Create a new Feature-Based Machining Sequence

Objectives

Learn how to create a new Feature-Based Machining Sequence

Overview

What is a Feature-Based Machining Sequence? How to create a new Feature-Based Machining Sequence

Feature-Based Machining Sequence

A Feature-Based Machining Sequence defines a series of drilling operations to be used on each feature found when Hole Making. New Feature-Based Machining Sequences must be added to the System database. These are found in the Feature-Based Machining node in the Configuration tree. In that node, we have all the hole features that Prospector can find:

Simple Through Hole Simple Blind Hole Counterbored Through Hole Counterbored Blind Hole Countersink Through Hole 2D Simple Hole 2D Simple Tapped Hole 2D Counterbored Hole 2D Counterbored Tapped Hole 2D Countersink Hole 2D Countersink Tapped Hole 2D Point

Each hole feature can have any number of Machining Sequences. We have included several examples in our database. There are two ways to add a Machining Sequence. Click on the Feature and under the Insert menu select "New Machining Sequence..." or right-click on the Feature and select "New Machining Sequence..." This will start up the New Machining Sequence Wizard.

Example 1 - Let's add a Machining Sequence for 2D Simple Holes that also Bores the holes

New Feature-Based Machining Sequences have to be created in the System database, so make sure to load the System Database in Insight. Go to "Cutting Strategy Selection/Mild Steel/Mold Components/Feature-Based Machining." Right-click on "2D SimpleHoles" and select "New Machining Sequence...":

E 2D SimpleHole (Circ E € Clearance Hole	X	Cu <u>t</u>	Ctrl+X
+ (i) 2D Simple Tapped	Þ	<u>C</u> opy	Ctrl+C
∃ · ⁽)	1	<u>P</u> aste	Ctrl+V
O 2D Counterbored Ta	X	Delete	Del
± () 2D Countersink Hol			
± ⊚ 2D Countersink Tap	*е	New Configuration	
X 2D Point	6	New Machining <u>S</u> equence	:e
hite		New Cutting Strategy	+
	ų,	Properties	Alt+Enter

This starts up the Add Machining Sequence wizard.

Ado	d Machining Sequence Wizard 🛛 ? 🛛 🗙
This wizard hel	ps you create a new machining sequence. neral information for your new machining sequence?
Material	Mild Steel
Configuration:	Mold Components
Feature:	2D SimpleHole (Circle)
Sequence Name:	
Sequence Description:	
	Click Next to continue.
	K Back Next > Finish Cancel

Page 1 - Machining Sequence information

It's telling use the Material, Configuration, and Feature. We need to supply the Name and a Description. Use:

Name:Bored HolesDescription:Holes that will be machined using a boring cycle.

The Name and Description show up in Prospector, we'll see this later. Click Next.

	Add Machi	ning Sequence Wizard	?	×
Add strate Note: You Available strategies: 2D Strategies Drill Center Drill Counter Bore Counter Sink Peck Drill Tap Thread Milling Gun Drilling Bore Bore + Stop Spindle	egies you want to	b use in your machining sequence han one of each strategy.	ce.	<u>U</u> p <u>D</u> n
	< <u>B</u> ack	Next > Finish	Can	cel

Page 2 - List of Drilling Strategies

On the left, we have the available drilling Strategies. On the right, is the list of drilling Strategies to be used for this Machining Sequence. Double-clicking on a Strategy on the left will add it to the list. Double-clicking on a Strategy on the right will remove it from the list. Alternatively, you can use the > and < buttons to add and remove a highlighted Strategy. The << button will remove all Strategies. The Up and Dn buttons can be used to re-order the list by moving the selected Strategy up or down. You can add any number of Strategies. You can add multiples of the same Strategy. Add:

Center Drill Drill Bore

	Add Machir	ning Sequence Wizard ? ×
	This machining sequence Do you want to re-use the	does not have any rules yet. rules from an existing configuration?
Machinin	g Sequence Strategies: er Drill	Existing Configurations:
	<u>С</u> ору F	Rules <u>R</u> eset
	< <u>B</u> ack	Next > Finish Cancel

Page 3 - Copy Rules

On the left, we have our list of drilling Strategies. On the right, we have a list of Configurations, just like the Configurations pane. We can copy the rules from any Configuration, either Basic Machining or Feature-Based Machining. For the first two, Center Drill and Drill, let's copy the rules from the other Machining for 2D Simple Holes. Click on Center Drill. Go to "Mild Steel/Mold Components/Feature-Based Machining/2D Simple Hole/Clearance Holes/Center Drill."

