SPRINT™: Blade Toolkit

Toolkit overview

The SPRINT™ Blade Toolkit offers a unique solution for end users requiring measurement data for the production and repair of blades and bladed disks. The data provided by the Blade Toolkit can be used in a number of high-precision applications including blade tip refurbishment, in-process blade measurement and root blending of bladed disks.

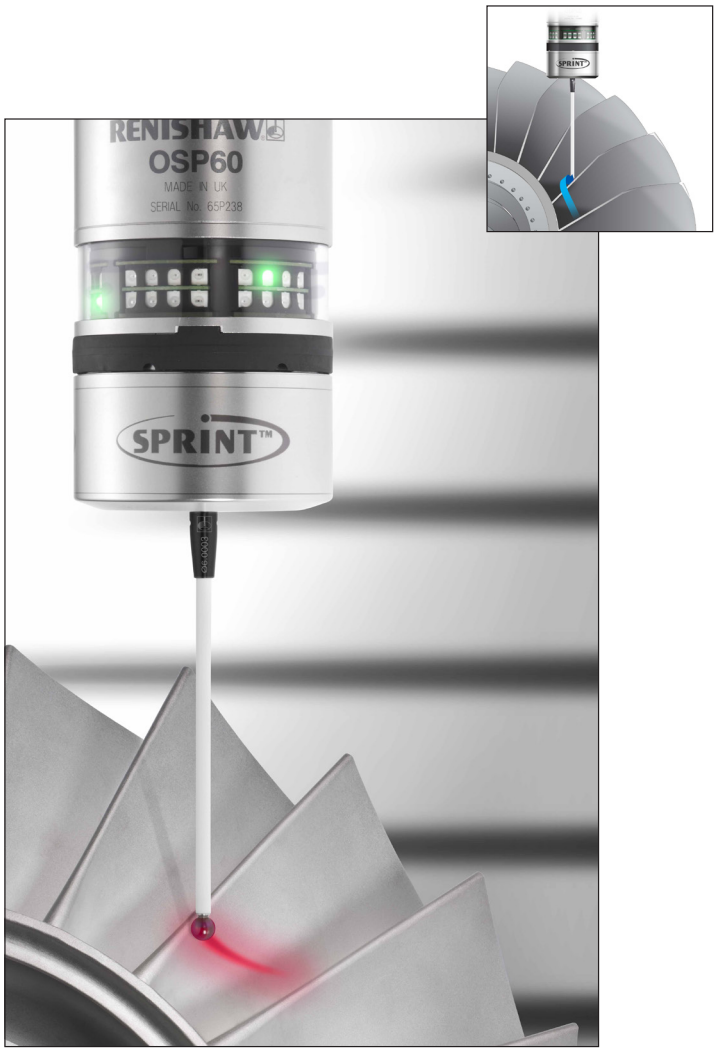
In comparison with traditional on-machine technologies, the SPRINT Blade Toolkit provides significant cycle time advantages and uniquely accurate definition of tightly curved surfaces such as leading edges. It also provides significant advantages in adaptive machining processes when compared to off-machine measurement methods, since measuring on-machine eliminates manual handling and the many issues associated with the transfer of components and set-ups between measurement devices.

The analysis software for blade measurements is run directly from the CNC controller through the Productivity+™ CNC plug-in. This means that the measurement data is automatically available either through user variables on the CNC, or on a connected PC for downstream data processing.

The system is capable of providing equivalent data when compared to existing on-machine probing systems, but with an increased level of speed and accuracy derived from the 1,000 3D points per second measured by the OSP60 SPRINT probe. This means that the time taken to integrate the system into an existing or new process is minimised.

The Blade Toolkit consists of two elements:

- An on-machine executable and analysis application: ‘SPRINT Blade: On machine’. This application is installed onto a PC which is connected to the CNC machine tool. This component of the Blade Toolkit performs the set-up, alignment, blade scanning, results collection and asynchronous data processing.
- A programming service provided by Renishaw engineers for the creation of individual programs for each part to be used with the Blade Toolkit.



The SPRINT™ Blade Toolkit is one of a range of industry focused applications developed by Renishaw for use with the SPRINT system. For more information on these applications, see www.renishaw.com/sprint

Target industries and applications

Industries

The SPRINT Blade Toolkit provides game-changing capability to companies in the aerospace and power generation sectors working to design and repair aerofoil blades and bladed disks.

Applications

The technology provided by the Blade Toolkit is particularly suitable for the collection of data for adaptive machining processes, such as adaptive root blending of friction-welded bladed disks and tip repair of blades in major engine overhauls.

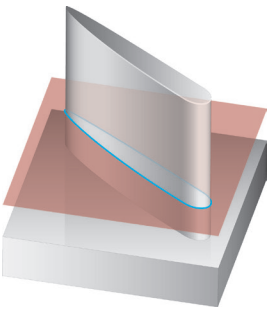
The application may also be used for in-process measurement data collection for process monitoring and Go/No go checks.

