



# Leica Map Start

Surface imaging and Metrology Software.  
The Extension for Leica Application Suite

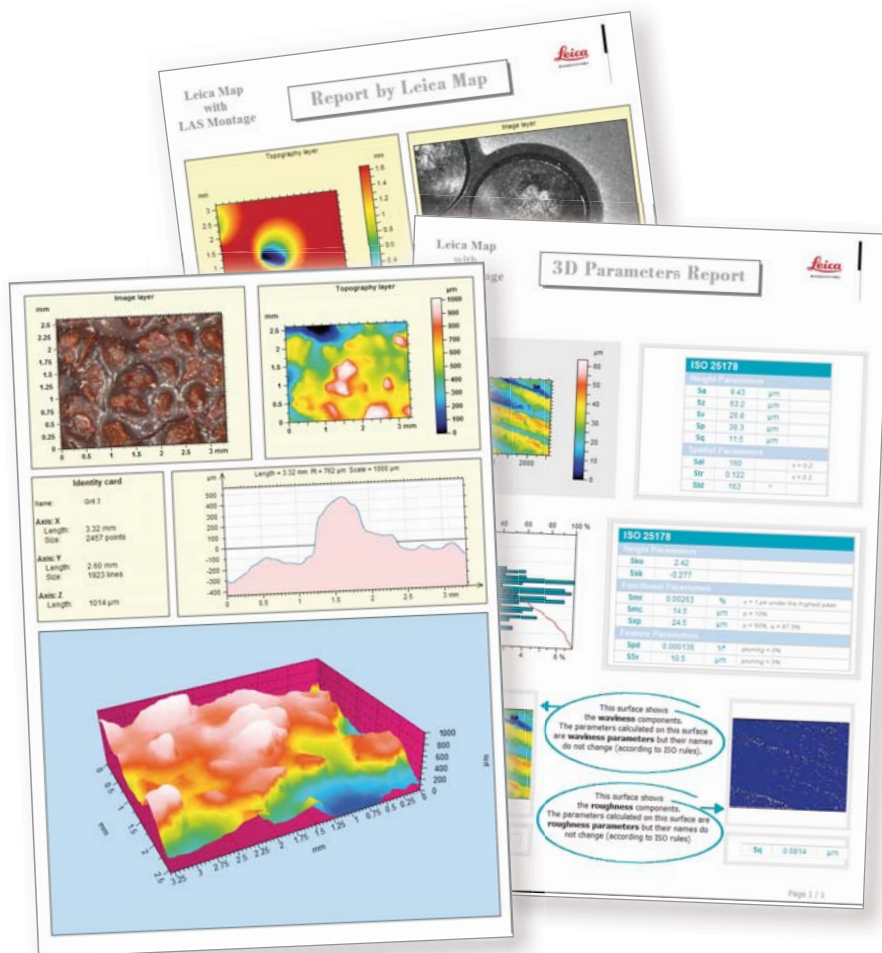
Living up to Life

**Leica**  
MICROSYSTEMS

# Industry-Standard Surface Imaging and Analysis

**Leica Map Start** is the entry level software package of the Leica Map series and is used for viewing and analyzing surface geometry and surface texture. Capabilities include visualization of all the features of measured surfaces, characterization of basic surface features including distances, angles and step heights, and calculation of surface texture parameters. There is a wide range of optional modules for cases in which more advanced surface analysis is required.

Powered by industry-standard Mountains Technology®, **Leica Map Start** builds detailed visual surface metrology reports in a highly intuitive desktop publishing environment\*. With its native 64 bit code written to make optimal use of multicore processors and providing accelerated processing and calculations, **Leica Map Start** is the perfect solution for analyzing fast measurements of industrial surfaces made by Leica compound and stereomicroscopes and macroscopes in laboratories, production facilities and onsite.



\* Mountains Technology® is a registered trademark of Digital Surf SARL.

