

Cutter parameter update

Problem

Updating of cutter length and diameter offsets is usually carried out in one of two ways:

- **Manual updates using information provided by offline or external measurement systems**

An external device such as a micrometer or co-ordinate measuring machine (CMM) is used to report the measured size of a feature and the measurement is then used to adjust parameters on a machine tool.

- These methods are prone to error because the operator must manually calculate the desired update based on the reported feature dimensions. For example, a bad calculation, a transposition of digits, or an offset mistakenly loaded into the wrong position could cause significant deviation from the expected result.
- These methods can introduce a significant delay to the process update. In batch production, this could result in several parts being machined before the update is applied, or a halt in production whilst the update is calculated and loaded.
- Operator skill and consistency can cause a variation in the level of control being applied. For example, some operators may choose not to adjust a tool.

- **Automatic update using a tool setting probe mounted within the CNC machine tool**

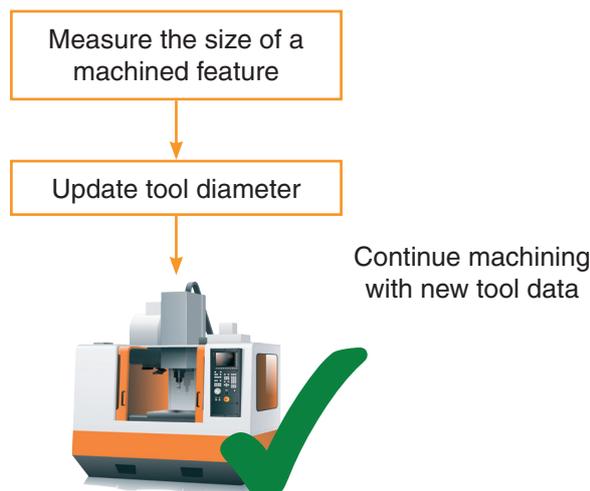
An automatic device is mounted in the machine tool and is used to set the parameters for the tool in-cycle.

- Measurements which are made under low-load conditions often do not reflect the cutting of material with that tool. Effects such as tool push-off are not accounted for and this leads to small variations in size which may not be acceptable for tightly toleranced features.

Solution

Use a spindle probe to measure the actual size of a machined feature and update the relevant tool offset.

It is sometimes beneficial to use a slave feature (which will subsequently be machined away), or to deliberately machine a feature under-size as part of a semi-finishing strategy. These features are then measured using the spindle probe and provide real process information which can be applied to a final cut.



Benefits

- Adjusts the process accurately to nominal every time
- No time delays: instant feedback and correction
- Compares actual machined surface or feature size to expected feature size using the same work co-ordinate system
- Automatic update of correct tool offset, consistently, without error
- Allows continuation of process without stoppages or waiting time
- Information relating to process performance is generated automatically for proof of quality and process traceability

Case study

Lathe probes installed on machines producing a variety of camshafts for automotive engines are used for process setting, tool updates, and post-process inspection. Sample inspection using the probe checks 17 defined machined features on a camshaft in order to automatically update tool offsets. Four criteria are used to force a post-process check: inspection frequency, tool servicing, machine variable change, and start of shift or first off part. Whenever a check is made, relevant results are fed back in order to update tool offsets automatically. Experience of actual tool wear has shown a checking frequency of every 20 parts is sufficient to prevent drift of accuracy for the process.

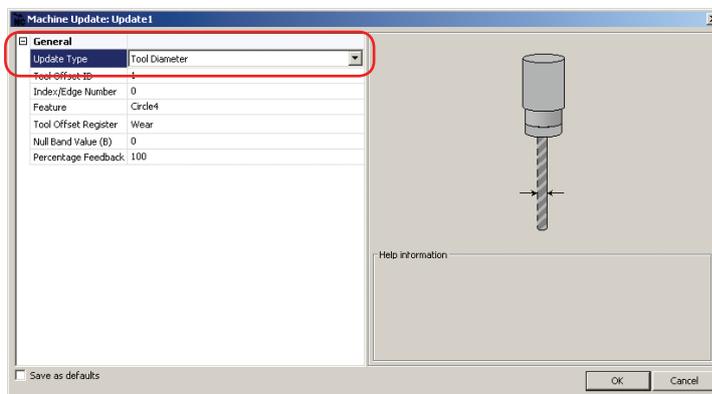


Example: tool diameter update

Measure a 50 mm diameter boss machined using tool T1. Update the relevant tool offset and then re-machine and re-measure the part to confirm size before continuing with the machining process