Benefits

The principal benefits of the SPRINT Blade Toolkit are:

- Significant cycle time advantages in comparison with traditional touch-trigger systems.
- Significant accuracy advantages compared to touch-trigger and optical systems, particularly the capability to scan around leading and trailing edges.
- Availability as a drop-in replacement for existing on-machine systems.
- Reduced errors and process time due to the elimination of part transfer between an external measurement device and the machine tool.
- The operational benefits provided by closed loop process control.

Technology overview

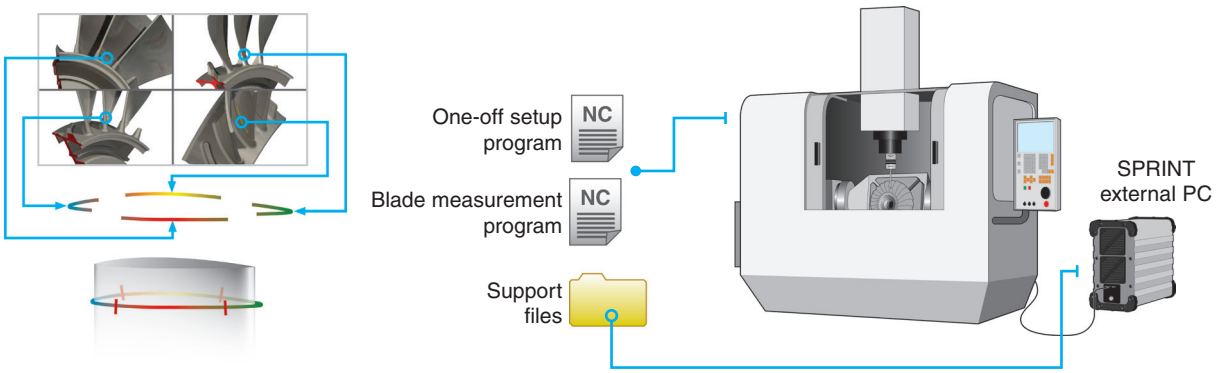


SPRINT blade measurement cycles are designed to measure blade sections, as represented by the intersection of a geometric plane with the profile of the blade, and incorporating the leading and trailing edges.

During a set-up process, the real orientations of the CNC machine tool are recorded. Each individual blade component is then measured in four orientations of the CNC machine, enabling the stylus of the OSP60 SPRINT probe to access each part of the blade section with no danger of collision with other parts of the blade (or bladed disk). Measurement data from the four measurement orientations can then be combined into a single data set which represents all of the data that has been captured from around the blade.

As part of the programming process, the user identifies the nominal positions of the measurement data which will be required for subsequent analysis. The entire SPRINT data set is then used to calculate the actual positions which correspond to the nominal points provided. This provides the most accurate set of data for subsequent analysis and allows the user to specifically control the data points which are returned; it also provides a ‘drop-in’ solution for existing discrete point measurement solutions.

The data may be returned to the user either as values stored in specific user variables for use in CNC programs, or in a .csv file which may be accessed from a PC. Whichever method is employed, data can then be used for automatic downstream analysis, with closed-loop process control activities being co-ordinated by the Productivity+ CNC plug-in.



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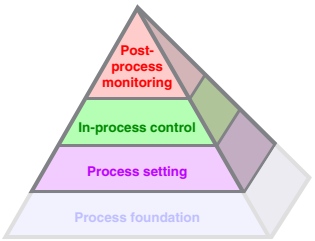
Productive Process Pyramid™

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.

The SPRINT Blade Toolkit addresses issues relating to the top three layers of the Productive Process Pyramid.

- Within the **informative layer** the Blade Toolkit can be used to measure blade sections for process monitoring purposes. This informative process is designed to log data and build information about process capability. This can be combined with a CMM for traceability assessment.
- Within the **active layer** the Blade Toolkit can be used to measure blade sections for on-machine gauging. This provides an in-process control allowing active adjustment of set up and tooling parameters.
- Within the **predictive layer** the Blade Toolkit can be used to measure blade sections for adaptive machining. This predictive process control element – used for blade repair, root blending and other similar tasks – allows the generation of a new toolpath for each unique part and will usually replace an existing touch-trigger or CMM process. Gathered data is passed to a processing utility for analysis and adaptive toolpath generation, either on-CNC, or off-CNC on a PC.

Requirements and compatibility

Requirements

To use the SPRINT Blade Toolkit you need:

- SPRINT system installation on the CNC machine tool, including machine options (OEM specific).
- An external PC (optional depending on specific machine controller type used), to support the required calculations.
- SPRINT Blade Toolkit on-machine installation.
- SPRINT Blade Toolkit programming service (for each part required).

Compatibility

The SPRINT Blade Toolkit is compatible with 5-axis milling machines with a table/table configuration fitted with a compatible controller.

Certain controller options are also required in order to use this Toolkit.

For more information on these options, refer to the range of SPRINT™ system controller requirements documents available from Renishaw.

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About Renishaw

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.

A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

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

For worldwide contact details, visit www.renishaw.com/contact

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