ACCRETECH Europe
Basic Surface Training

Prepared for: Basic Surface Training (only for internal use)

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Agenda Surface Webinar

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	Surface Metrology	Part I	20.May 2020
1	Surface Metrology		
2	Roughness		
3	Filter		
4	Measurement Procedure		

	Surface Metrology	Part II	04.June 2020
5	Surface Texture Parameters		
6	3D Surface		
7	Non-contact Surface		

Agenda Surface Webinar Part I

Surface Metrology	Part I	20.May 2020

1 Surface Metrology

2 Roughness

3 Filter

4 Measurement Procedure

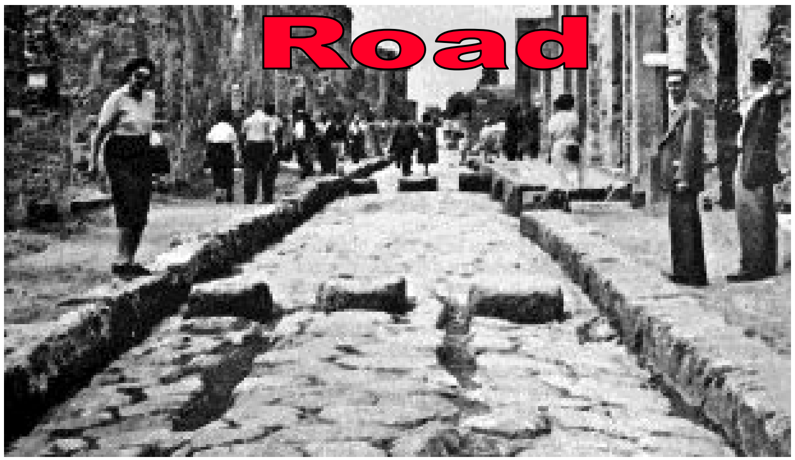
Surface Metrology	Part II

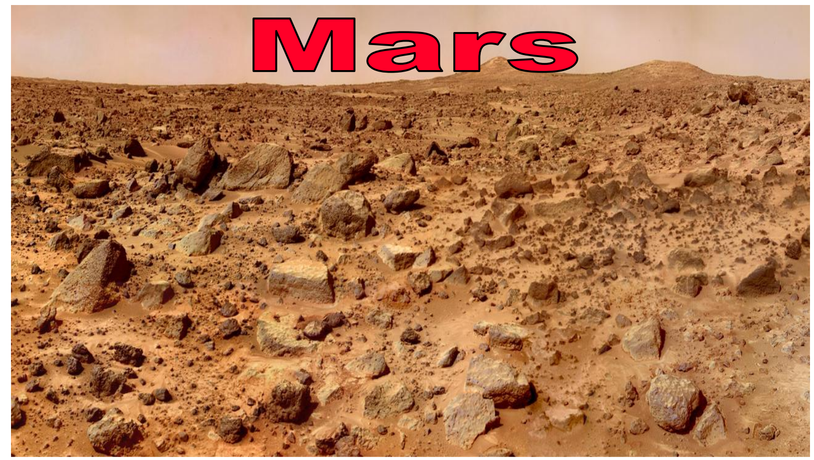
5 Surface Texture Parameters

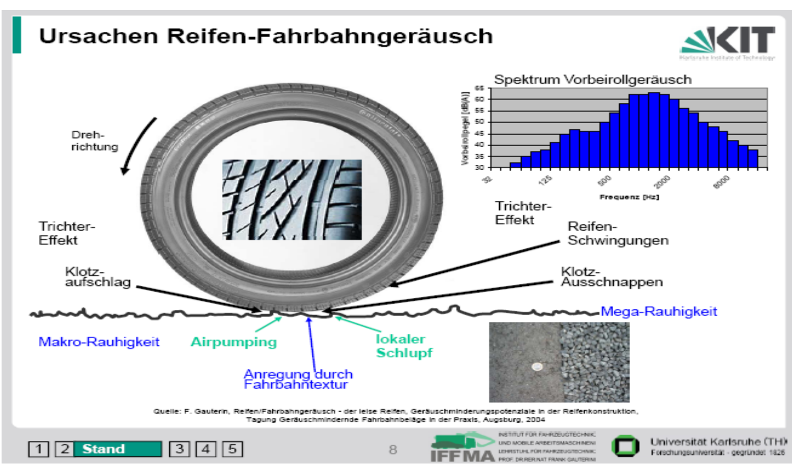
6 3D Surface

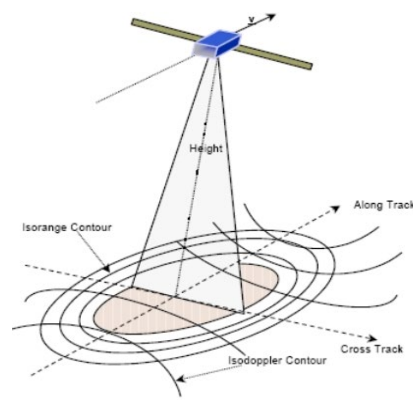
7 Non-contact Surface

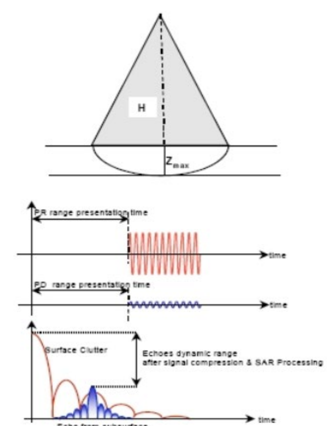
Surface metrology all around
Macro surface











Our Focus
Micro Surface - Industrial production

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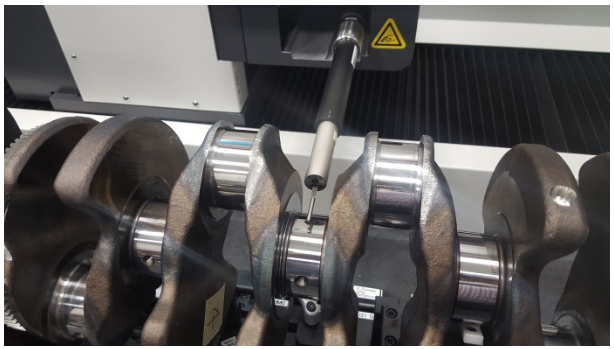
Full automation Crankshaft measurement



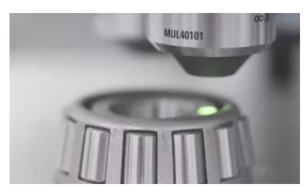
Surfcom C5

High precision measurements example ball screw and gauges

Surfcom Nex Line and Surfcom Crest

Example Housing and Motor blocks

Surfcom Nex Line



Optical Surface

Optscope Interferometer
Laser detector

Semiconductor, Wafer, Electro parts

Surface metrology

Surface texture of mechanical components has been checked over 80 years in order to improve performances of manufactured products.

The roughness testers recorded surface heights using a stylus tip in contact with the surface and a traverse unit.

The measured profile was drawn on a carbon paper and a value of roughness was given on a galvanometer.

The first ACCRETECH roughness testers with LVDT type was installed 1957.

For a long time, only one parameter was known and used, under the name Ra (Roughness average) or CLA (Center Line Average) or even AA (Arithmetic Average).

Then came RMS or Rq, Rz and Rmax, and later many more parameters.

Surface metrology

Today, profile parameters and areal parameters are defined in a handful of international standards that sometimes have local variations due to national or sectorial standards.

Profile parameters are separated into three groups depending on the type of profile from which they are calculated:

P - R - and W - Parameters are calculated on the Primary Profile

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Surfcom Nex Serie

Surfcom Crest

Surface testing methods

Surface testing

Objective test method

Subjective test method

Light-section

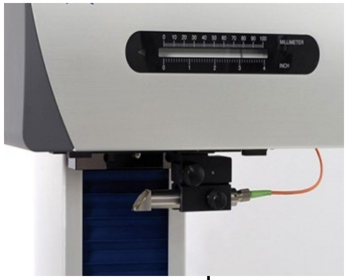
Optical testing

Tactile testing

Opt Scope

microscope

Surfcom Nex



optical detector

Reference stylus system

Surfcom Touch 50

One skid stylus system

Handysurf+

Visual testing

Touch testing

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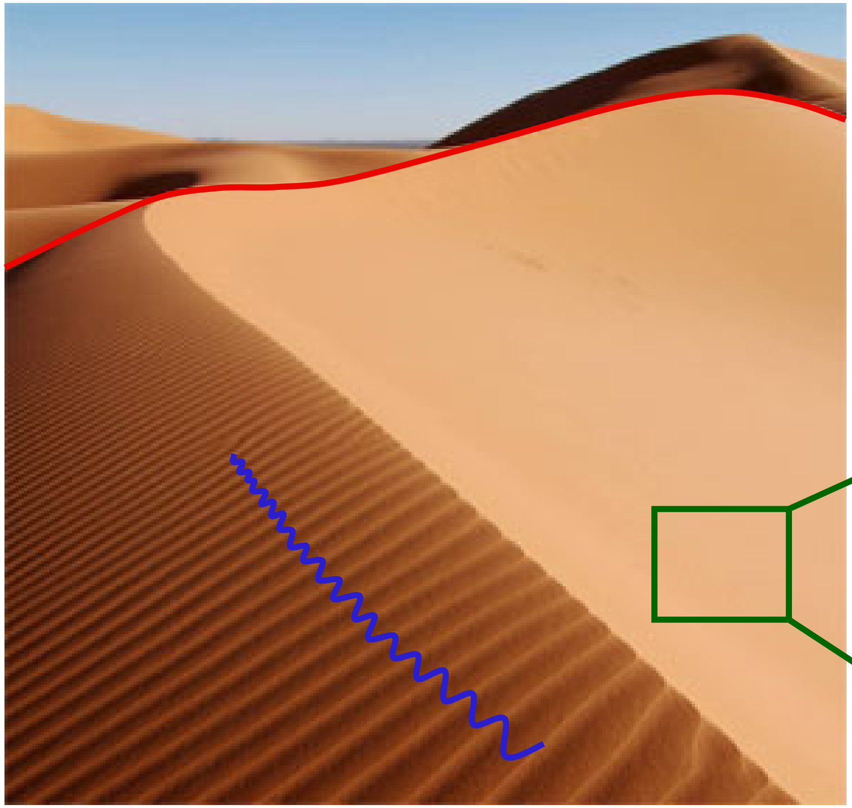
What is roughness ?



Form

Waviness

Roughness

Why we are measuring roughness?

- Characterization of surface properties

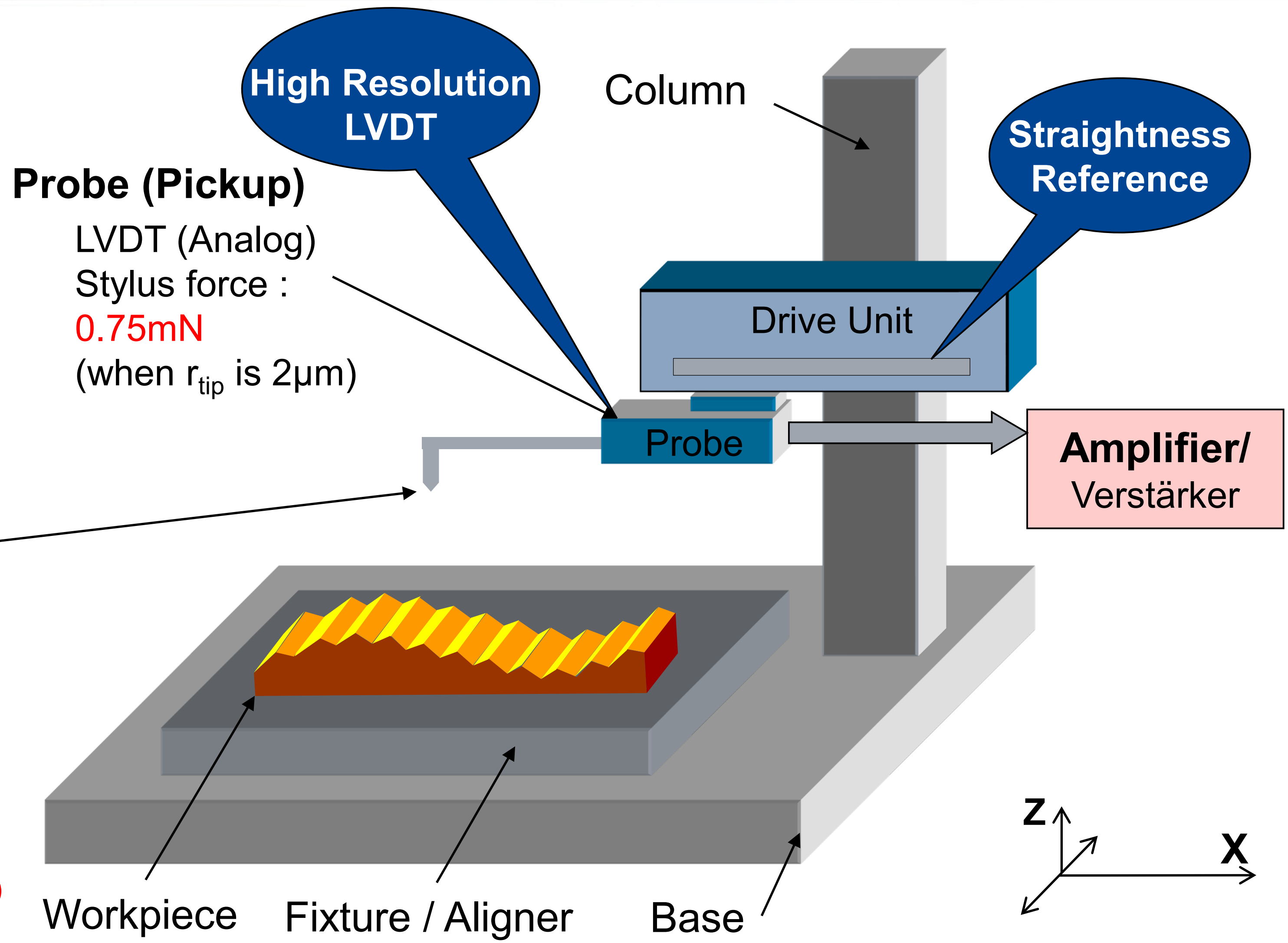
- Quality control

- Measurement of abrasion

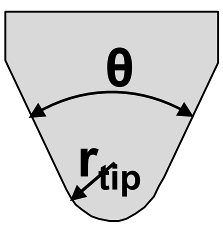
- Improve quality

- Optimize production cost

Standard Surfaces measuring systems



Stylus tip/
Tastspitze



Stylus tip geometry
θ=60° (or 90°) cone
r_{tip}=2µm (or 5, 10µm)

