to compare it to the existing behavior of Toward Snap. Toward Snap begins fanning the tool when the tool axis intersects the control curve or when the specified Fan Distance is reached, whichever occurs first. In other words, Toward Snap allows the tool to begin fanning before reaching the specified Fan Distance if the tool axis intersects the control curve first.



Toward Constant maintains the specified Tilt Angle until the specified Fan Distance is reached. It does not take into consideration the intersection of the tool axis and the control curve.

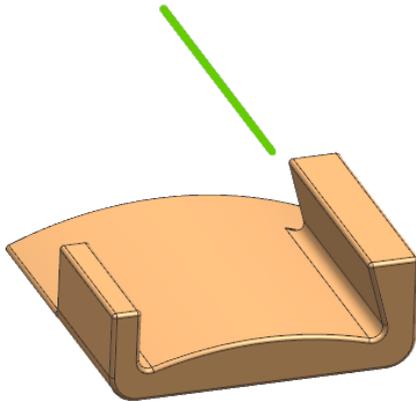


## Prerequisites:

1. You will need access to **NX CAM 11.0.1** in order to run this demonstration.
2. If you haven't done so already, download and unzip **tool\_tilt\_enhancements.7z**.

## Demo:

1. Open **tool\_tilt.prt** in NX.

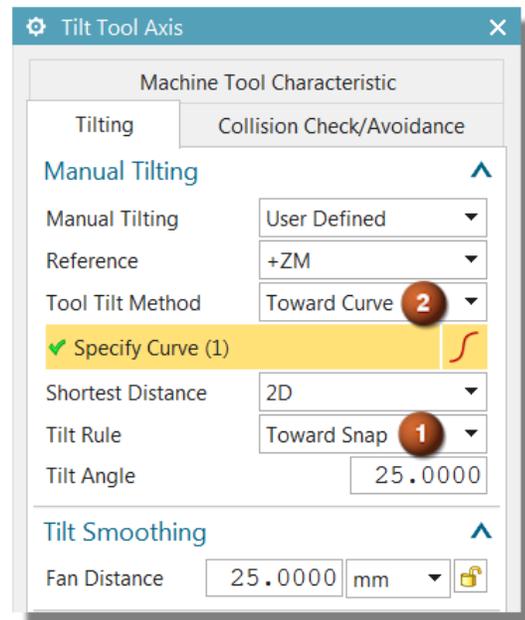
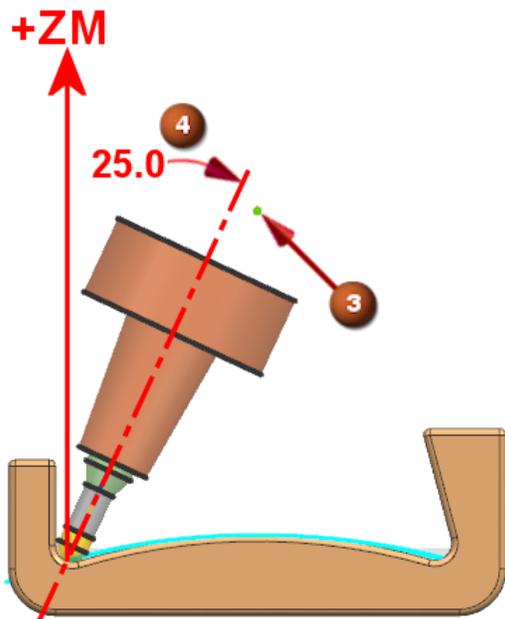