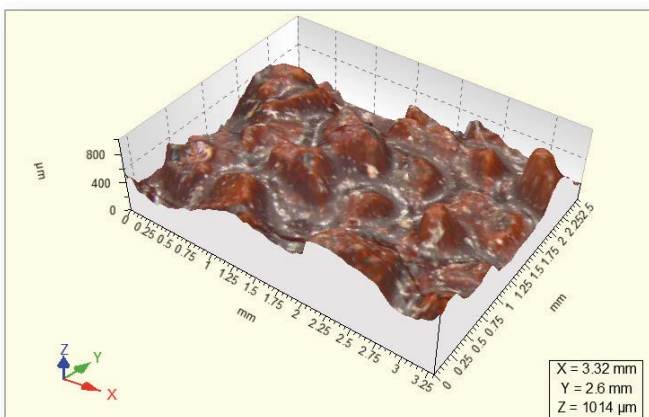
# See More Detail with Simultaneous Image Views

Leica microscopes with motorized focus drives are **capable of generating height maps of surface topography**, true color images and intensity images. Using the **Leica Map Start** software you can manipulate topography, color and intensity images simultaneously, for example when zooming in on a surface feature, or independently, for example when characterizing the surface texture of the surface topography. In addition you can fly over a surface following a predefined flight plan and even, with the

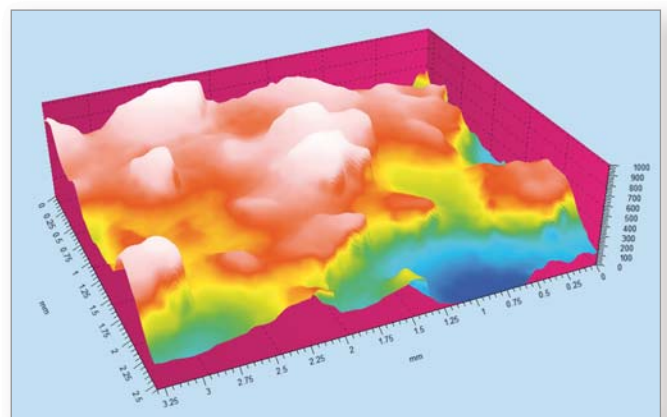
**4D Analysis** option, fly over a series of surfaces as they change with respect to time or another physical dimension.

The ability to overlay the color image or the intensity image on the topography makes it possible to **see the surface topography in true color** and to locate defects, for example fractures, that are most visible in the intensity image.

Furthermore, **images can be normalized, corrected** and enhanced by applying a wide range of tools, for example inversion and rotation, thresholding to remove anomalous spikes, retouching and smoothing.



3D view of extended focus colour image

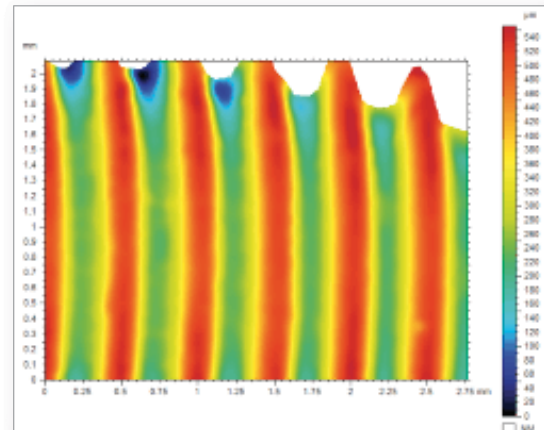


3D view of pseudo-colour depthmap image

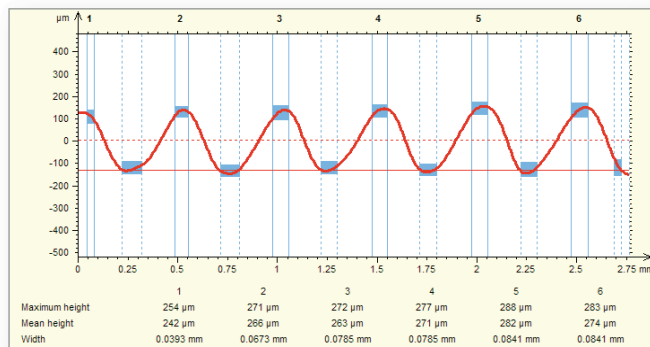
# Surface Characterization

ISO 25178			
Height Parameters			
<b>Sa</b>	105	μm	Arithmetic mean height
<b>Sq</b>	119	μm	Root mean square height
<b>Sp</b>	193	μm	Maximum peak height
<b>Sv</b>	363	μm	Maximum pit height
<b>Sz</b>	556	μm	Maximum height
<b>Ssk</b>	-0.101		Skewness
<b>Sku</b>	1.83		Kurtosis
Functional Parameters			
<b>Smr</b>	0.0169	%	Areal material ratio
<b>Smc</b>	154	μm	Inverse areal material ratio
<b>Sxp</b>	194	μm	Extreme peak height

Height and bearing ratio parameters



Surface after form removal



Step height measurements

**Leica Map Start** contains a basic set of tools for characterizing surface geometry. It calculates distances and angles on surfaces and profiles (multi-point vertical cross-sections) and calculates step heights on profiles.