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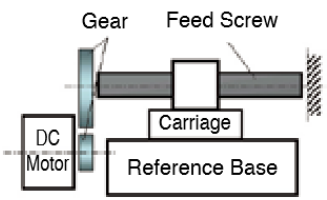
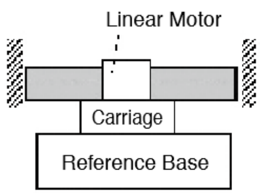
The simple structure of the linear motor unit with a noncontact



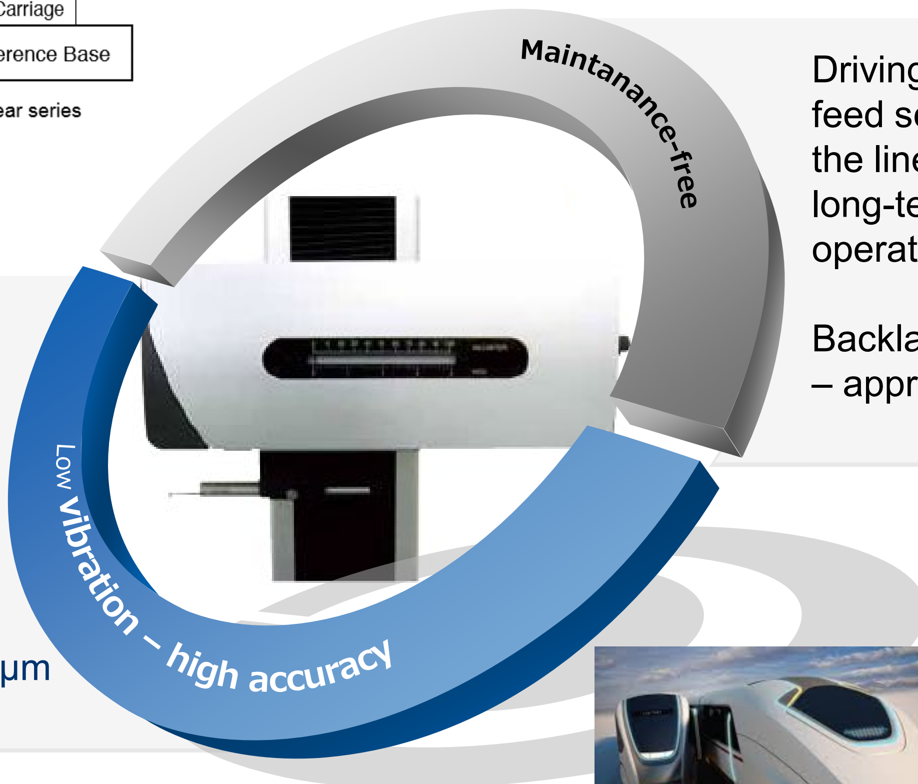
Standard series



Linear series

Driving unit and withou
feed screws or gearboxes, the linear motor ensures a long-term stable operation.

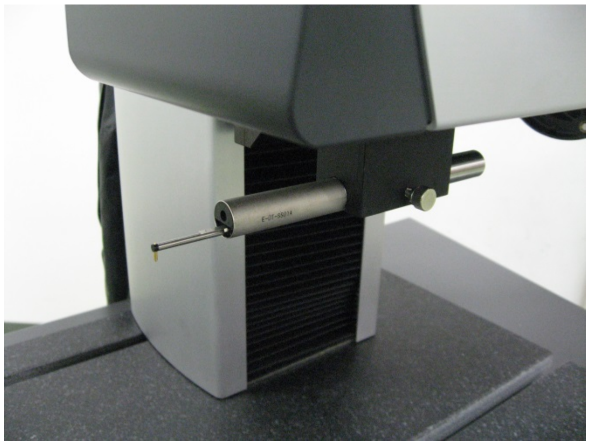
Backlash is also reduced – approach distance

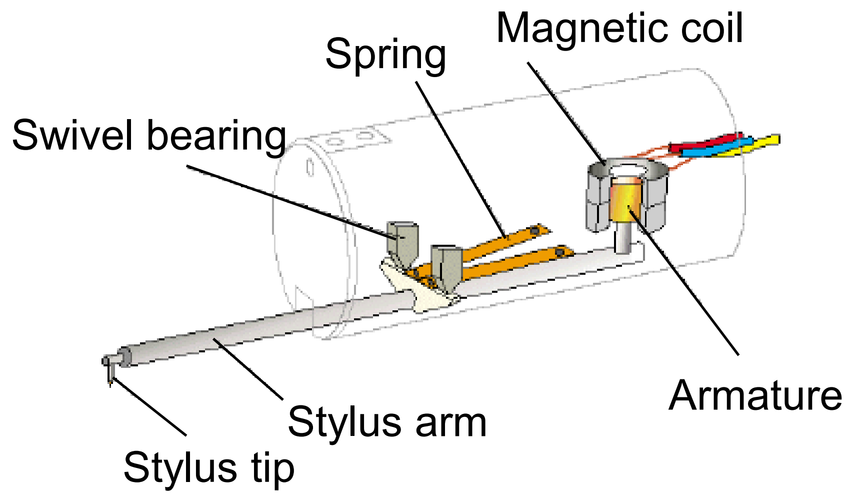


Due to the adoption of the linear motor, the vibration is reduced to less than one-fifth

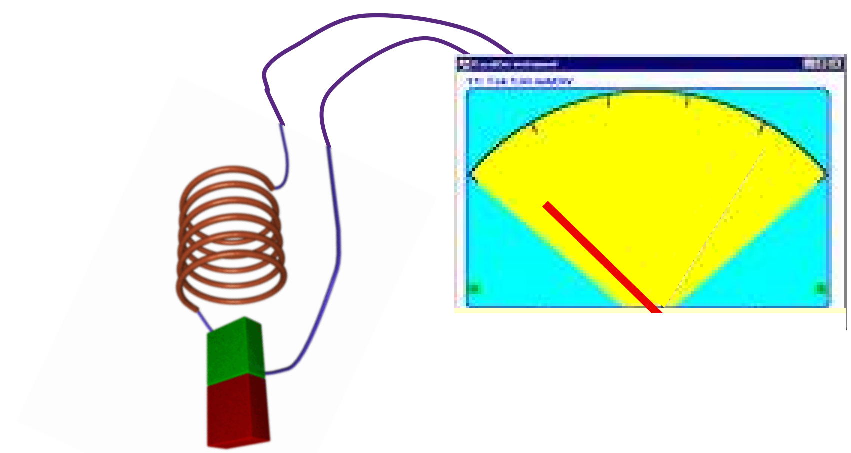
(Ra=1nm)
Straightness 0.05+1L/1000µm
(S-Nex 001)

Tactile Roughness Detector
LVDT Sensor





Range measuring Z +/1000µm
High resolution of 0,3nm
Depend on measuring range



Linear **V**ariable **D**ifferential **T**ransformer

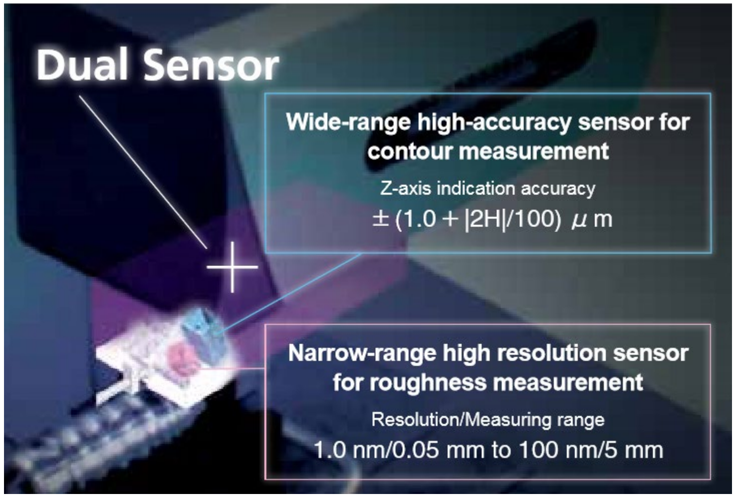
Tactile Roughness Detector
Dual Sensor – Laser Interferometer

SD type

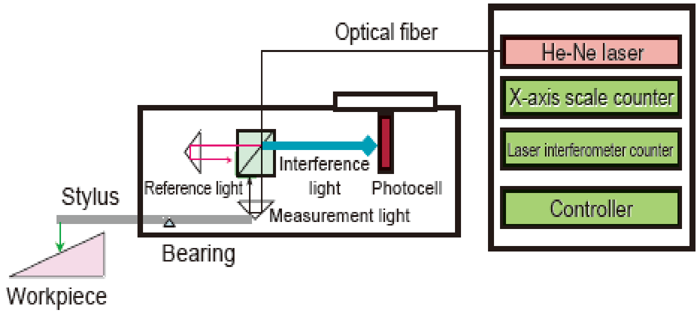
Roughness and Contour analyzed
in a Single Measurement

Dual Sensor
LVDT => Roughness
Class scale => Contour

Highly Stable Optical Path
Laser Interferometer



<Sensor Structure>



largest Range measuring Z 26 mm
With high resolution of 0,3nm

Profile method

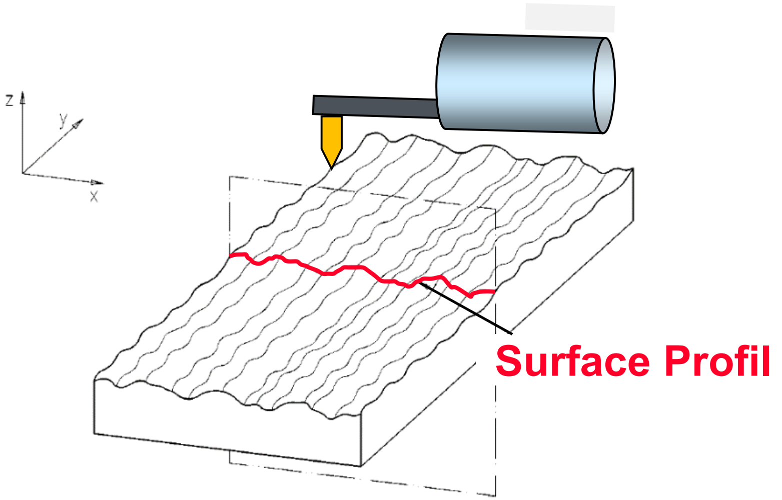
Surface profile:

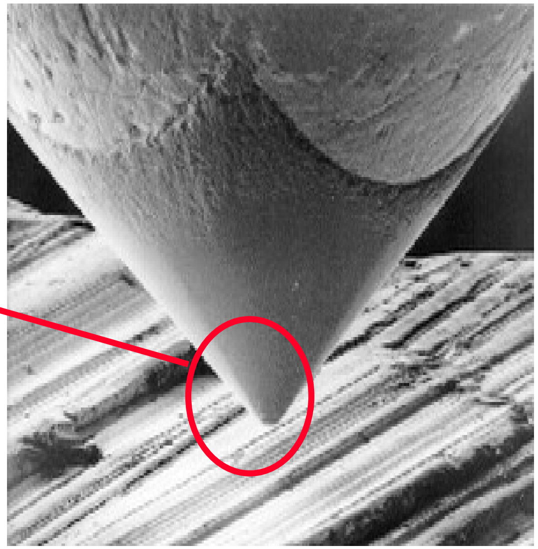
profile which arises by cutting through the real surface in a defined plane [DIN EN ISO 4287: 1998]