2. Orient the part to a **Right** view.

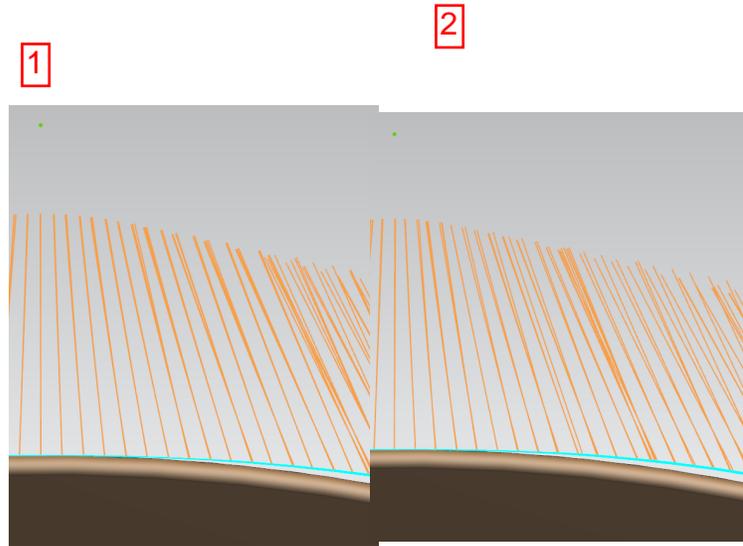
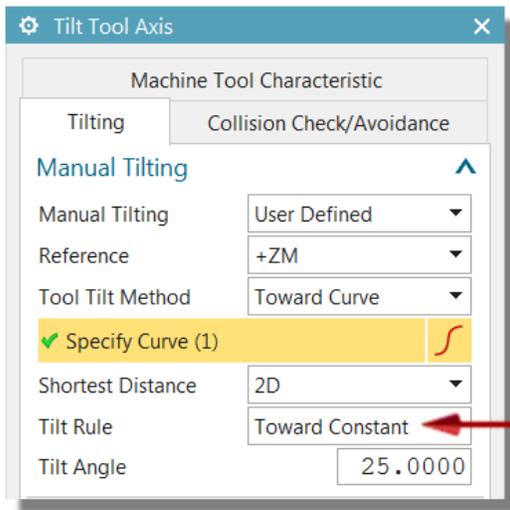
## Toward Constant Tilt Rule

1. In the Operation Navigator, right-click **VAC\_TILT\_TOOL** and choose **Tool Path**→**Tilt Tool Axis**.

The Tilting options are available only when using a Ball Mill tool. Tilt Rule is set to Toward Snap (1). Toward Curve (2) tilts the tool toward the control curve (3) at an angle (4) measured from the specified Reference axis (+ZM).

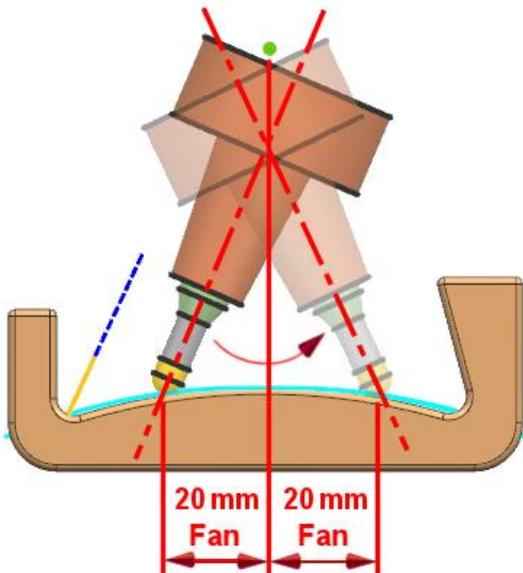


2. Select **Toward Constant** from the **Tilt Rule** list.



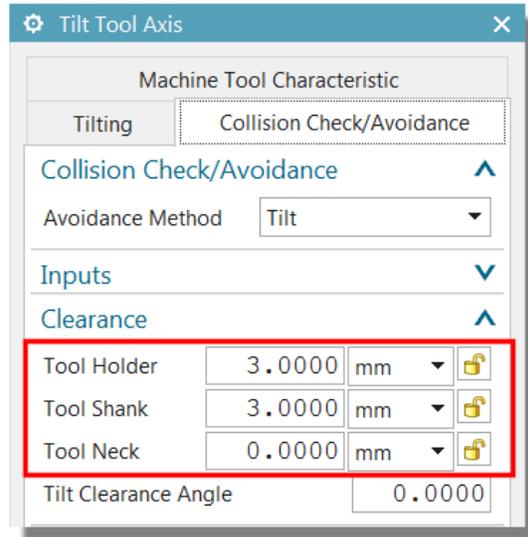
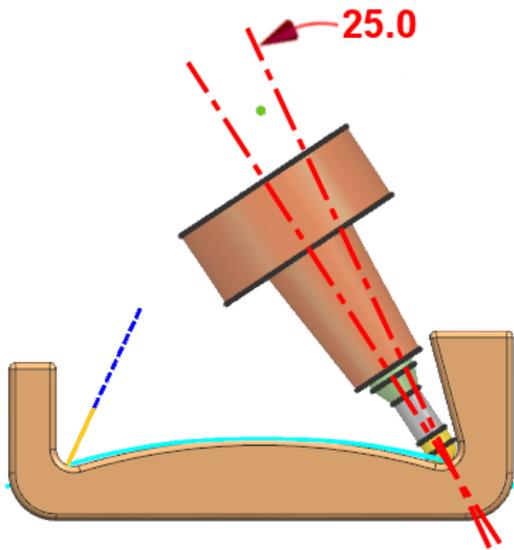
3. Type **20.0000** mm in the **Fan Distance** box.
4. Click **OK**.
5. Click **Verify Tool Path** .
6. Reduce the **Animation Speed** and click **Play** .