	Add Machi	ning Sequence V	Wizard ? ×
	This machining sequence Do you want to re-use the Sequence Strategies:	does not have any rule rules from an existing Existing Configuration	es yet. configuration? 1s:
Cento Drill	er Drill		Countersink Through Hole Countersink Blind Hole 2 D Simple Hole (Circle) Clearance Holes Center Drill 2 D Simple Tapped Hole
	<u>C</u> opy F	Rules <u>R</u> eset	
	< <u>B</u> ack	<u>N</u> ext >	Finish Cancel

The Copy Rules button is now enabled, click it. The Strategy turns red indicating the Rules were copied. The Reset button is enabled if you want to delete the Rules.

Add Machi	ning Sequence Wizard ? ×
This machining sequence Do you want to re-use the	does not have any rules yet. rules from an existing configuration?
Machining Sequence Strategies:	Existing Configurations:
Center Drill C Drill Drill Bore	Countersink Through Hole Countersink Blind Hole Countersink Blind H
Copy I	Rules Reset
< <u>B</u> ack	Next > Finish Cancel

Click on Drill and copy the Rules similarly. For Bore, we'll copy from Basic Machining. Click on Bore. Go to "Mild Steel/Mold Components/Basic Machining/Finish." Click "Copy Rules" to copy the Rules.

Add Machining Sequence Wizard ? ×
This machining sequence does not have any rules yet. Do you want to re-use the rules from an existing configuration?
Machining Sequence Strategies: Existing Configurations: Center Drill P20 Drill Mild Steel Bore Mold Components Basic Machining Rough Semi Rough Semi Rough Semi Finish Finish End Finish
Copy Rules Reset
< <u>B</u> ack <u>N</u> ext> Finish Cancel

Click Finish to add the Machining Sequence. Our new Machining Sequence is added to the list:



Now let's take a closer look at the rules we just copied, specifically, the tool selection Rule for the Drilling and Bore Strategies. For the Drill Program, the Diameter of the tool is set to the Diameter of the Feature - makes sense.

🗄 🔄 Drill Tool		
···· 🗋 Name		
···· 🗋 Diameter	"2d Simple Hole Feature,Diameter"	2
Length		
Tool Point	it Angle	

For the Bore Program, the Diameter of the tool is a complicated Rule because we copied it from Basic Machining:

🖃 😋 Tool Selection	
🗋 Tool Type	"Boring Bar"
🖃 🔄 Boring Bar	
···· 🗋 Name	
Diameter	<pre>If Not IsEmpty("3d Simple Blind Hole Feature,Diameter") Then "Bore,Tool Selection,Boring Bar,Diameter" = "3d Simple Blind Hole Feature,Diameter" Else If Not IsEmpty("3d Simple Through Hole Feature,Diameter") Then "Bore,Tool Selection,Boring Bar,Diameter" = "3d Simple Blind Hole Feature,Diameter" Else If Not IsEmpty("2d Simple Hole Feature,Diameter") Then "Bore,Tool Selection,Boring Bar,Diameter" = "2d Simple Hole Feature,Diameter" Else "Bore,Tool Selection,Boring Bar,Diameter" = .5</pre>
Length	

Let's changed the Diameter to be the Diameter of the Feature. Click in the cell and hit backspace to delete the Rule. Down in Common Expressions, Variables/Features/2d Simple Hole Feature, double-click on Diameter.