2-dimensional view of the surface

stylus tip consists of a conical diamond

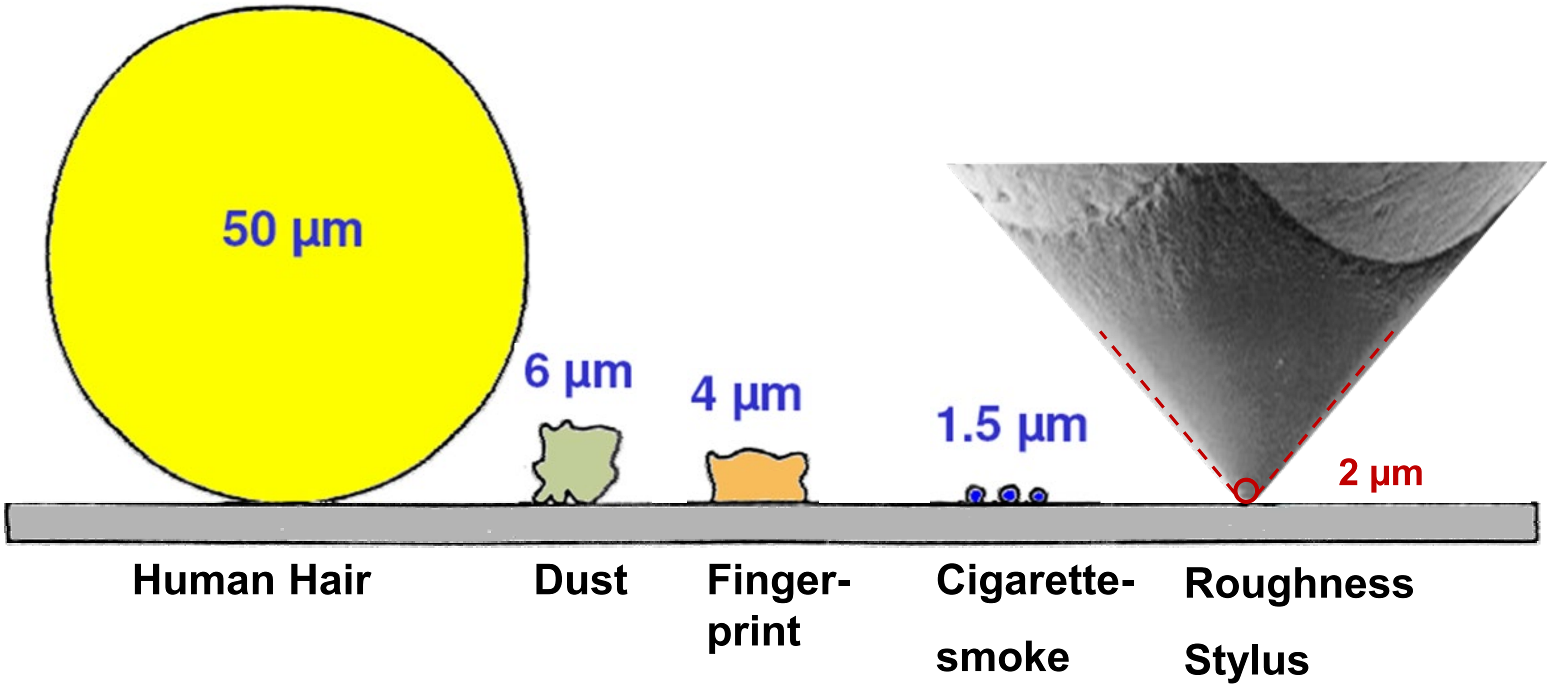
tip Radius: 2 µm / 5 µm or bigger
60 - 90 degree





Overview proportions

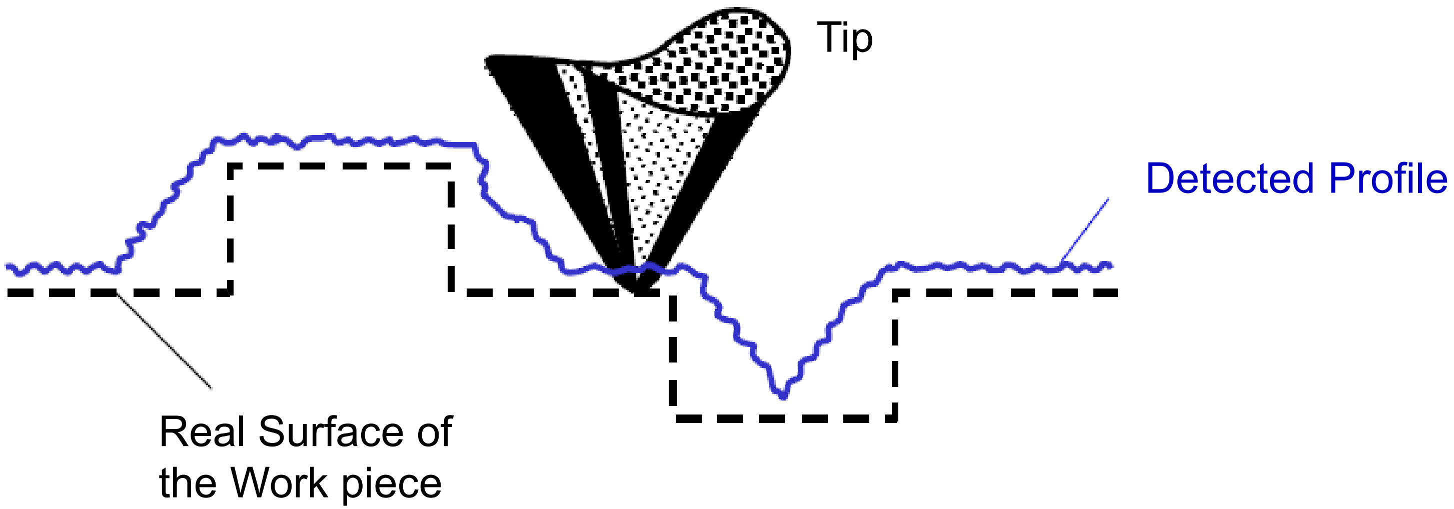
the „ µm “ in comparison



Detected profile
DIN EN ISO 3274: 1998

Definition:

line of the tip-center, which is scanning the surface finish in the cutting plane



Filter effect of the tip

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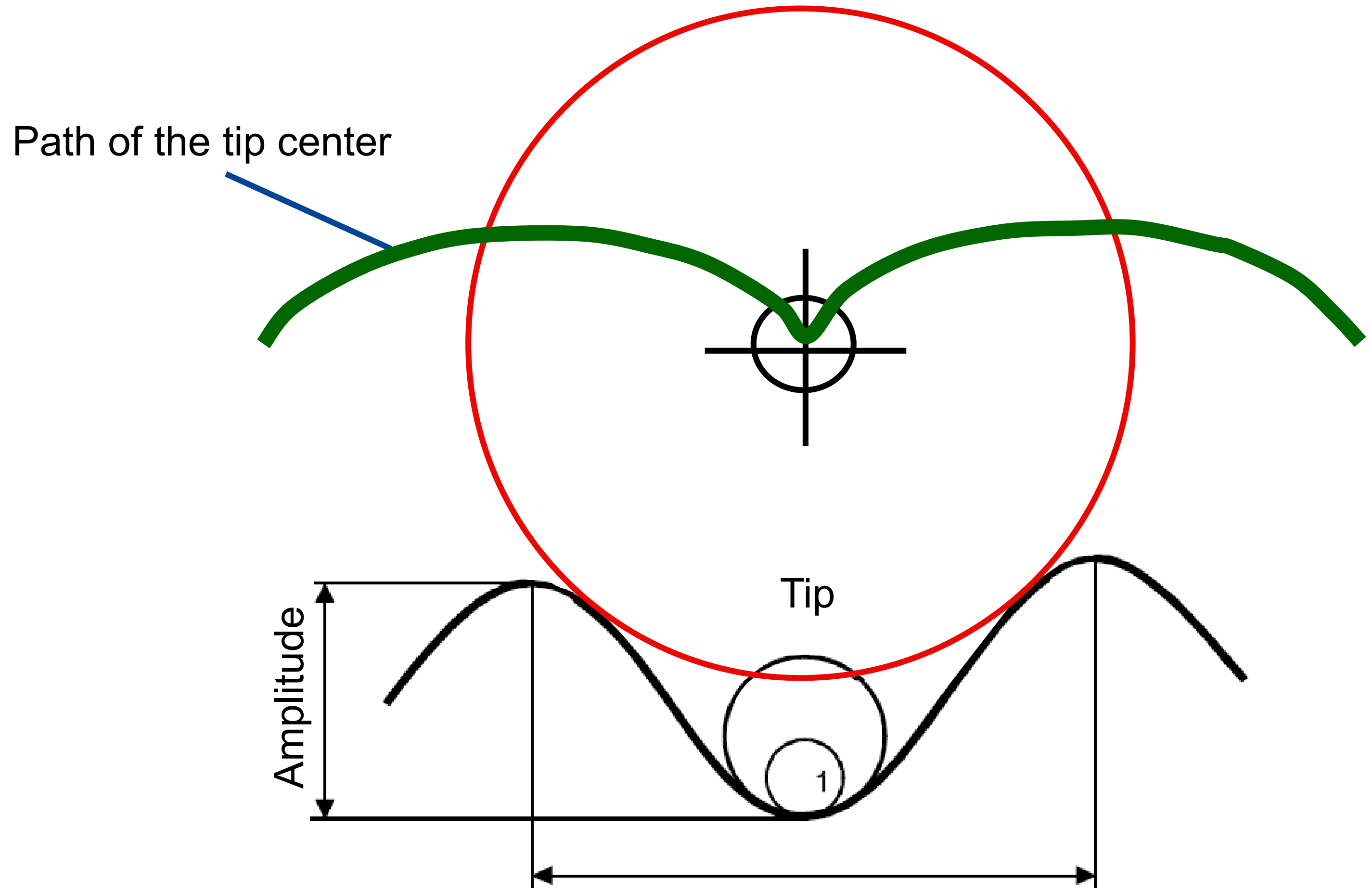
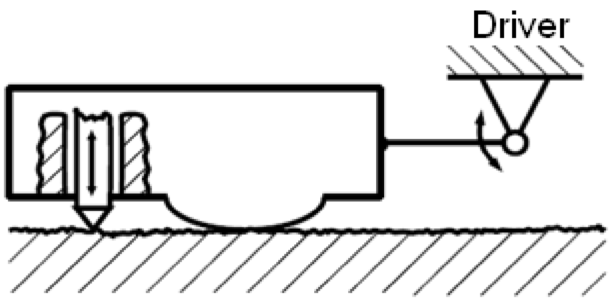
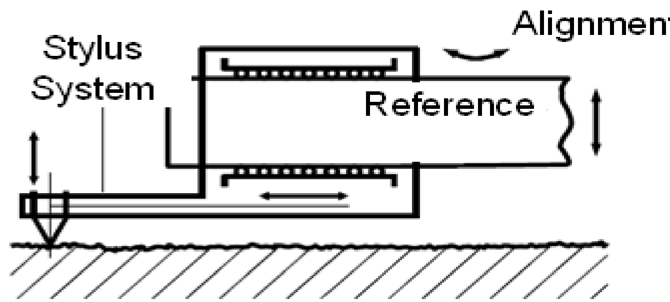


Stylus reference



One Skid Stylus System



Reference Stylus System
(measuring reference must be aligned to surface finish)

Handysurf

Surfcom Touch

Surfcom Nex Surfcom Crest

Additional Roughness Systems

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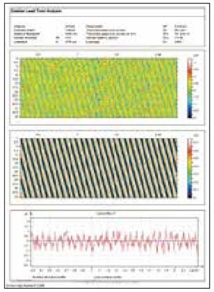
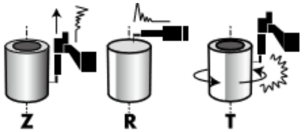
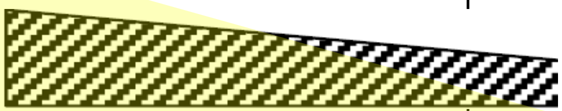
Dedicated catalog is available.

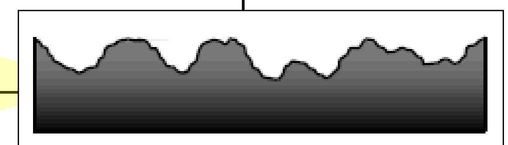
RONDCOM NEX Rs DX





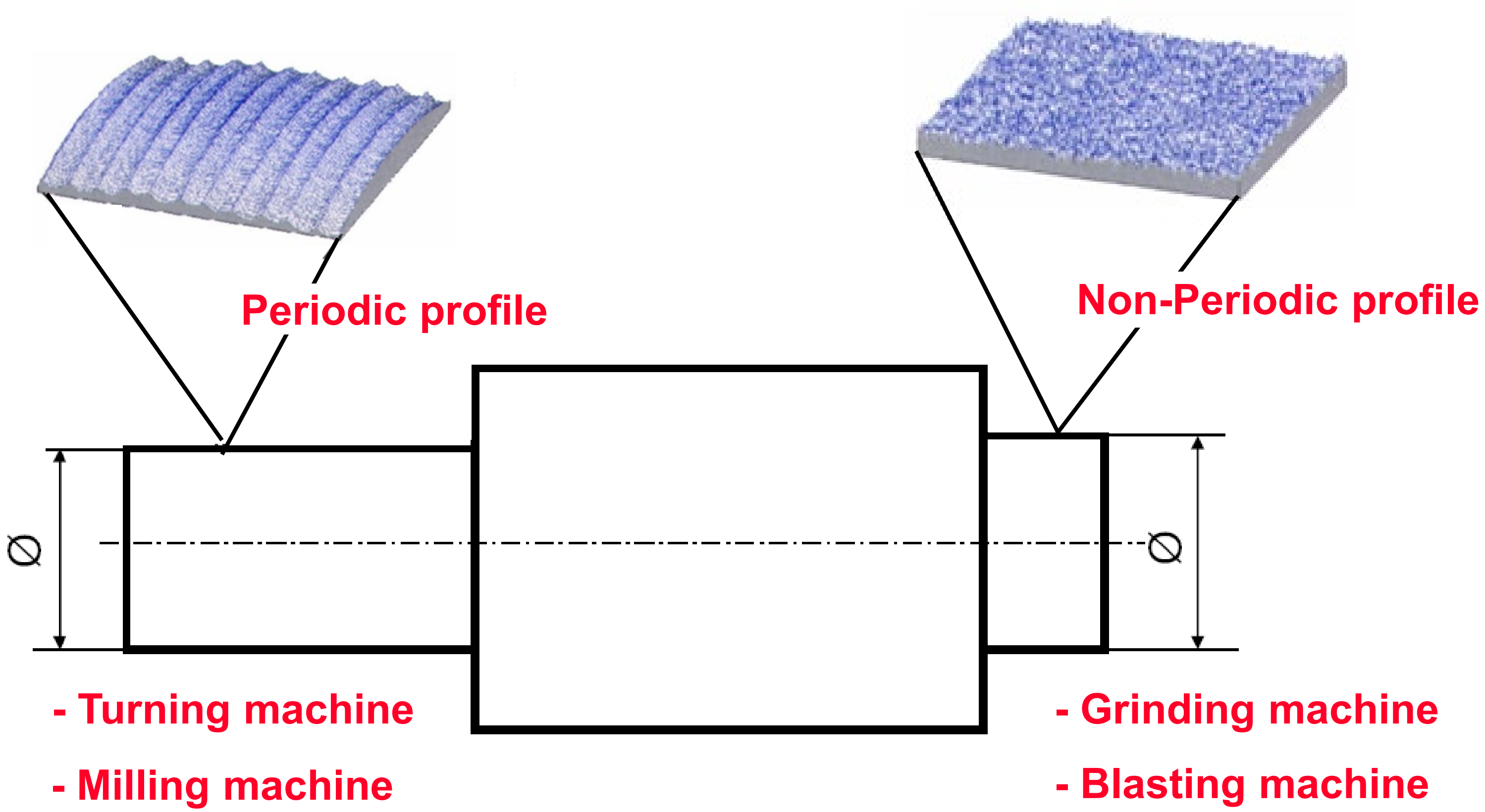
Classification system of form Deviation
DIN 4760: 1982