The tool axis intersects the control curve before reaching the specified Fan Distance. Unlike Toward Snap, Toward Constant does not take into consideration the intersection of the tool axis and the control curve in determining when to begin fanning. Toward Constant maintains the specified Tilt Angle until the specified Fan Distance is reached.



Because Avoidance Direction is set to Lead/Tilt, the tool “hinges” on the curve, moving within a plane for each zig and zag motion.

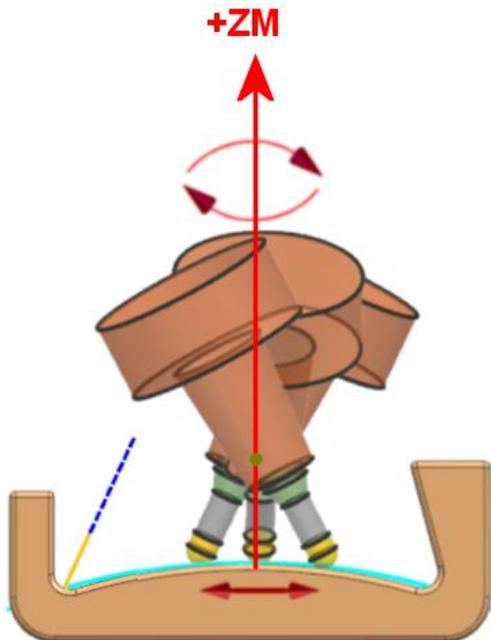
Notice that the tool exceeds the specified 25.0000 degree Tilt Angle as it undercuts the wall on the right. The system increases the tool tilt based on the specified Clearance parameters to avoid colliding with the part.



7. Click **Stop** .
8. Click **OK** to complete the tool path visualization.

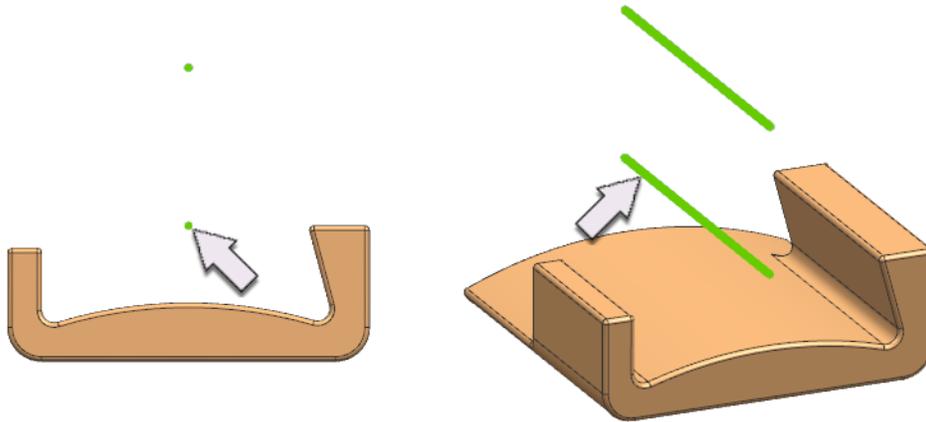
## Rotate/Tilt Avoidance Method

**Rotate/Tilt** swivels the tool about the specified Reference axis to maintain a constant angle relative to the axis.

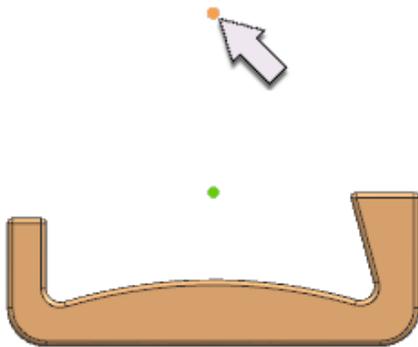


You will specify a lower control curve so you can see the behavior of Rotate/Tilt clearly.