Now our Rule is set:

🗄 🕞 Tool Selection		
Tool Type	"Boring Bar"	
🚍 🔂 Boring Bar		
🗋 Name		
🗋 Diameter	"2d Simple Hole Feature,Diameter"	2
Length		
🗄 💼 Reamer		

Let's also change the Rule for Depth. Again, it's a complicated Rule based on some of the 3D Features, since this is 2D, let's just use 1" for now. Click in the cell and hit backspace to delete the Rule. Type in 1.0 and hit enter:

🗋	Depth	2	

Let's test it out in Prospector. Save the Database.

Prospector

In Finish, new 2D Program, pick Hole Making. Find 2D Simple Holes with a diameter of 2.5. At the bottom of the list of drilling Strategies, you see the list of Feature-Based Machining Sequences for this feature.

Available Operations:	Description	
Basic Machining Drill Center Drill Counter Bore Counter Sink Peck Drill Tap Thread Milling Gun Drilling Bore Bore + Stop Spindle Bore + Stop Program Bore + Stop Program Bore + Dwell + Stop Program Bore + Dwell Feature-Based Machining Clearance Holes Bored Holes	Holes that will be machined boring cycle. (Center Drill, Bore)	using a Drill,
Bore + Dwell Feature-Based Machining Clearance Holes Bored Holes	Holes that will be machined boring cycle. (Center Drill, Bore)	Drill

Select the name we used for the Machining Sequence - "Bored Holes." You'll see the description on the right along with the list of Strategies. Click Next. And now we can go through the rest of the wizard. Each Strategy in the list will have its own Tool, Tool Assembly, and Parameters page.

	Center Drill: Tool	Selection	?	x
Program List Center Drill Tool Tool Assembly Parameters Drill Tool Tool Assembly Parameters Bore Tool Tool Assembly Parameters	Center Drill: Tool Select Tool 	Selection Tool Details Length: 3.5 V Drill Length: .3125 V Home Position Station Number: Length Comp. Spindle Speed:	? Diameter: .75 ∨ Countersink Angle: 60 ∨ Drill Diameter: .3125 ∨ 0 ∨ 0 ∨ 1 1 1 503	×
	Add Tool	Plunge Feed Rate: Coolant:	5.536508 No Coolant	~
	< Back	Vext > Finis	h Cancel	

You can quickly jump around using the navigation control on the left. The last page contains a list of all the Strategies with all their

	Property	Value	^
1 3			
	E Bore		
	🗋 Use Multi-Cavity Layout	No	
	Use Patch Surfaces	No	
	Clear Plane	.1	
	Retract To Clear Plane	No	
	Clear Distance	.1	
	Drill Order	Optimized	
	Drill Start Quadrant	Second Quadrant	
	Drill Cut Direction	Cut X-Major	
Show Advanced	Home Position		
Settings	tool		~

Click Finish. If you haven't used Machining Sequences or Remachining Sequences before, this might look new. Instead of a single Program being added to the tree, we have another level - the Program Group. This represents an instance of the Machining Sequence - it's named Bored Holes (1):

🗄 🏪 Fin	iish	
ė 🔛	Bored Holes(1)	
	prog1	Center Drill
	prog2	Drill
	prog3	Bore

Under that level are the Programs, in order. You cannot change the order of a Program Group. You can Update the Group or you can Update individual Programs in the Group. You can view/change the Properties of the Group or Properties of individual Programs in the Group. Build will generate the Programs in order. Let's take a look at another example. This time for a 3D Feature.