1. Order 	Geometric error	Straightness, Flatness, Cylinderform, Formerror
2. Order 	Surface waviness	Waviness
3. Order 	Surface roughness	Roughness Rills
4. Order 		Roughness Grooves Vibrations
5.Order		Micro porous structure
6.Order		Lattice structure



Overlapping
1.- 4. Order

Roughness in production



Agenda Surface Webinar Part I

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Surface Metrology	Part I	20.May 2020
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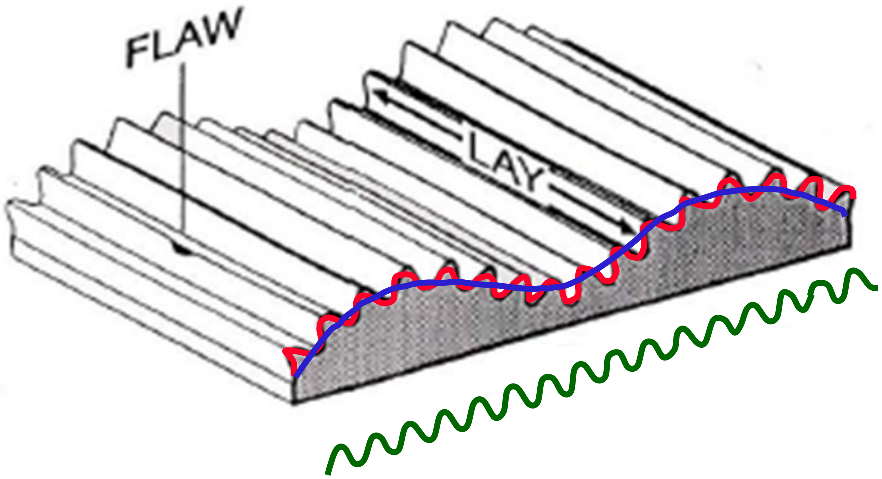
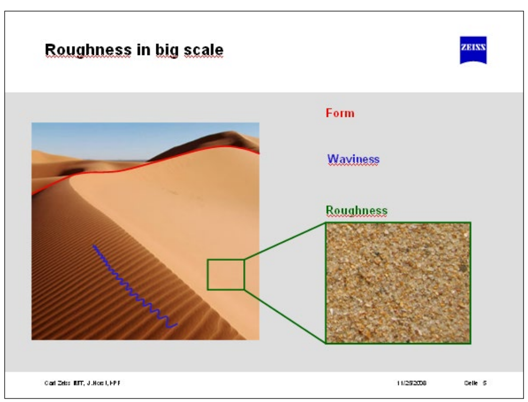
Basic Surface Metrology



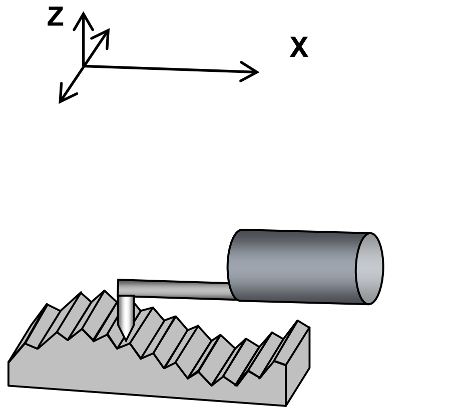
ERROR OF FORM
Long period or non-cyclic Deviations
(errors in ways or spindles, uneven wear)

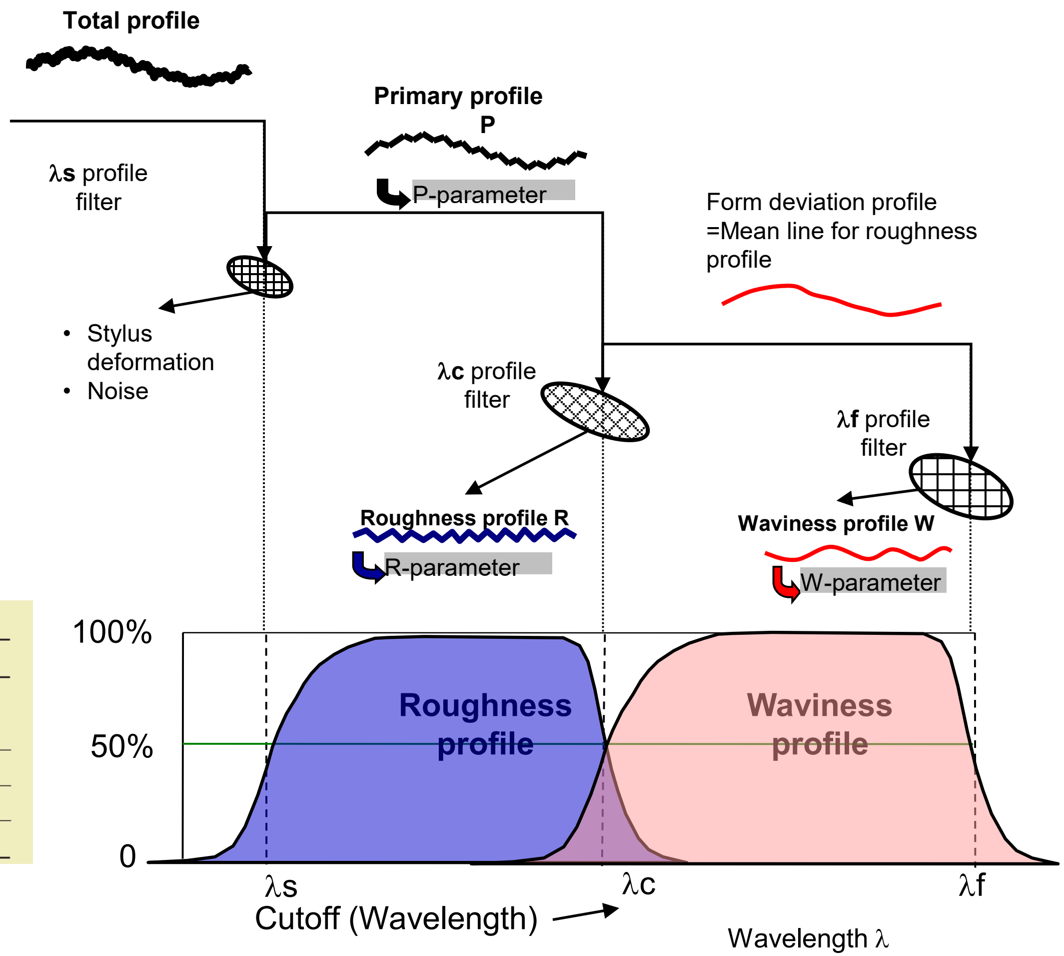
WAVINESS
More widely spaced irregularities
(vibration & chatter)

ROUGHNESS
- Closely spaced irregularities
(cutting tool marks, grit of grinding wheel)



Filter
DIN EN ISO 4287: 1998





Selection of λc & Stylus Tip r_{tip}

λc (mm)	λs (µm)	λc/λs	r_{tip} (µm)
0.08	2.5	30	2
0.25		100	
0.8		300	2 (5 at $Rz > 3$ µm)
2.5	8		5 or 2
8	25		10, 5 or 2

Filter
DIN EN ISO 4287: 1998

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λ s – profile filter:

Filter which defines the boarder between roughness and rates of even shorter wavelengths (on the surface finish)

λ c – profile filter:

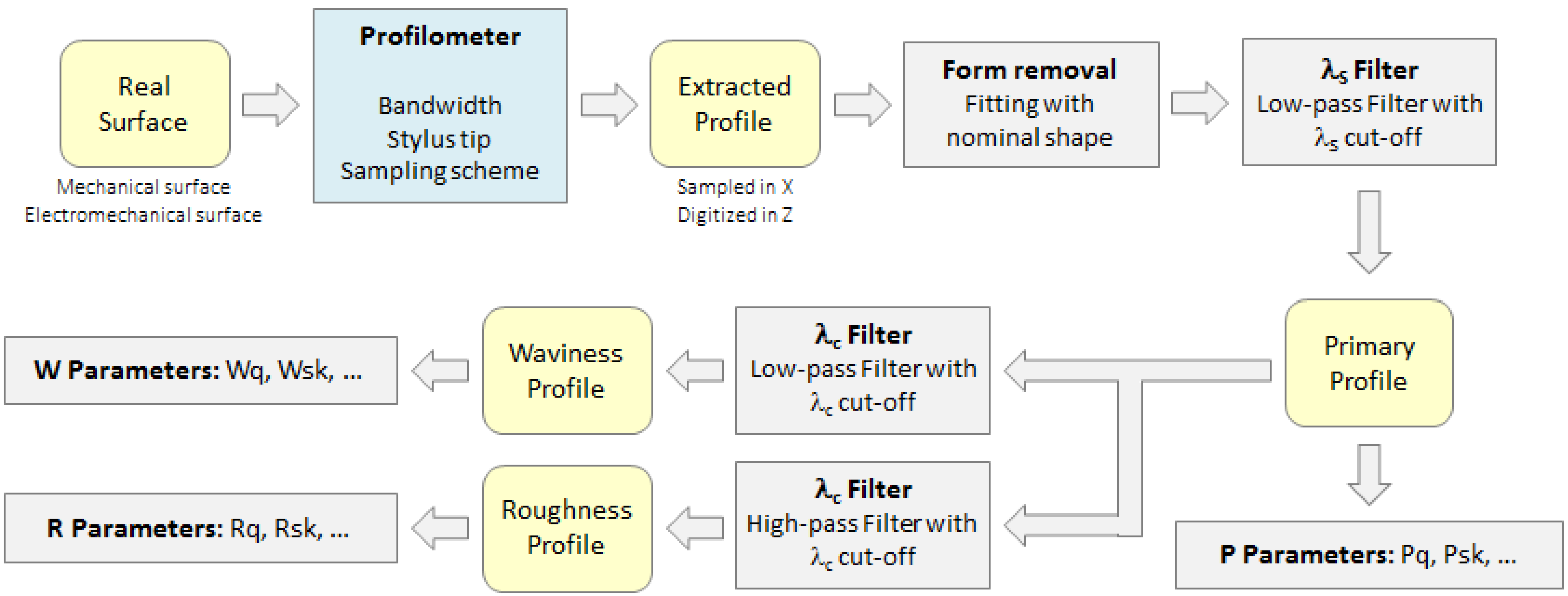
Filter which defines the boarder between roughness and waviness

λ f – profile filter:

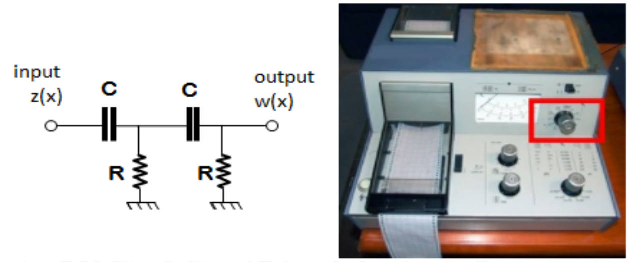
Filter which defines the boarder between waviness and rates of even longer wavelengths (on the surface finish)

Surface Filter 2D Surface

Filtration is required for several purposes in the process of surface texture analysis.

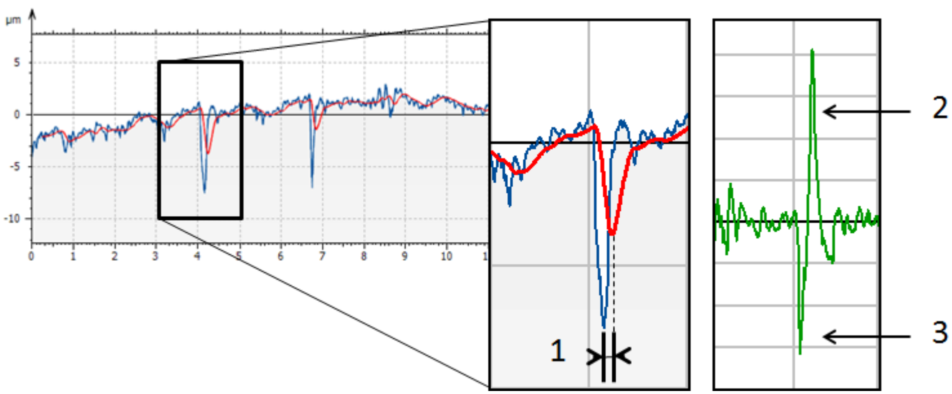


- The first filters were implemented as physical high-pass filters using resistors



Analog RC2 filter (left) and Talysurf 10 with cut-off selection (right)

- The first profile analysis programs implemented the RC filter using an algorithm in order to provide the same amount of filtering as the analog filter.