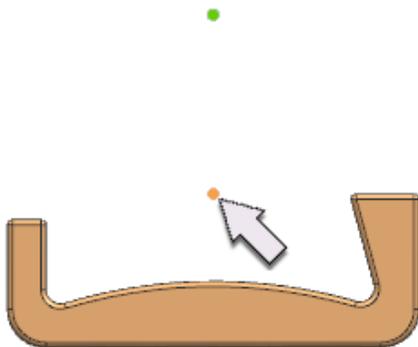
1. Select **Menu**→**Edit**→**Show and Hide**→**Show All** to display the lower curve.



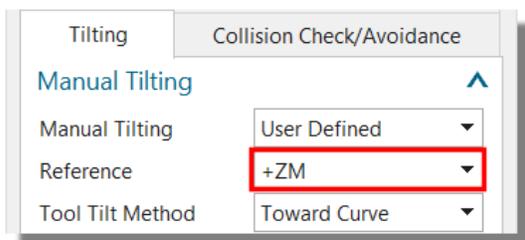
2. In the Operation Navigator, right-click **VAC\_TILT\_TOOL** and choose **Tool Path**→**Tilt Tool Axis**.
3. Hold down the Shift key and select the upper line to remove it as the control curve.



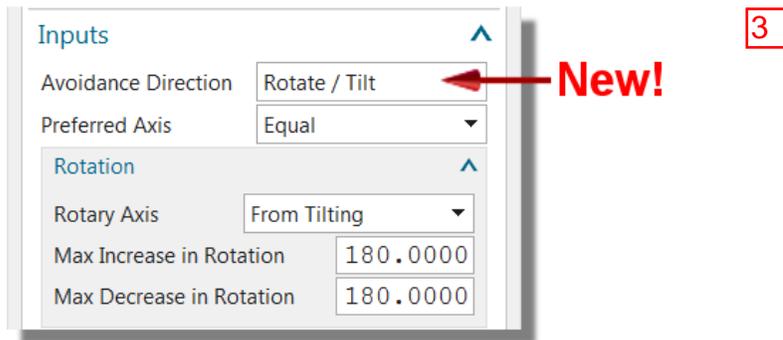
4. Select the lower line to specify it as the new control curve.



Notice the Reference axis is set to +ZM. This is the axis the tool will rotate about.

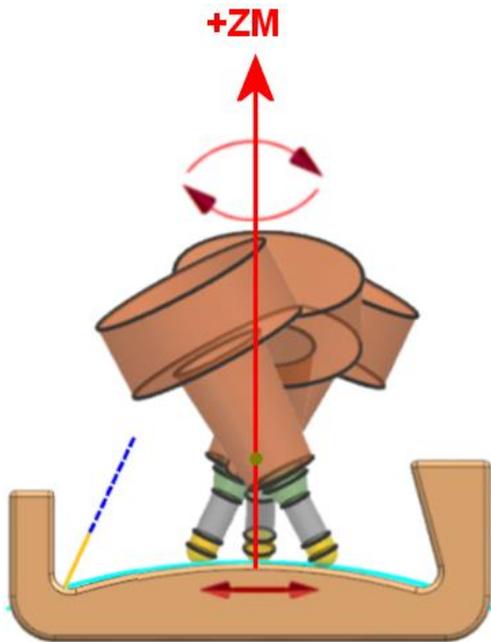


- Click the **Collision Check/Avoidance** tab.
- In the Inputs section of the dialog box, select **Rotate/Tilt** from the **Avoidance Direction** list.



Notice that the Rotary Axis option is set to From Tilting. This means the axis of rotation will use the +ZM Reference specified under Manual Tilting on the Tilting tab.

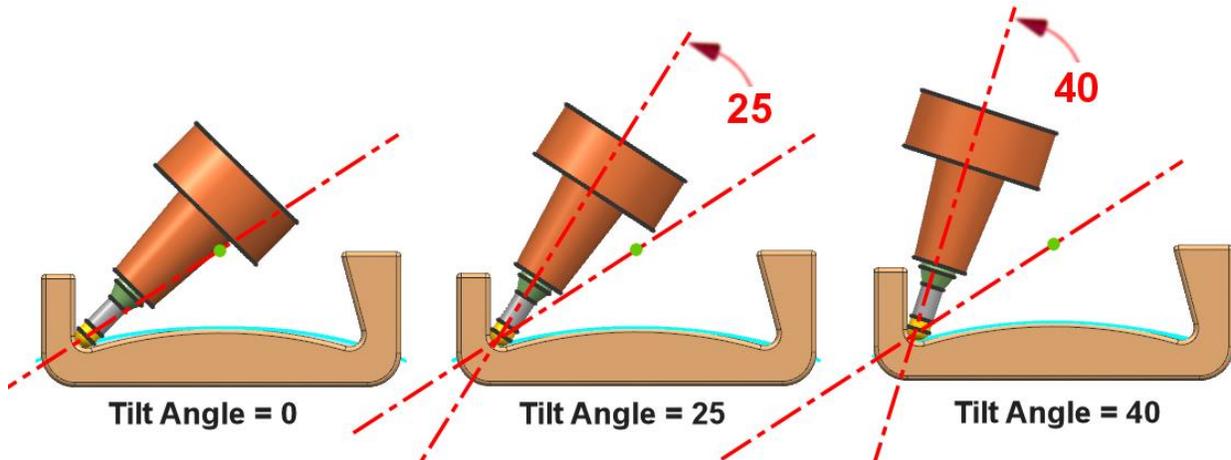
- Click **OK**.
- Click **Verify Tool Path** .
- Click **Play** .