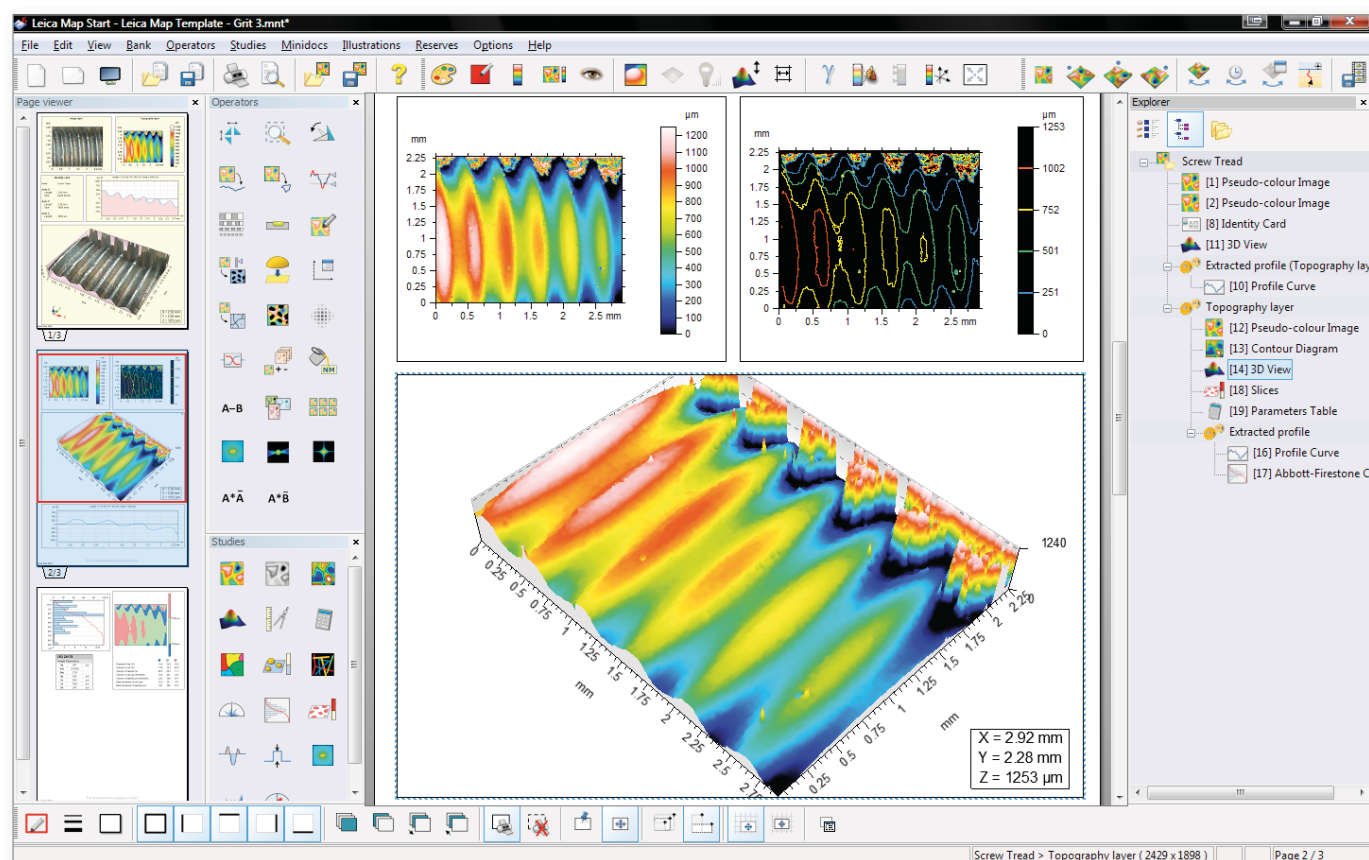
Height and functional bearing ratio parameters are calculated in accordance with the new ISO 25178 standard on area surface texture. The cut-off between the roughness and waviness components of the surface is calculated automatically.

