

SupaScan: surface condition monitoring

Application overview

As well as extremely fast workpiece set-up and detailed post-process inspection, SupaScan can also monitor surface condition of flat surfaces. This allows the detection of:

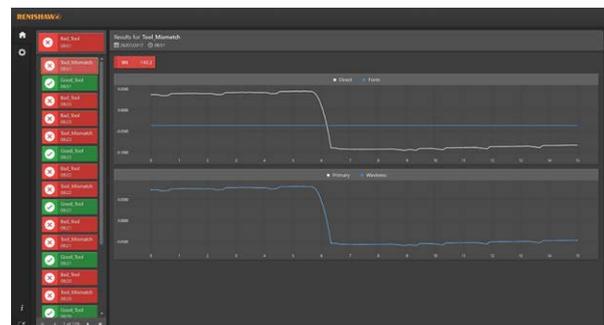
- periodic errors – caused by worn tooling, or machine vibration, resulting in a repeated pattern on the surface;
- surface peaks – due to chipped or worn tooling;
- steps on the surface – caused by unexpected differences between cutter dimensions, tool push-off, part deflection under cutting forces, or thermal changes in the machine.

Using SupaScan to automate surface condition monitoring allows these issues to be resolved and corrections to be made whilst the component is still in the fixture; helping to reduce rework and scrap.

Automatically monitoring surface condition means time spent using manual gauges and transferring components between measurement devices is eliminated, and measurement reproducibility – when compared with manual measurement techniques – is enhanced.

In use, SupaScan analyses surface measurement data and a complementary application – Surface Reporter – provides real-time, graphical representations of the results. Colour-coded results clearly indicate to the operator whether the component surface is within tolerance. Data can also be written to machine variables or exported to external applications for further analysis.

SupaScan allows the same stylus configuration employed for surface condition monitoring to be used for part setting and post-process inspection, making it a highly-flexible solution.



Surface Reporter app displaying a 140 μm surface step

Target industries and applications

Industries

SupaScan provides surface condition monitoring capability for companies in all high-value and high-volume manufacturing sectors, such as medical, automotive, aerospace, consumer electronics, mould and die, and power generation.

Applications

Surface condition monitoring is typically used to detect chipped, damaged or worn tooling, cutter mismatch, and step-over errors in metal machining operations, and is a common requirement during the machining of sealing surfaces.

Benefits

The principal benefits of using SupaScan for surface condition monitoring are:

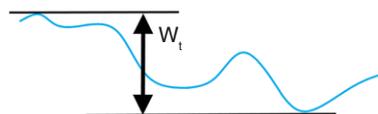
- SupaScan can detect surface defects caused by chipped, damaged or worn tooling, mismatches between cutters and step-over errors. Monitoring surface condition allows tools to be used for their full lifespan and sister tooling to be called before valuable workpieces are damaged.
- Surface condition results can be output to the Surface Reporter app – providing a visual indication of whether the part is in tolerance – or machine tool variables allowing automatic 'lights out' control.
- Automating surface condition monitoring using SupaScan on the machine tool improves measurement reproducibility and reduces issues associated with manual measurement.

Technology overview

The output of the surface condition inspection is the total waviness value – W_t – which is passed into machine variables, for use in controlling downstream processes, or exported to a .csv file. The surface profile trace can also be shown on the Surface Reporter app – a complementary, graphical reporting application.

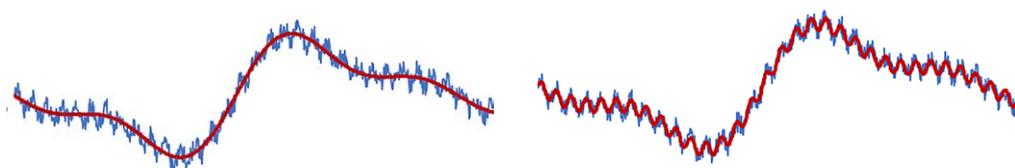
The OSP60 probe is used to measure surface condition on-machine in any direction. Peaks on the surface – potentially caused by chipped tooling – can be measured accurately using the system. Surface scratches – potentially caused by material build-up on the tool – can also be detected.