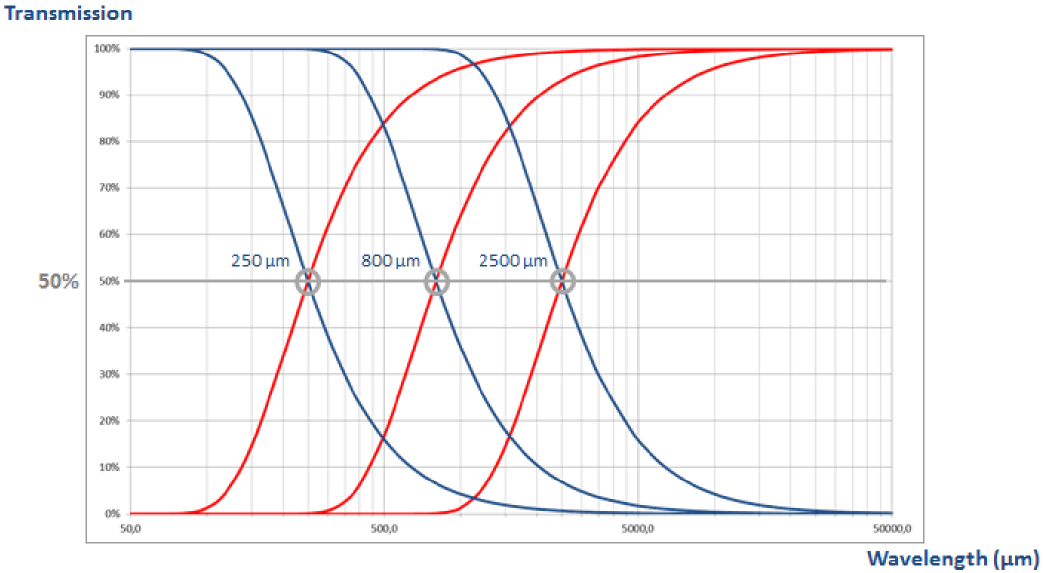


A close look at the phase shift (1) effect on a groove. The mean line is "late" compared to the primary profile.
The effect on the roughness profile is overshoots around the groove (2) and minimized groove depth (3).

- At the beginning of the 1990's, a phase-correct version of the RC2 filter was created in an attempt to fix this problem. It was called RC2-PC.

Gaussian filters

The Gaussian filter was introduced, for profiles, in the [ISO 11562] standard in 1996. The standard defines a transfer function for the low-pass filter that produces the waviness (mean line) profile. Subtracting this mean line from the primary profile gives the roughness profile.

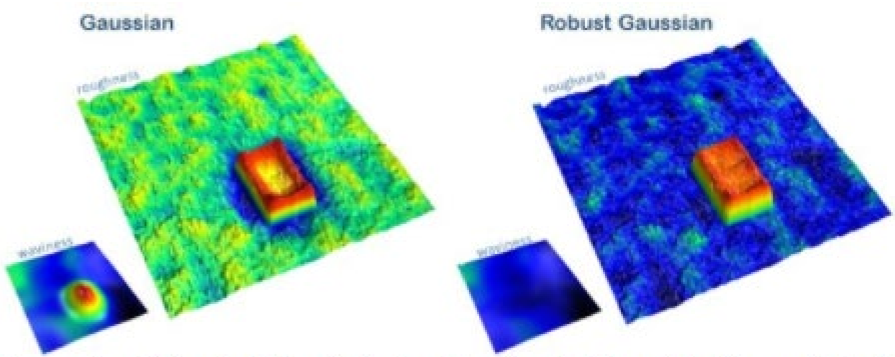


Gaussian filters have been successfully used for various applications in industry and research for 20 years.
However, this filter does not behave very well around outliers, steps and in the presence of form.
This is why robust filters have been developed.

Filter history

Robust Gaussian filters

A robust filter has its mean line (plane) correctly following the general trend of the profile (surface), without being disturbed by outliers.

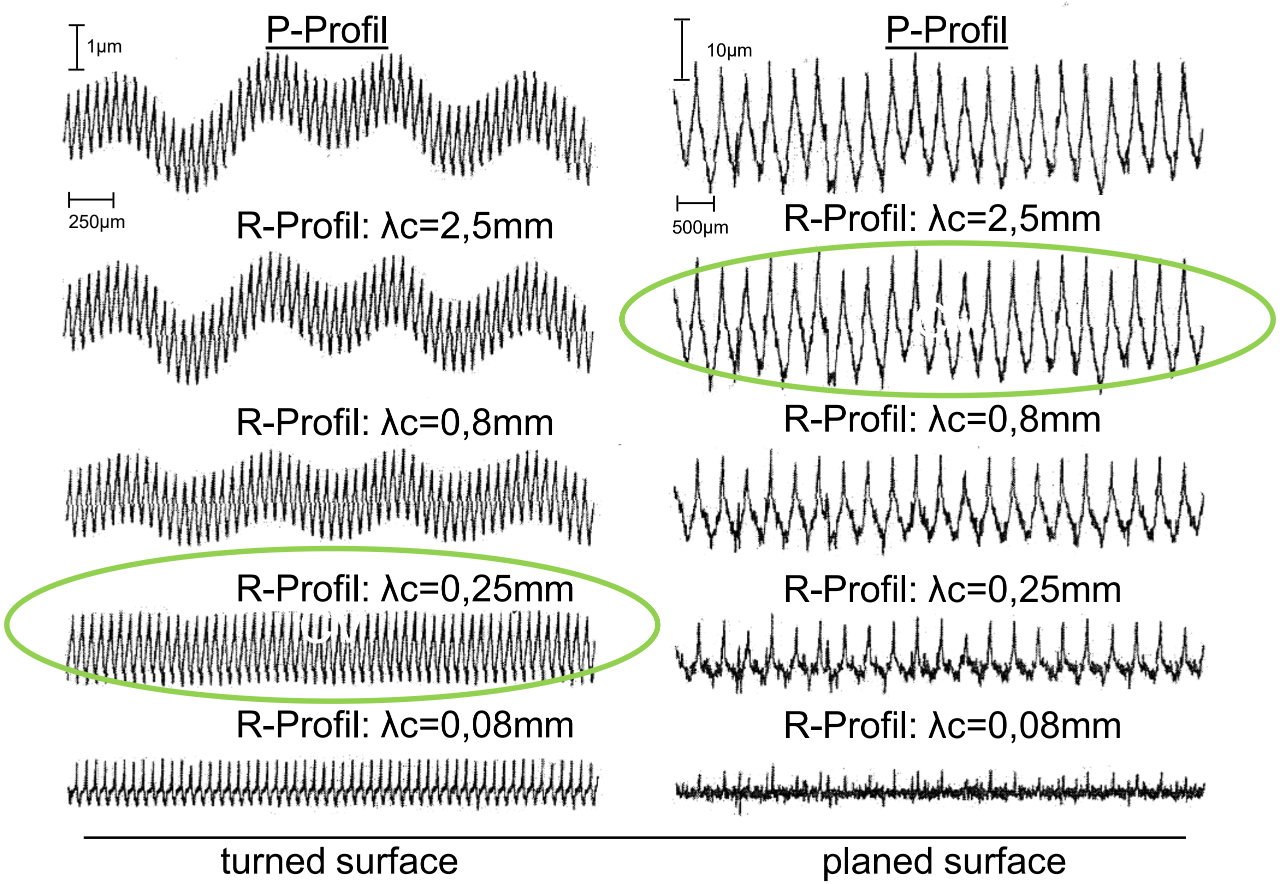


The Gaussian filter (left) is disturbed by local discontinuities while Robust Gaussian filter (right) is not.

Robust Spline filters

The Robust Spline filter is defined in [ISO 16610-32] for profiles and [ISO 16610-62] for surfaces.
This robust filter is theoretically better than the Robust Gaussian filter, the results are very close in both cases and as the Robust Gaussian filter is much simpler to implement, it is preferred in most cases.

Filter effect of Cut-Off selection



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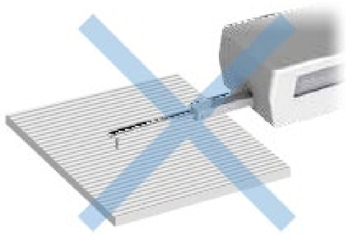
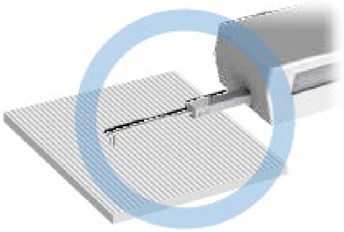
Measuring Procedure for Stylus-type Surface Roughness Instruments ISO 4288:1996

STEP1 Position the measurement target.

Remove any oil or dust on the measurement target's surface.
If the measurement direction is not indicated, position the target so that the measurement direction will give the maximum parameters in the height direction (Ra, Rz).



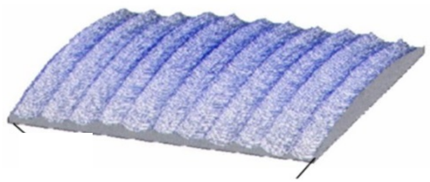
Parallel to the creases



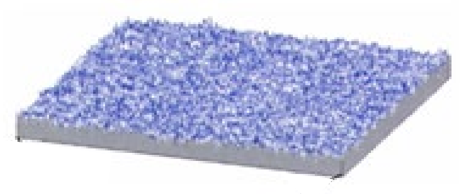
Orthogonal to the creases (direction that will give the maximum height parameters)

STEP2 Visually inspect the surface of the target.

Judge whether the surface texture of the target (creases, roughness profile) is periodic or non-periodic.



Periodic profile



Non-Periodic profile

Measuring Procedure for Stylus-type Surface Roughness Instruments ISO 4288:1996

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STEP3-1 When the sampling length is represented pictorially

When the sampling length is indicated on the figure or in the requirements of the product's technical information, set the cutoff value, λc, to the indicated sampling length.

STEP3-2 When the roughness profile is periodic

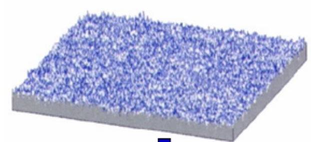
STEP3-3 When the roughness profile is not periodic

Surface roughness

Cutoff (Wavelength)	λc
Sampling length	lr
Evaluation lenght	ln
Tracing	lt

Mean width of the profile elements

RSm in mm	λc in mm	lr / ln / lt in mm
> 0,013 ... 0,04	0,08	0,08 / 0,40 / 0,48
> 0,04 ... 0,13	0,25	0,25 / 1,25 / 1,50
> 0, 13 ... 0,4	0,8	0,80 / 4,00 / 4,80
> 0,4 ... 1,3	2,5	2,50 / 12,5 / 15,0
> 1,3 ... 4,0	8,0	8,00 / 40,0 / 48,0

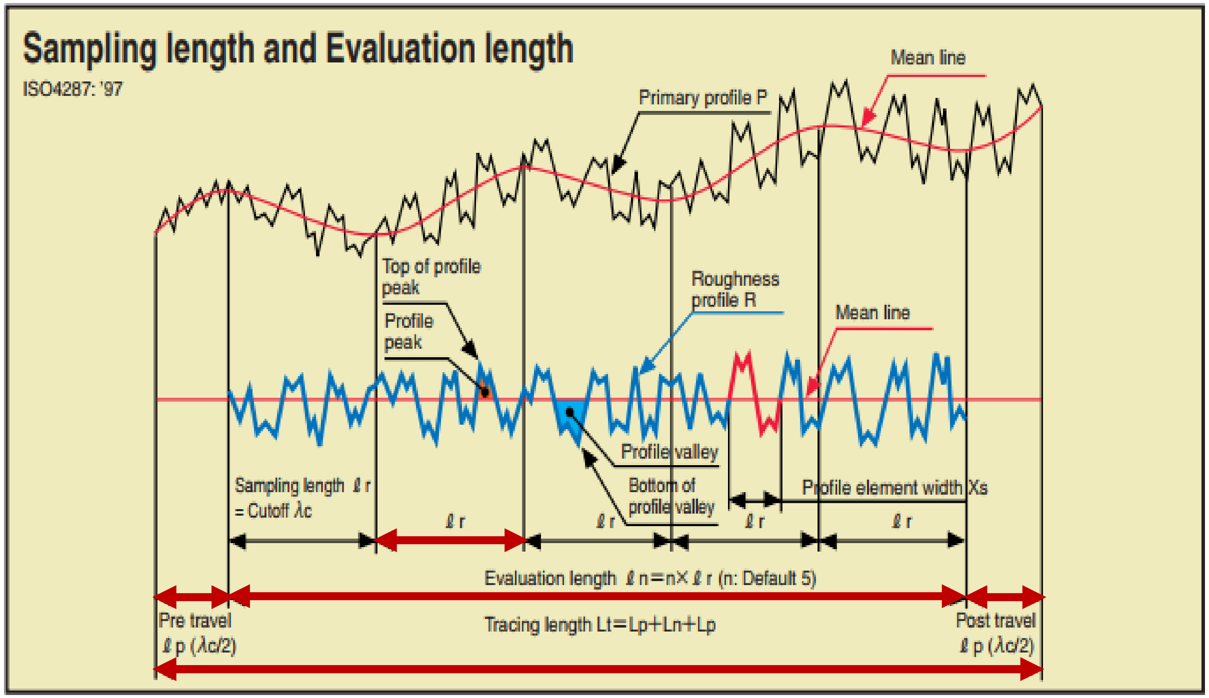


Surface roughness

Cutoff (Wavelength)	λc
Sampling length	lr
Evaluation lenght	ln
Tracing	lt

Arithmetical mean deviation Ra in µm	Maximum height of profile Rz in µm	λc in mm	lr / ln / lt in mm
> (0,006) ... 0,02	> (0,025) ... 0,1	0,08	0,08 / 0,40 / 0,48
> 0,02 ... 0,1	> 0,1 ... 0,5	0,25	0,25 / 1,25 / 1,50
> 0, 10 ... 2,0	> 0, 5 ... 10	0,8	0,80 / 4,00 / 4,80
> 2,00 ... 10,0	> 10 ... 50	2,5	2,50 / 12,5 / 15,0
> 10,0 ... 80,0	> 50 ... 200	8,0	8,00 / 40,0 / 48,0

Sampling length and Evaluation length



lr – Sampling length (Cut Off λc)

ln – Evaluation length

lp – Pre travel / Post travel

lt – Tracing length (lp+ln+lp)

The sampling length is usually defined as the cut-off length (λc) of the filter used to separate roughness and waviness.