Optional modules, in particular **Basic Surface Texture, Contour Analysis** and **Advanced Contour Analysis**, provide additional tools for the analysis of surface geometry and texture if required.

# Traceability Combined with Interactivity

In **Leica Map Start** a **surface analysis document is built visually**, frame by frame. Every step in the analysis – for example the generation of a 3D image, an analytical study of surface geometry or texture, the insertion of a measurement identity card – is recorded in a hierarchical analysis workflow that shows the dependencies between steps and provides full metrological traceability.

**Leica Map Start** is **fully interactive**. Any step in the workflow can be fine-tuned – for example the location of a profile that has been extracted from a surface – and dependent steps are recalculated automatically. New steps can be inserted at any time. To gain time, sequences of commonly used steps can be saved and inserted in any document.



Multiple page analysis document with page viewer (left) and analysis workflow (right)

# Ideal Partners – LAS Montage and Leica Map

A series of image planes at known spacing covering the in focus region of a specimen are acquired by LAS Montage in conjunction with a Leica microscope. From this stack a depthmap and an extended focus image are derived. These images are analyzed automatically by applying an existing **Leica Map Start** analysis document as a template. In routine environments, the template can be prepared by a metrologist and protected against modification by non-authorized staff. The **analysis workflow in the template document is applied automatically** to each measurement in the series and a report on each measurement is generated automatically. Reports can include pass/fail messages with green/red traffic lights.

## Optional Statistics

The **Statistics** optional module provides dynamically **updated parameters on a series of measurements**, including capability (Cpk) parameters for monitoring the repeatability of the production process. It can analyze multiple measurement populations and all results can be exported in Excel format for use by an external quality management system.

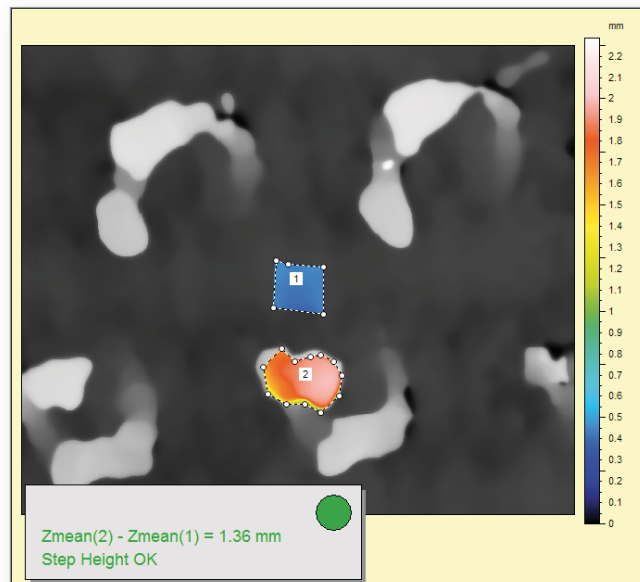
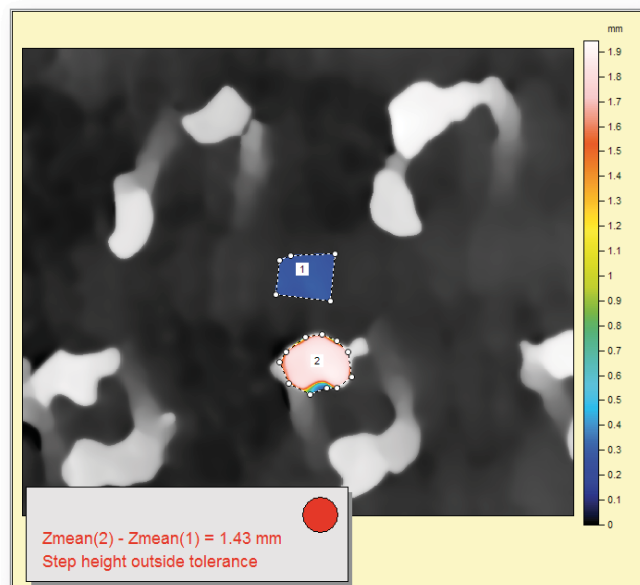


Image of two similar surfaces showing traffic light acceptance symbols. The step height measured on the upper surface fails and the lower passes.