Using a $\varnothing 2$ mm stylus ball, the OSP60 probe can obtain surface condition information as well as undertake other SupaScan probing tasks, such as workpiece set-up and post-process inspection.



W_t waviness measurement output by SupaScan

After filtering out the form profile from the raw surface scan data, SupaScan software filters the waviness profile from the remaining data. Users can customise how the waviness profile is filtered by setting the value of the λ_c cut-off wavelength.



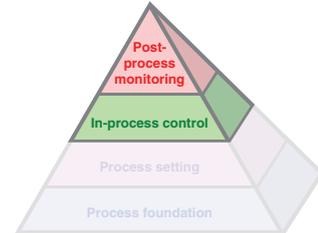
Filtering using a larger λ_c cut-off wavelength (left), and a smaller λ_c cut-off wavelength (right)

Productive Process Pyramid™

Process variation is the enemy of competitiveness and profitability. It causes waste and inefficiency, leads to high quality costs and manning levels, and results in late deliveries and poor traceability.

Renishaw's Productive Process Pyramid™ provides a framework within which to identify and control variation in your factory, backed by innovative technology, proven methods and expert support.

The Productive Process Pyramid shows how layers of control can build upon one another to systematically remove variation from the machining process, increasing throughput, maximising conformance and eliminating human error.



Use of SupaScan for surface condition monitoring addresses issues relating to the top two layers of the Productive Process Pyramid.

- Within the **informative layer**, surface condition data captured by the application can be output and either analysed by an external application or used as part of a downstream process.
- Within the **active layer**, the application can be used to measure surface condition to determine the level of tool wear and determine whether a tool needs to be replaced.

Requirements and compatibility

Requirements

To use SupaScan for surface condition monitoring you need:

- A probing installation (OSP60 probe, OSI-S interface and OMM-S receiver) on the CNC machine tool.
- DPU-1 data processing unit (which includes a suite of SupaScan programming and probe calibration macros for the make and model of your machine tool control).

Optional:

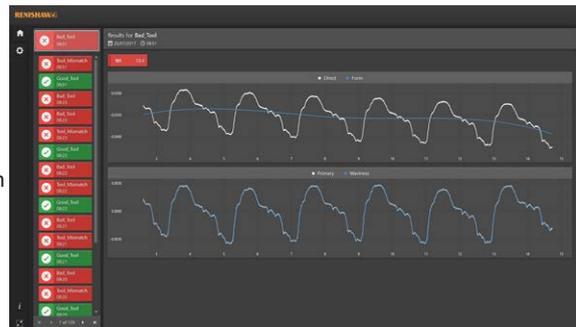
- The Surface Reporter app.

Compatibility

SupaScan is currently compatible with Fanuc Series 0–3xi and Siemens 840D solution line controls.

Certain controller options are also required in order to use SupaScan. For more information on these options, refer to the range of controller requirements documents available from Renishaw at www.renishaw.com/sprint.

For more information about the surface condition measurement capability of SupaScan, see application note addendum: *SupaScan surface condition monitoring: technology demonstration* (Renishaw part no. H-5465-8329).



Surface Reporter showing excessive waviness due to worn tooling

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Renishaw is an established world leader in engineering technologies, with a strong history of innovation in product development and manufacturing. Since its formation in 1973, the company has supplied leading-edge products that increase process productivity, improve product quality and deliver cost-effective automation solutions.

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Products include:

- Additive manufacturing and vacuum casting technologies for design, prototyping, and production applications
- Dental CAD/CAM scanning systems and supply of dental structures
- Encoder systems for high-accuracy linear, angle and rotary position feedback
- Fixturing for CMMs (co-ordinate measuring machines) and gauging systems
- Gauging systems for comparative measurement of machined parts
- High-speed laser measurement and surveying systems for use in extreme environments
- Laser and ballbar systems for performance measurement and calibration of machines
- Medical devices for neurosurgical applications
- Probe systems and software for job set-up, tool setting and inspection on CNC machine tools
- Raman spectroscopy systems for non-destructive material analysis
- Sensor systems and software for measurement on CMMs
- Styli for CMM and machine tool probe applications

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