For example, using a cut-off length of 0.8 mm and 5 sampling lengths, parameters will be estimated on each segments (Ra1, Ra2, ., Ra5) and the parameter value will be given as the mean of these estimated values.

Thank you for your attention !!!

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CORPORATE MOTTO

WIN-WIN RELATIONSHIPS
CREATE THE WORLD'S No.1 PRODUCTS

Our corporate brand "ACCRETECH" was created from the words "accrete," which means grow together, and "technology." The brand thus expresses in a single word our corporate philosophy: growing together with partners and customers by collaborating technology, knowledge and information from internal and external sources to create the world's No. 1 products.

Agenda Surface Webinar Part II

	Surface Metrology	Part I	
1	Surface Metrology		
2	Roughness		
3	Filter		
4	Measurement Procedure		

	Surface Metrology	Part II	04.June 2020
5	Surface Texture Parameters		
6	3D Surface		
7	Non-contact Surface		

Agenda Surface Webinar Part I

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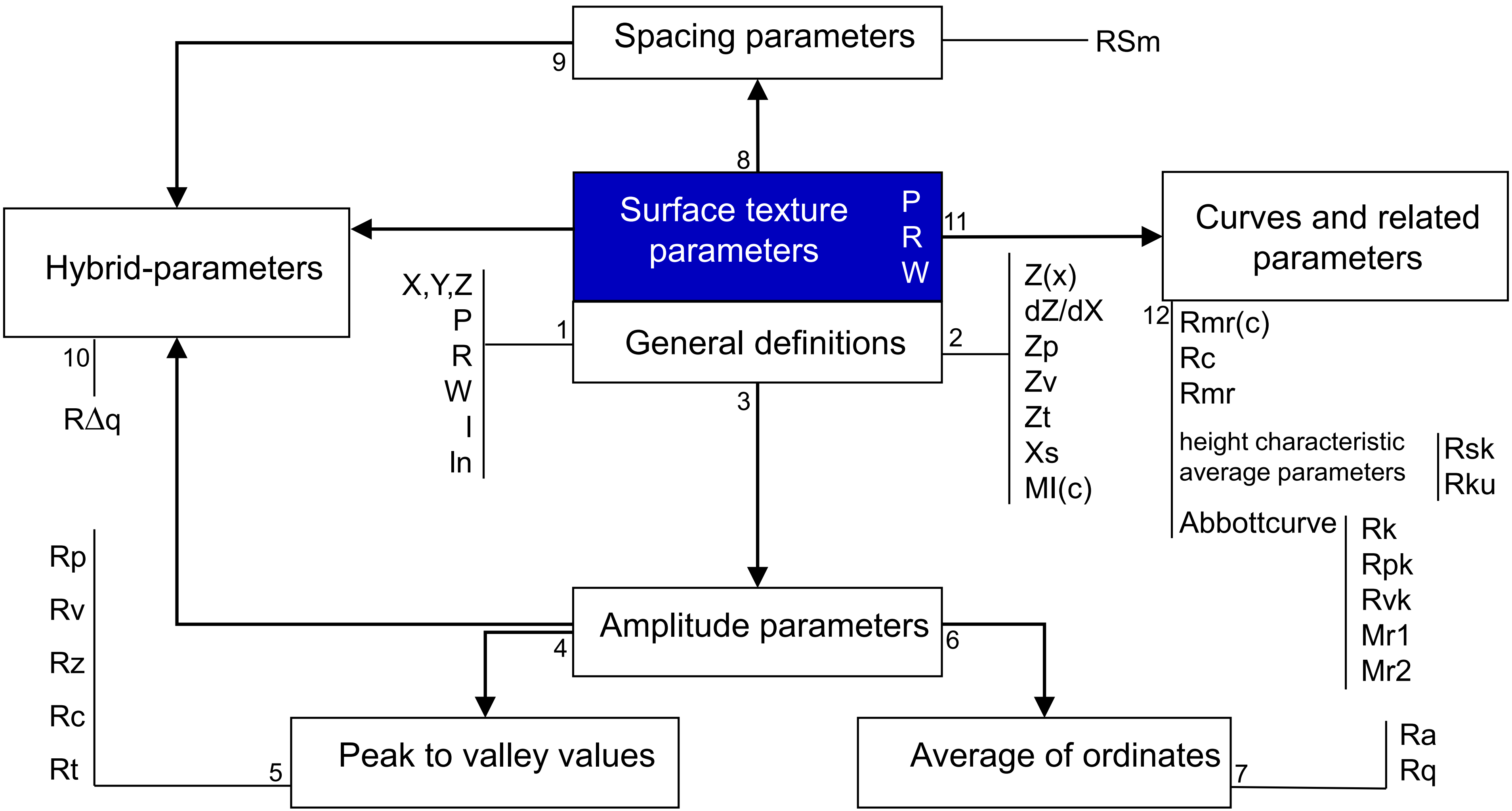
Surface Texture Parameters
DIN EN ISO 4287

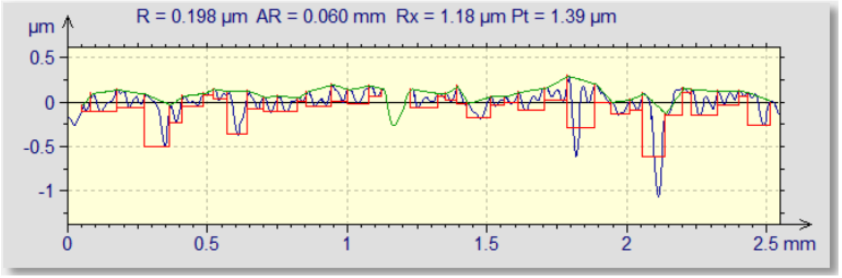


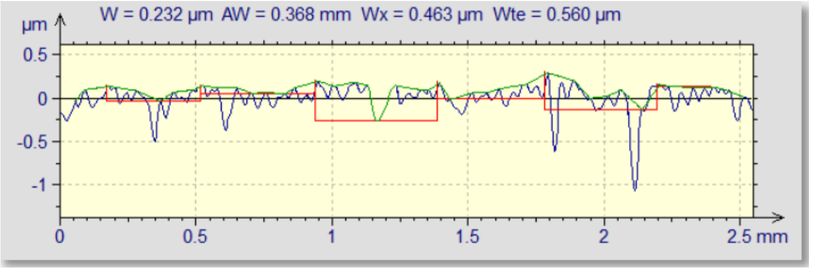
Motifs parameters - Profile method
ISO 12085

This standard is the international version of a French standard established by CNOMO, a consortium involving PSA Peugeot Citroen and Renault, during the 80s and 90s.

The method is commonly called the French motifs method or R&W parameters.

Today, these parameters are less used but the conclusions regarding the relationship between function and specification remain important and can be used with other parameters.





Roughness parameters
R, mean depth of roughness motifs
AR, mean spacing of roughness motifs
Rx, maximum depth of roughness motifs

Waviness parameters
W, mean depth of waviness motifs
AW, mean spacing of waviness motifs
Wx, maximum depth of waviness motifs
Wte, Amplitude of the upper envelope

Motifs are defined on a profile as a peak-valley-peak trio and are detected by a special segmentation method

Other standards

ASME B46.1 and JIS `94

This standard today is more in line with ISO standards than the previous versions, except for some differences. The main difference is about sampling length and averaged parameters.
In ASME and JIS , all profile parameters are defined and calculated on the evaluation length.

VDA 2006

This standard from the German automotive industry collects parameters defined in ISO 4287 and ISO 13565 and introduces several rules that differ from ISO.

The main difference concerns the use of microroughness filter λs that is prohibited here.

It also reintroduces the parameter Rmax that was once part of ISO 4287 and is a good complement to Rz.

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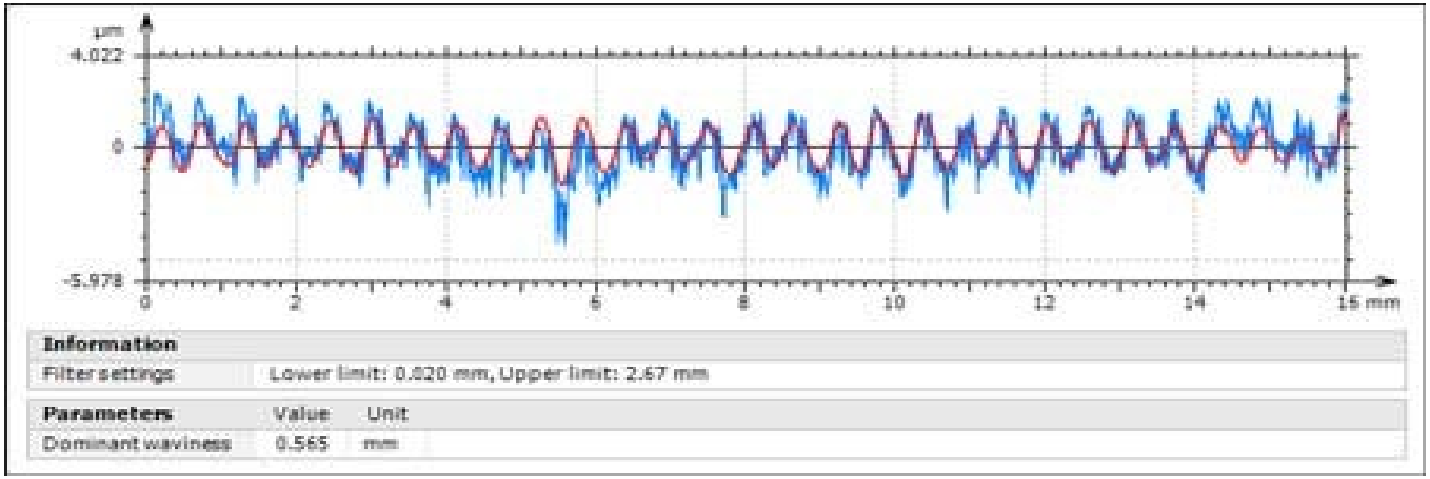
VDA 2007

This standard defines special parameters for the evaluation of periodic surfaces, especially in the field of mating surfaces. It is usually referred to as Dominant waviness. It defines three parameters calculated after a special zero bandpass filter:



WDSm, horizontal waviness

WDc, mean height of waviness profile elements

WDt, total waviness profile height

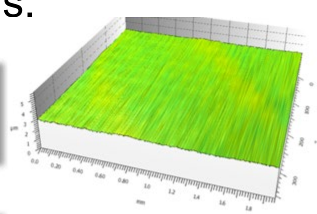
Other standards

Daimler MBN 31 007-7

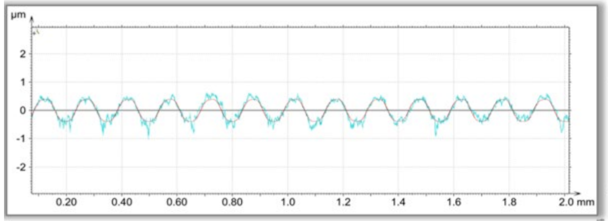
This internal standard provides methods and parameters to analyze lead-reduced dynamic sealing surfaces. It is referred to as Lead or Twist analvsis.

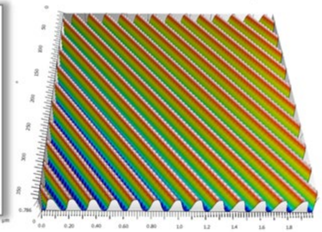
The following parameters are calculated:

Parameter		Wert	Einheit	Parameter		Wert	Einheit
Durchmesser		80.0	mm	Periodenlänge	DP	0.150	mm
Messstrecke		2.00	mm	Theoretischer Förderquerschnitt	DF	59.7	µm²
Maximale Wellenlänge		0.400	mm	Theoretischer Förderquerschnitt pro Umdrehung	DFu	597	µm² /...
Gängigkeit	DG	10.0		Prozentuale Auflagelänge	DLu	34.0	%
Dralltiefe	Dt	0.786	µm	Drallwinkel	Dγ	0.343	°



DG, number of threads
Dt, lead depth
DP, period length
DF, theoretical supply cross section
DFu, DF per turn
DLu, contact length
Dγ, lead angle
DSγ, offset lead angle





Daimler MBN 31 007-12

Wst, maximum absolute height difference of the waviness profile

Roughness parameter used by industry

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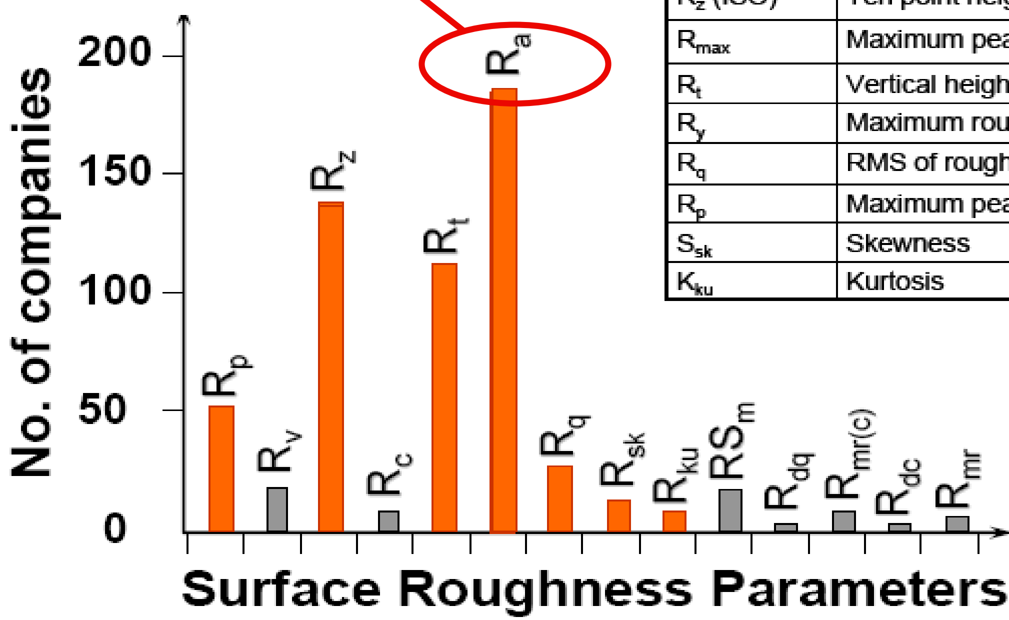
Often used as a standard