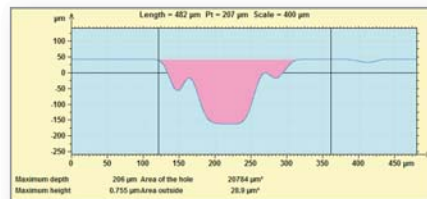
# Further Analysis of Surface Texture

The **Basic Surface Texture** optional module provides additional features for the analysis of surface texture.

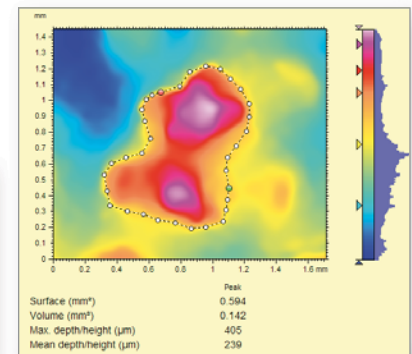
Geometrical studies include the calculation of areas of peaks and valleys on vertical cross-sectional profiles, volumes of bumps and holes, and step heights between zones on surfaces (for example in the assessment of layered electronic and mechanical components, MEMS and electronic circuit boards).

Functional studies include the Abbott-Firestone or bearing ratio curve, the depth distribution histogram and surface subtraction (applied in tribological studies including studies of bearing and sealing surfaces and wear).

In addition, the roughness and waviness components of a surface can be separated using **ISO 16610 advanced filtering techniques** and **ISO 4287** primary and roughness parameters are calculated.



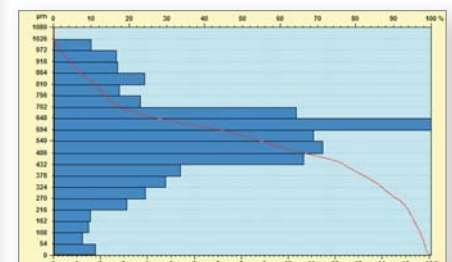
Cross-section profile measure area under mean surface



Calculation of volume of a manually defined hole



Coplanarity of contact zones on an electronic component using the step height (surfaces) study



Abbott-Firestone curve and depth distribution histogram

# Grains and Particles Analysis

The **Grains & Particles** optional module detects and analyzes grains, particles and islands (collectively referred to as “grains”) and motifs.

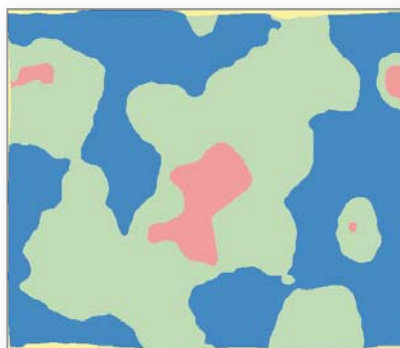
Grains are separated from the background on the horizontal plane using binarization techniques. Statistics are generated for all grains, a sub-set of grains or individual grains (area, perimeter, diameter, form factor, aspect ratio, roundness, orientation, etc.).

Grains can be sorted into subsets with respect to a threshold value on any parameter. This grain topography

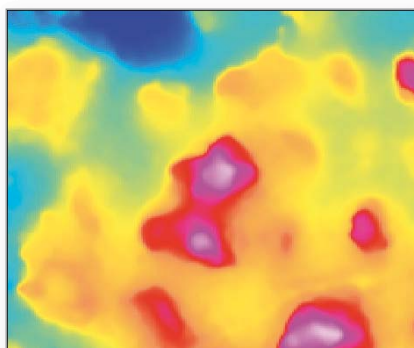
can be **viewed independently from the background**. Grains can also be analyzed on the vertical axis with respect to a specified threshold height. In this case height and volume parameters are generated in addition to area, etc.

A surface is partitioned into motifs by applying segmentation by watersheds. Small or insignificant motifs can be merged into larger ones in accordance with user-configurable criteria. Motif shape detection means that spheres can be fitted to motifs for example in the characterization of

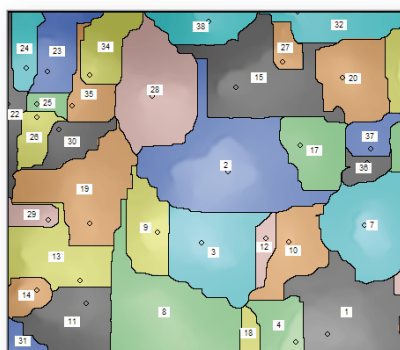
lens. Height, area, volume and other parameters are generated. Motifs analysis can be applied to find relationships between peak and valley locations and functional performance.