Sample Productivity+™ probe software program

 G-Code Block: MachineCircleFeature  Inspection Cycle: Cycle1  Measured Circle: Measure_Circle	Machine and inspect circle feature.
 Machine Update: UpdateToolDiameter	Update tool information based on feature data.
 G-Code Block: RemachineCircleFeature  Inspection Cycle: Cycle2  Measured Circle: Reinspect	Re-machine and re-inspect circle feature.
 G-Code Block: MachineRemainingFeature	Machine remaining features.



Sample Inspection Plus software program

	Machine 50 mm diameter boss 0.5 mm oversize using tool T1
T02 M06	Select the probe
G54 X0. Y0.	Move to start position
G43 G1 H1 Z50. F3000	Activate offset 1 and move to 50 mm above Z surface
G65 P9810 Z10. F1000	Protected positioning move
G65 P9814 D50.5 Z-10. T1	Measure 50.5 mm diameter boss Update tool offset 1
	Machine 50 mm diameter boss to size
T02 M06	Select the probe
G54 X0. Y0.	Move to start position
G43 G1 H1 Z50. F3000	Activate offset 1 and move to 50 mm above Z surface
G65 P9810 Z10. F1000	Protected positioning move
G65 P9814 D50. Z-10. H0.05	Measure 50 mm diameter boss. Set tolerance of ±0.05
	Continue machining process

Renishaw plc
New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR
United Kingdom

T +44 (0) 1453 524524
F +44 (0) 1453 524901
E uk@renishaw.com
www.renishaw.com

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Renishaw worldwide

Australia

T +61 3 9521 0922
E australia@renishaw.com

Austria

T +43 2236 379790
E austria@renishaw.com

Brazil

T +55 11 4195 2866
E brazil@renishaw.com

Canada

T +1 905 828 0104
E canada@renishaw.com

The People's Republic of China

T +86 21 6180 6416
E china@renishaw.com

Czech Republic

T +420 548 216 553
E czech@renishaw.com

France

T +33 1 64 61 84 84
E france@renishaw.com

Germany

T +49 7127 9810
E germany@renishaw.com

Hong Kong

T +852 2753 0638
E hongkong@renishaw.com

Hungary

T +36 23 502 183
E hungary@renishaw.com

India

T +91 80 6623 6000
E india@renishaw.com

Indonesia

T +62 21 2550 2467
E indonesia@renishaw.com

Israel

T +972 4 953 6595
E israel@renishaw.com

Italy

T +39 011 966 10 52
E italy@renishaw.com

Japan

T +81 3 5366 5316
E japan@renishaw.com

Malaysia

T +60 3 5631 4420
E malaysia@renishaw.com

The Netherlands

T +31 76 543 11 00
E benelux@renishaw.com

Poland

T +48 22 577 11 80
E poland@renishaw.com

Russia

T +7 495 231 16 77
E russia@renishaw.com

Singapore

T +65 6897 5466
E singapore@renishaw.com

Slovenia

T +386 1 527 2100
E mail@rls.si

South Korea

T +82 2 2108 2830
E southkorea@renishaw.com

Spain

T +34 93 663 34 20
E spain@renishaw.com

Sweden

T +46 8 584 90 880
E sweden@renishaw.com

Switzerland

T +41 55 415 50 60
E switzerland@renishaw.com

Taiwan

T +886 4 2473 3177
E taiwan@renishaw.com

Thailand

T +66 2 746 9811
E thailand@renishaw.com

Turkey

T +90 216 380 92 40
E turkiye@renishaw.com

UK (Head Office)

T +44 1453 524524
E uk@renishaw.com

USA

T +1 847 286 9953
E usa@renishaw.com

For all other countries

T +44 1453 524524
E international@renishaw.com

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H - 5650 - 4015 - 01

Issued 1111 Part no. H-5650-4015-01-D