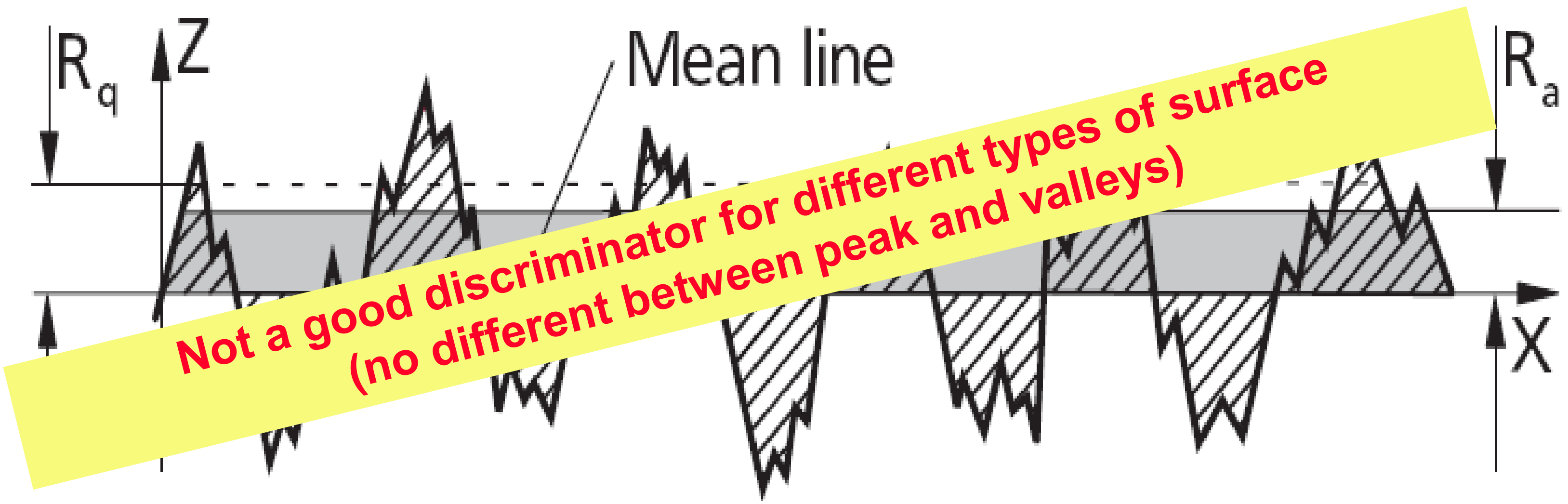


PARAMETER DESCRIPTION		STANDARD
R_a	Roughness average	ISO 4287, BS 1134, ANSI B46.1, DIN 4768
R_z (DIN)	Mean peak-to-valley height	DIN 4786
R_z (ISO)	Ten point height	ISO 4287, BS 1134, DIN 4768
R_{max}	Maximum peak-to-valley height	DIN 4768
R_t	Vertical height between max/min	
R_y	Maximum roughness depth	ISO 4287, BS 1134, DIN 4768
R_q	RMS of roughness average	ISO 4287, DIN 4768
R_p	Maximum peak height	DIN 4762
S_{sk}	Skewness	ISO 4287, DIN 4768
K_{ku}	Kurtosis	

Number of companies using R parameters described in ISO 4287.1997.
From CIRP survey of 284 companies in 18 countries.

Rz, Rmax Parameter
DIN EN ISO 4287

The most commonly used parameter to monitor a production process
Default parameter on a drawing if not otherwise specified



Ra : Roughness average R_a is the arithmetic average of the absolute values of the roughness profile ordinates.

$$R_a = \frac{1}{l}\int_0^l |Z(x)|\, dx$$

Rz, Rmax Parameter
DIN EN ISO 4287

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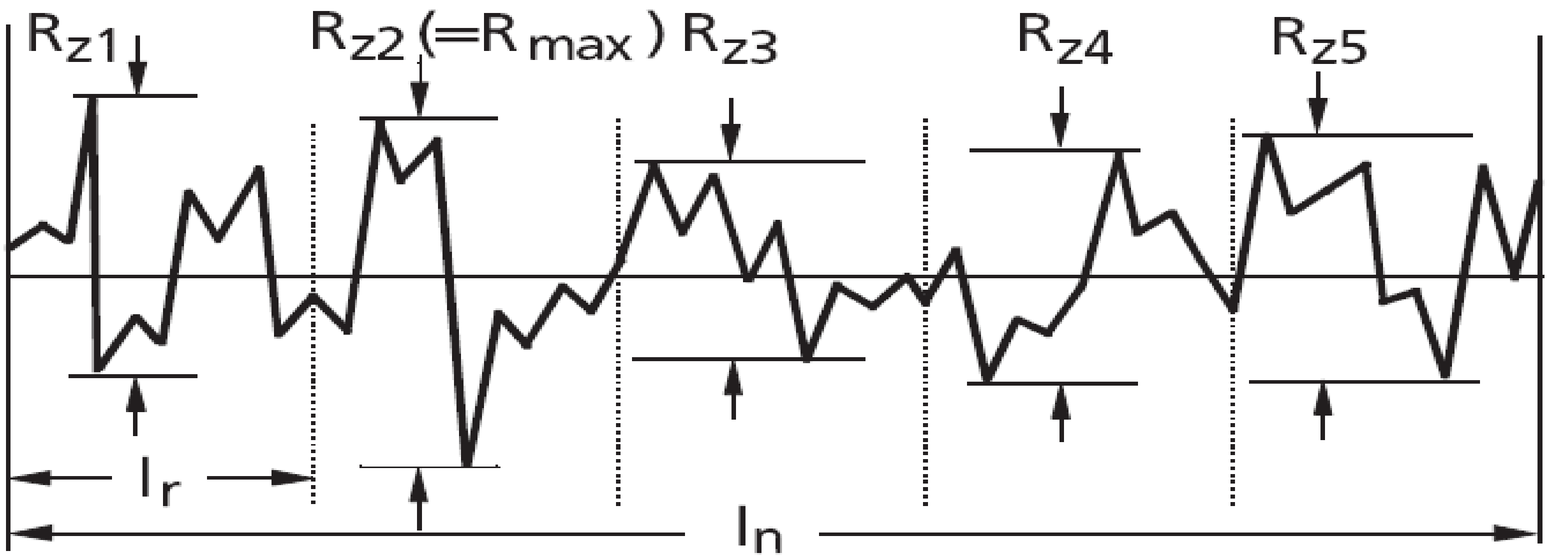
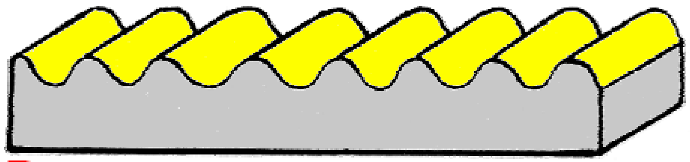
Rz is more sensitive than Ra to changes in surface finish as maximum profile heights and not averages are being examined.



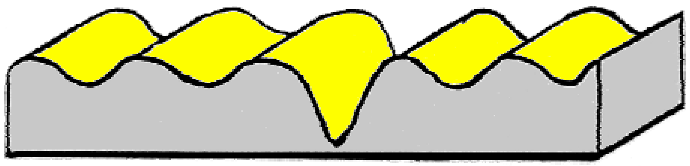
Rz : **Mean roughness depth R_z** is the arithmetic mean value of the single roughness depths R_{zi} of consecutive sampling lengths: $R_z = \frac{1}{n}(R_{z1} + R_{z2} + ... + R_{zn})$

Rmax : **Maximum roughness depth R_{max}** is the largest single roughness depth within the evaluation length.

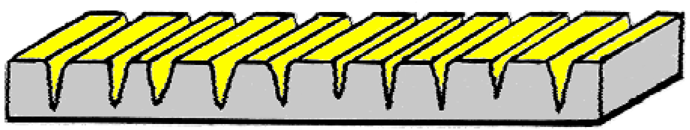
Statement of Ra



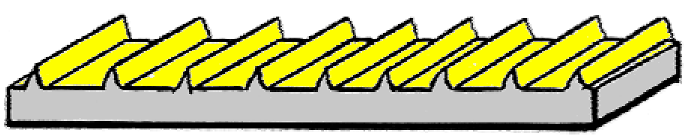
Ra = 2 µm



Ra = 2 µm



Ra = 2 µm



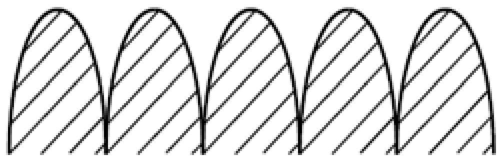
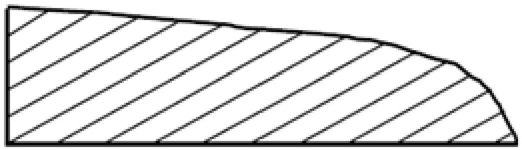
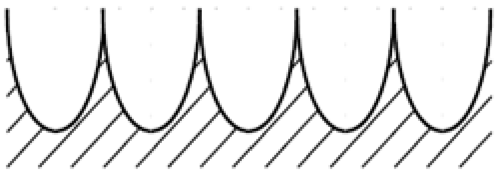
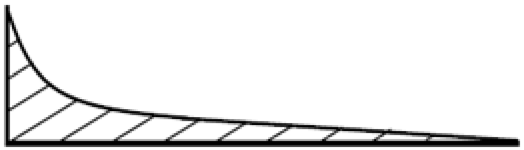
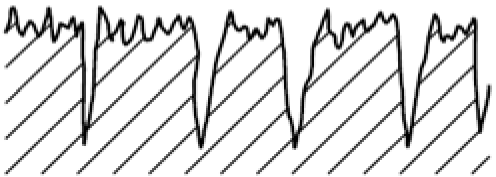
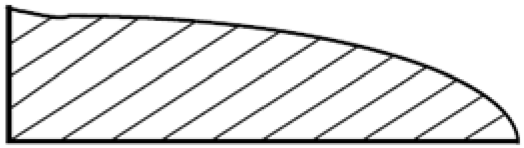
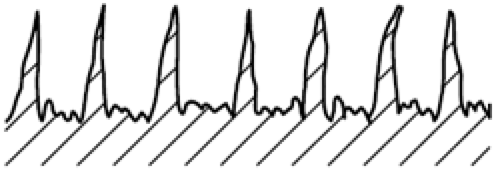
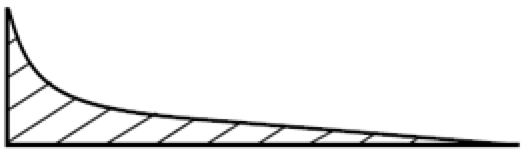
Ra = 2 µm

Ra
is used to monitor production processes where gradual changes in surface finish due to wear can occur

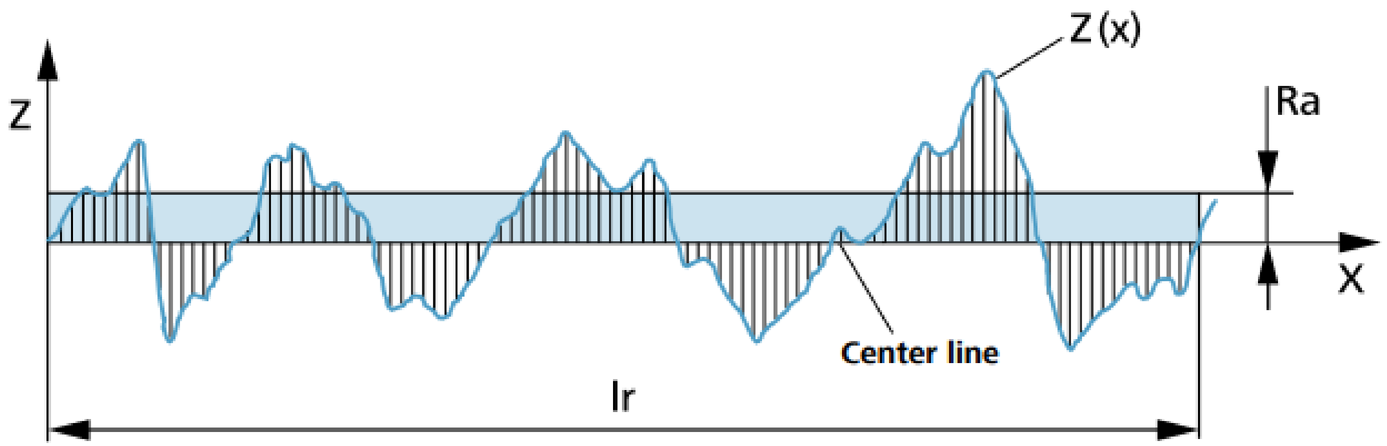
Ra
is an average, defects in the surface do not greatly influence the results, therefore it is not useful in detecting defects

Ra
does not differentiate between peaks and valleys

Statement of Surface parameters and Bearing Area Curve (BAC)

Picture Profil	P_t	R_{z1max}	R_z	R_a	Bearing Area Curve
	1	1	1	0,25	
	1	1	1	0,25	
	1	1	1	0,2	
	1	1	1	0,2	