Example 2 – Countersink Through Hole Machining Sequence with a Tapped Program

Back to Insight. In Cutting Strategy Selection/Mild Steel/Mold Components/Feature-Based Machining, right-click on Countersink Through Hole and select New Machining Sequence:

📩 👾 Counterminte T		
E- F. H. C. S	∦ Cu <u>t</u>	Ctrl+X
🔤 🔄 Centi	🖹 <u>С</u> ору	Ctrl+C
🔁 Drill	Paste	Ctrl+V
E Courtersink F	X Delete	Del
⊇ O SimpleHol	* New Configuration	۱
Clearance General Ho	🔚 New Machining <u>S</u> e	quence
E Centi	New C <u>u</u> tting Strate	egy 🕨
E Drill	Properties	Alt+Enter

For the name, use "Countersink Through Tapped Holes" and Description "Countersink through holes that need to be tapped." Use

the following Strategies: Center Drill, Drill, Counter Sink, and Tap. For the first three, copy the Rules from the existing FHCS Machining Sequence. Copy the Tap Rules from Basic Machining/Finish. We'll edit the Tap Rules. First, let's change the Depth:

Countersink Through Hole Generative F. H. C. S. Clearance Through Generative Countersink Through Tapped Holes Generative Counter Drill	Clear Distance	"Tap,Retract To Clear Plane" = "Yes" Else "Tap,Retract To Clear Plane" = "No" End If 0.1
Drill Counter Sink Tap Countersink Blind Hole O 2D Simple Hole Hole O 2D Simple Tapped H	📄 Depth	If Not IsEmpty("3d Simple Blind Hole Feature, Diameter") Then "Tap.Depth" = "3d Simple Blind Hole Feature, Full Diameter Depth" Else If Not IsEmpty("3d Countersink Blind Hole Feature, Full Diameter Depth") Then "Tap.Depth" = "3d Countersink Blind Hole Feature, Full Diameter Depth" Else "Tap.Depth" = 1.0
	Drill Order	"Optimized"

Click in the Rule for Depth and hit backspace to clear the Rule. I want to Tap down an inch, but not from the top of the hole, but from the bottom of the counter sink. Here's how I can do it. Down in the Common Expressions pane, find the "3d Countersink Through Hole Feature" and double click on Countersink Depth:

🚊 🔂 3d	Countersink Through Hole Feature
>	Feature Name
>	Diameter
	Depth
	Countersink Diameter
···· >	Countersink Depth
>	Countersink Angle
÷	Center
4 👝 🗛	CONTRACTOR DE LA CONTRACT

Now type a space, plus sign (+), another space and the number 1. Hit Enter to save the Rule:

3d Countersink Through Hole Feature, Countersink Depth + 1	🗋	Depth	"3d Countersink Through Hole Feature,Countersink Depth" + 1	2
--	---	-------	---	---

And let's just use the Diameter of the Hole for tool selection. Go down to the Tool Selection area, open up the Tap Tool, clear the Rule for Diameter, double click Diameter down in the Common Expressions pane, and hit Enter. You should see this:

Iool Selection	
🗋 Tool Type	"Tap Tool"
🗄 🛁 Tap Tool	
🗋 Name	
Diameter	"3d Countersink Through Hole Feature,Diameter"
···· Li Length	
····· 🗋 Length ····· 🗋 Threads Per Inch	

Save the database and return to Prospector to test out the new Machining Sequence.

Prospector

Open up the 3D Hole project. In Finish, new 2D Program, Hole Making. On the feature page, select Countsink Through Hole and click Find Now. Next to the Strategy page and we see our new Machining Sequence:

Н	ole Making Operati	ons ? ×
Available Operations:		Description
Basic Machining Drill Center Drill Counter Bore Counter Sink Peck Drill Tap Thread Milling Gun Drilling Bore Bore + Stop Spindle Bore + Stop Program Bore + Dwell + Stop Program Bore + Dwell Feature-Based Machining F. H. C. S. Clearance Through Countersink Through Tapped Holes		Countersink through holes that need to be tapped. (Center Drill, Drill, Counter Sink, Tap)
	< <u>B</u> ack <u>N</u> ext >	Finish Cancel

Select it and hit Finish. A new Program Group is added to the Project. This one has four programs:



Let's take a quick look at the Tap program:



Measuring from the bottom of the countersink to the end of the Tap, we see that the Z distance is one inch:

Measure Distance		
X Distance: 0.000000		
Y Distance: -8.000000 3D Distance: 8.062258		
Z Distance: 1.000000		
ОК		