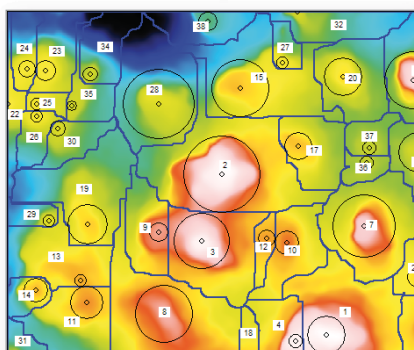
Threshold separation of peaks does not select the details in this case



Pseudo-colour image shows peaks in depthmap



Watershed finds regions of the peaks



Estimate size of peaks shown as circles

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There are two optional modules for contour analysis, the dimensional analysis of component geometry on cross-sectional profiles extracted from the surface.

The **Advanced Contour Analysis** module compares profiles with CAD models (DXF) or user-defined nominal forms, which can include large positional tolerances. It provides comprehensive form deviation analysis and generates a full analysis report.

The **3D Fourier Analysis** optional module is used to filter noisy images and to eliminate specific frequencies by directly editing the FFT and provides tools for spectral analysis.

The **Surface Stitching** optional module assembles multiple measurements that overlap on the horizontal or vertical axes into a single surface ready for analysis.

# Leica Map Start Specifications

## Instrument compatibility

- ▶ The Leica Map Start software is dedicated to Leica microscopes, macroscopes and stereo-microscopes with motorized focus controls and requires LAS Montage software to be installed.

## PC requirements

- ▶ Recommended minimum: Windows 7 or Vista; 4 GB RAM; multi-core processor; 1280x1024 or higher graphics resolution in 32-bit colors. 250 MB disk space; OpenGL accelerated graphics board; USB port for hardware protection key.

## Desktop publishing environment

- ▶ Build a detailed visual metrology report frame by frame in an intuitive desktop publishing environment, working in onscreen, portrait or landscape format.
- ▶ Work in one of six European languages, Japanese, Mandarin or Korean.

## Productivity features

- ▶ Save common sequences of analysis steps and reuse them in any document.
- ▶ Use any document as a template for the automatic analysis of similar measurement data sets.
- ▶ Navigate to anywhere in a document with a single click using the page viewer.
- ▶ Hierarchical analysis workflow assuring full metrological traceability.
- ▶ Fine-tune any step at any time with automatic recalculation of dependent steps.

## Real time 3D imaging

- ▶ View 3D topography images in real time, overlay color (RGB) and intensity images on the topography.
- ▶ Fly over surfaces, record flights as movies.
- ▶ Select any color palette for the vertical scale and fine-tune it automatically or interactively to highlight surface features.

## Data correction and denoising

- ▶ Invert, rotate, flip the surface, remove nominal surface tilt, delete aberrant points, retouch areas, smooth data points.

## Dimensions

- ▶ Measure distances and angles on profiles and surfaces, measure step heights on profiles.

## ISO 3D surface texture parameters

- ▶ Calculate 3D height and bearing ratio parameters (ISO 25178, EUR 15178).

## Leica Map Premium

In addition to purchasing Leica Map Start plus optional modules, it is also possible to order or upgrade to Leica Map Premium. Leica Map Premium is a top of the line surface imaging and analysis package including all of the functions in Leica Map Start and all of the optional modules with the exception of Advanced Contour Analysis and Statistics.

Leica Map Premium is a universal solution that is compatible with single-point tactile and optical profilers and scanning probe microscopes, as well as optical microscopes. In addition, Leica Map Premium includes numerous additional features that are not included in Leica Map Start or its optional modules, in particular tools for advanced functional analysis, the analysis of surface isotropy, directionality and

periodicity, fractal analysis, and sub-surface analysis. Functional studies of the surface bearing ratio curve, depth distribution and wear and lubrication zones, together with ISO 25178 functional volume, hybrid and spatial parameters are important in tribological applications. Sub-surfaces are extracted (for example from layered mechanical or electronic surfaces) and analyzed in exactly the same way as full surfaces. ISO 12781 flatness parameters are calculated.