- Click **Stop** .
- Click **OK** to complete the tool path visualization.

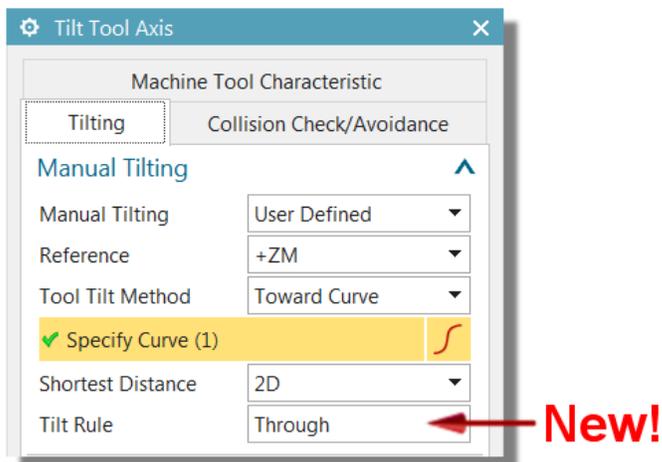
## Through Tilt Rule

Recall that when the Tilt Rule is set to Away, the tilt angle is measured away from the line intersecting the guiding point towards the +ZM axis. When Tilt Angle = 0, the tool axis intersects the guiding point. The tool axis does not violate this angle unless the tool axis is forced to change due to collision avoidance or when cutting another side of the part.



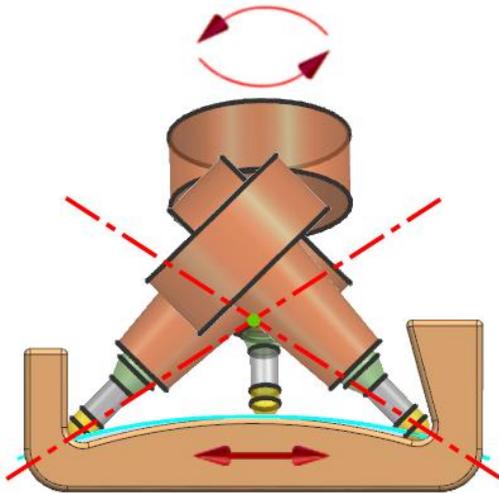
**Through** is a new tilt rule that serves as an alternative to the method of setting the Tilt Rule to Away and the Tilt Angle to 0.0000.

1. Right-click **VAC\_TILT\_TOOL** and choose **Tool Path**→**Tilt Tool Axis**.
2. Select **Through** from the **Tilt Rule** list.



3. Click **OK**.
4. Click **Verify Tool Path** .
5. Click **Play** .

**Through** produces the same behavior as setting Tilt Rule to Away and Tilt Angle to 0.0000. Because Avoidance Direction is set to Rotate/Tilt, the tool swivels about the +ZM axis to maintain a constant tilt angle.



6. Click **Stop** .
7. Click **OK** to complete the tool path visualization.
8. Continue practicing with the options in the **Inputs** section of the Tilt Tool Axis dialog box to see how they affect the tool tilt.
9. When you are finished, close the part without saving.

## Siemens Industry Software

### Headquarters

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
+1 972 987 3000

### Americas

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
+1 314 264 8499

### Europe

Stephenson House  
Sir William Siemens Square  
Frimley, Camberley  
Surrey, GU16 8QD  
+44 (0) 1276 413200

### Asia-Pacific

Suites 4301-4302, 43/F  
AIA Kowloon Tower, Landmark East  
100 How Ming Street  
Kwun Tong, Kowloon  
Hong Kong  
+852 2230 3308

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