# Leica Map Start Optional Modules

## Basic Surface Texture

- ▶ Level surfaces and profiles.
- ▶ Calculate the area of peaks and valleys and the volume of bumps and holes.
- ▶ Calculate the material/void composition and thickness of up to three vertical surface slices.
- ▶ Subtract one surface from another (wear).
- ▶ Measure step heights on surfaces.
- ▶ Apply ISO 16610 advanced roughness/waviness filtering techniques (robust Gaussian and spline filters).
- ▶ Calculate ISO 4287 primary and roughness parameters.

## Grains & Particles

- ▶ Detect grains and particles and separate them from the background on the horizontal axis; generate statistics on all/selected/individual grains (area, perimeter, diameter, form factor, aspect ratio, roundness, orientation, etc.).
- ▶ Detect islands above a specified threshold height and generate height and volume parameters in addition to area, etc. for all/selected/individual islands.
- ▶ Partition a surface into motifs applying segmentation by watershed. Detect motif shapes and fit spheres to motifs where applicable. Generate statistics on all/selected/individual motifs. Calculate features parameters (ISO 25178).

## Contour Analysis

- ▶ Measure dimensions, radii, diameters, angles on cross-sectional vertical profiles or horizontal profiles.
- ▶ Define nominal form using auto-dimensioning and interactive tools.
- ▶ Specify tolerances and check for form deviations.

## Advanced Contour Analysis

- ▶ Display magnified form deviation graphics.
- ▶ Analyze surfaces with large positional tolerances.
- ▶ Compare measured data with CAD models (DXF).

## Statistics

- ▶ Generate statistics on multiple measurement populations.
- ▶ Update statistics dynamically when new measurements are made.
- ▶ Generate capability parameters (Cpk) to monitor the repeatability of the production process.

## 3D Fourier Analysis

- ▶ Filter noisy images by thresholding the FFT
- ▶ Filter out specific frequencies by direct edition of the FFT
- ▶ Analyze frequency spectrum, power spectrum density, etc.
- ▶ Calculate auto- and inter-correlations.

## 4D Analysis

- ▶ Visualize and analyze surface evolution with respect to a 4th dimension (time, temperature, etc.)
- ▶ Fly over a surface as it changes, record an animated movie.
- ▶ Generate statistics on surface change.
- ▶ Highlight areas of preponderant change.

## Surface Stitching

- ▶ Extend the field of view by automatically stitching together multiple measurements.
- ▶ Extend the vertical range by patching together measurements made at different heights into a single surface.

# “With the user, for the user”

## Leica Microsystems

Leica Microsystems operates globally in four divisions, where we rank with the market leaders.

### • Life Science Division

The Leica Microsystems Life Science Division supports the imaging needs of the scientific community with advanced innovation and technical expertise for the visualization, measurement, and analysis of microstructures. Our strong focus on understanding scientific applications puts Leica Microsystems' customers at the leading edge of science.

### • Industry Division

The Leica Microsystems Industry Division's focus is to support customers' pursuit of the highest quality end result. Leica Microsystems provide the best and most innovative imaging systems to see, measure, and analyze the microstructures in routine and research industrial applications, materials science, quality control, forensic science investigation, and educational applications.

### • Biosystems Division

The Leica Microsystems Biosystems Division brings histopathology labs and researchers the highest-quality, most comprehensive product range. From patient to pathologist, the range includes the ideal product for each histology step and high-productivity workflow solutions for the entire lab. With complete histology systems featuring innovative automation and Novocastra™ reagents, Leica Microsystems creates better patient care through rapid turnaround, diagnostic confidence, and close customer collaboration.

### • Medical Division

The Leica Microsystems Medical Division's focus is to partner with and support surgeons and their care of patients with the highest-quality, most innovative surgical microscope technology today and into the future.

The statement by Ernst Leitz in 1907, “with the user, for the user,” describes the fruitful collaboration with end users and driving force of innovation at Leica Microsystems. We have developed five brand values to live up to this tradition: Pioneering, High-end Quality, Team Spirit, Dedication to Science, and Continuous Improvement. For us, living up to these values means: **Living up to Life.**

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