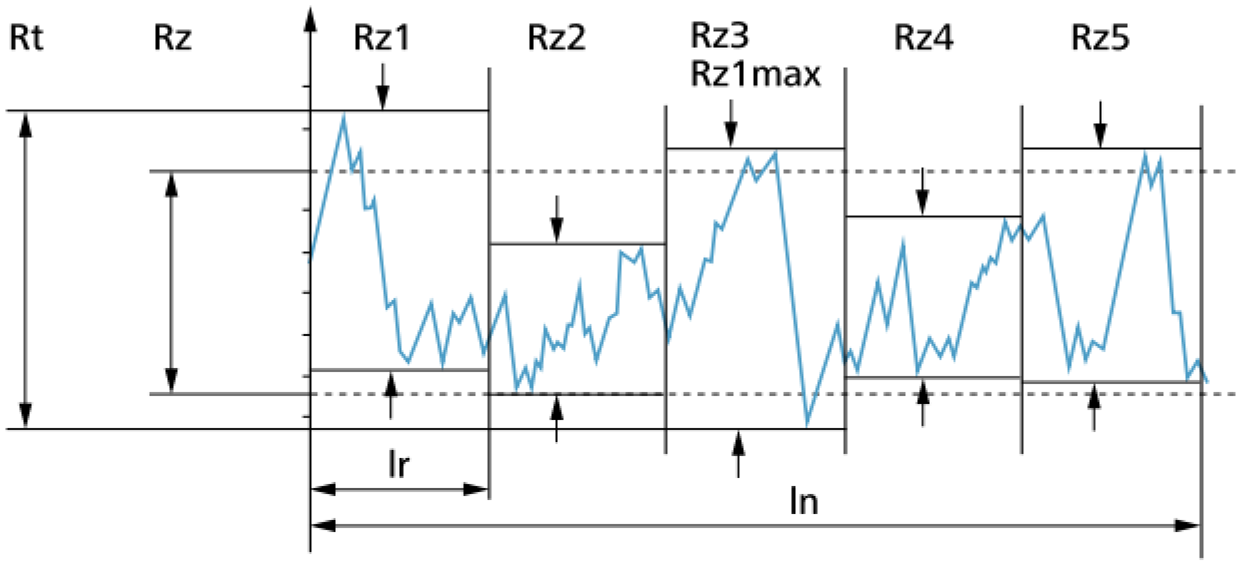
Ra – parameter according to ISO 4287



Ra – arithmetical mean deviation of the assessed profile

Ra is the arithmetic mean roughness value from the amounts of all profile values.
Ra does not differentiate between peaks and valleys and has therefore a relatively weak information character

Rz, Rz1max, Rt – parameters according to ISO 4287



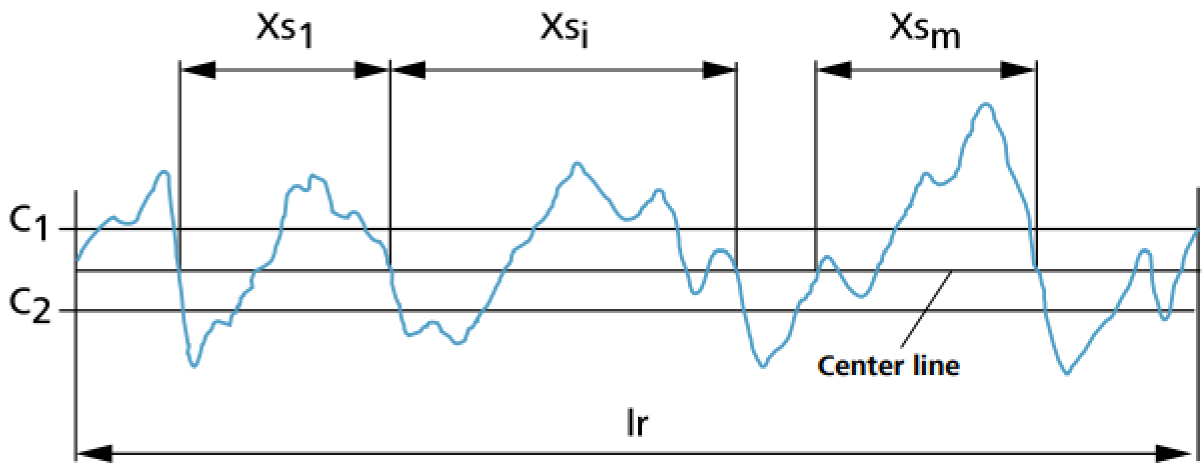
Rz/Rz1max – maximum height of profile:

Average value of the five Rz values/greatest
Rz value from the five sampling lengths lr.
Rz1max: ISO 4287:1997

Rt – total height of profile:

Rt is the distance between the highest peak and the deepest valley of the profile of the total evaluation length ln.

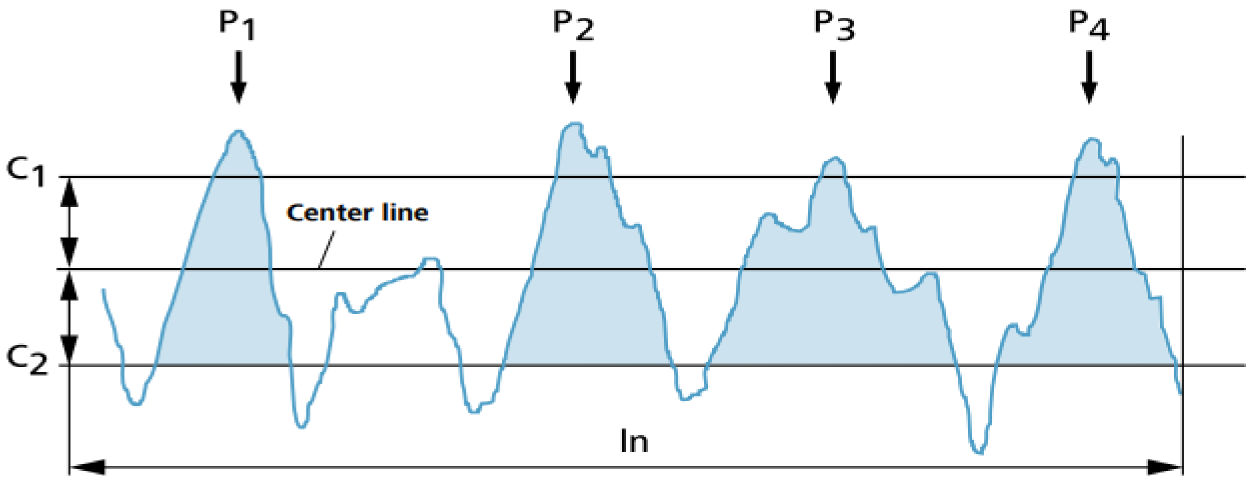
RSm – parameter according to ISO 4287



RSm – mean width of the profile elements

RSm is the arithmetic mean value of the width of the roughness profile elements within the sampling length and requires the definition of height discriminations (c1, c2) matching the function of the surface. If not specified otherwise, the sum of the height discriminations should add up to 10 % of Rz.

RPc – parameter according to EN 10049/ISO 4287



RPc – standardized number of peaks

RPc corresponds to the number of local peaks, which successively exceed an upper section line c1 and a lower section line c2.

High spot count HSC is the number of roughness profile peaks per cm exceeding the specified upper profile section level c1.

Rmr(c) – parameter according to ISO 4287

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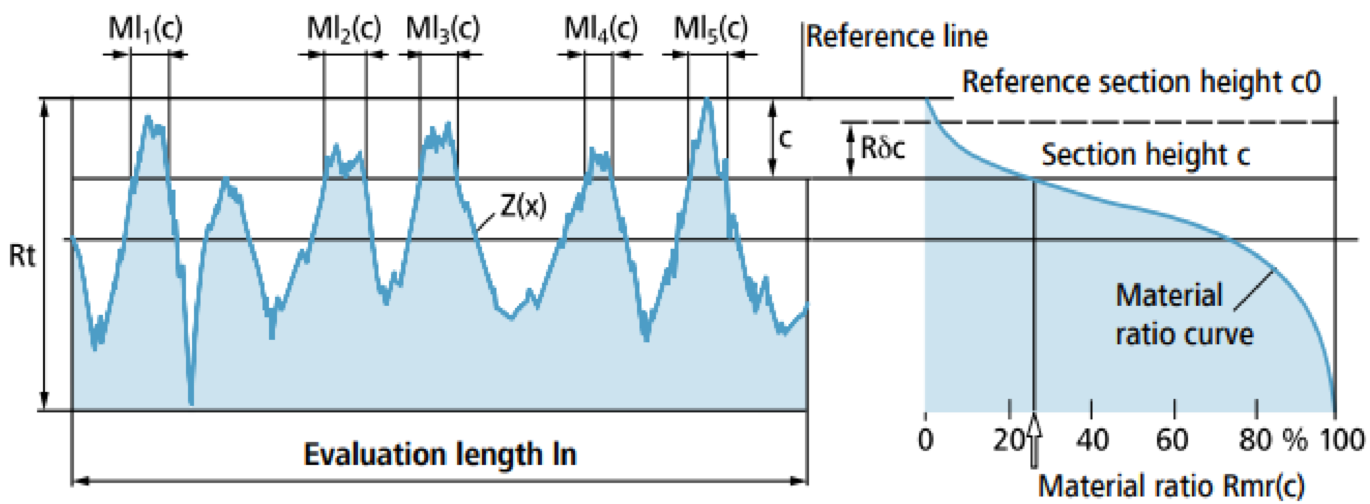
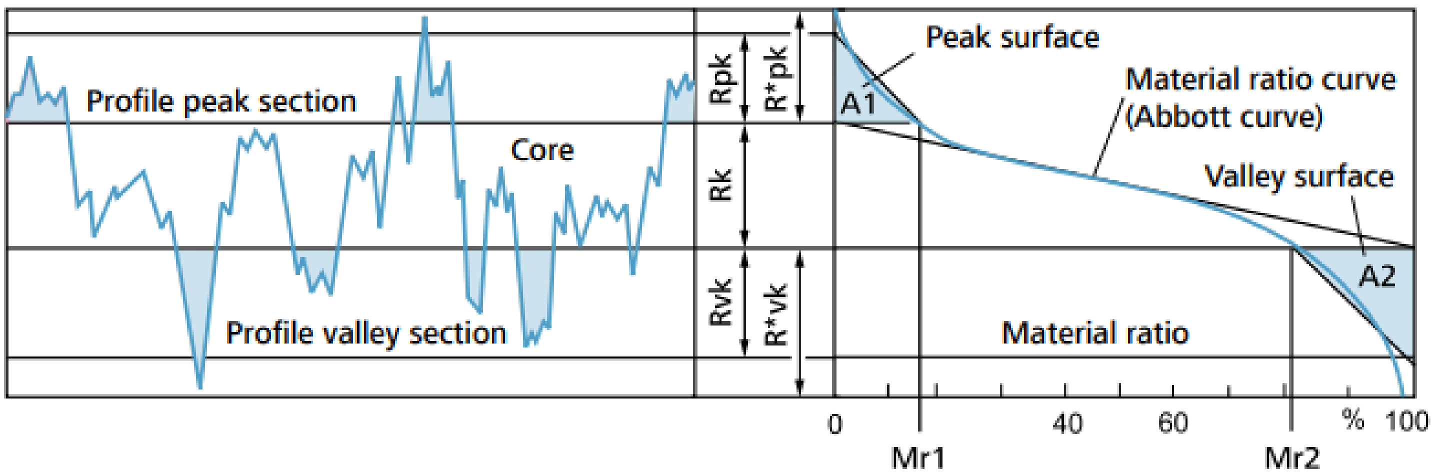


Rmr(c) – material ratio of the profile

Rmr indicates what ratio the totaled length in the material has assumed relative to the evaluation length (in %). The comparison is made in the specified section height c and the total evaluation length ln. The material ratio curve indicates the material ratio as a function of the section height.

Rk, Rpk, Rvk, Mr1, Mr2 – parameters according to ISO 13565-2



Parameters of the material ratio curve

Rk – core roughness depth: Depth of the roughness core profile.

Rpk – reduced peak height: Mean height of the peaks protruding from the roughness profile.

Rpk* – highest profile peak height (not included in ISO 13565-2)

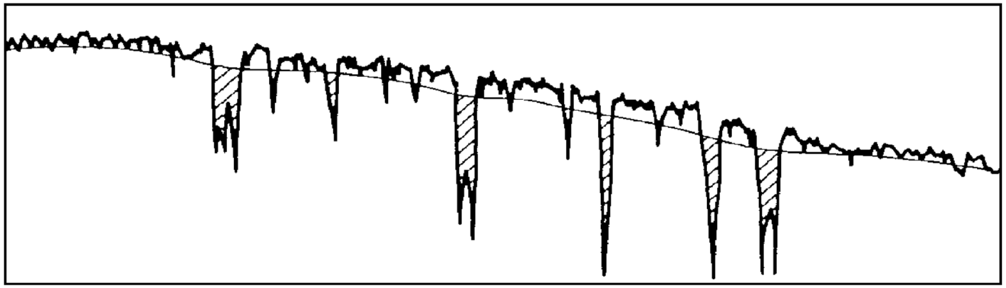
Rvk – reduced valley depth: The mean depth of the valleys reaching into the material from the core.

Rvk* – deepest profile valley depth (not included in ISO 13565-2)

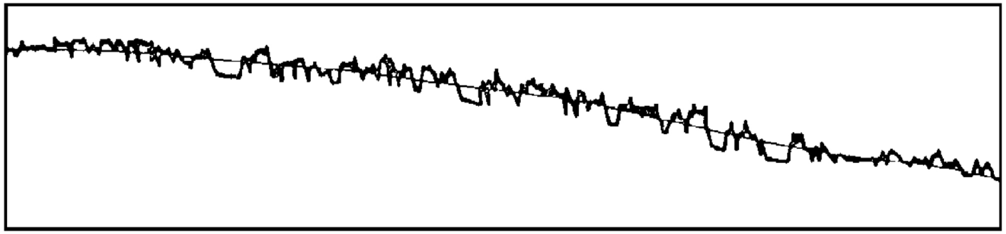
Mr1, Mr2 – material ratio: Smallest (Mr1) and greatest (Mr2) material ratio (in %) at the limits of the roughness core area.

Special filter as per DIN EN ISO 13565-1

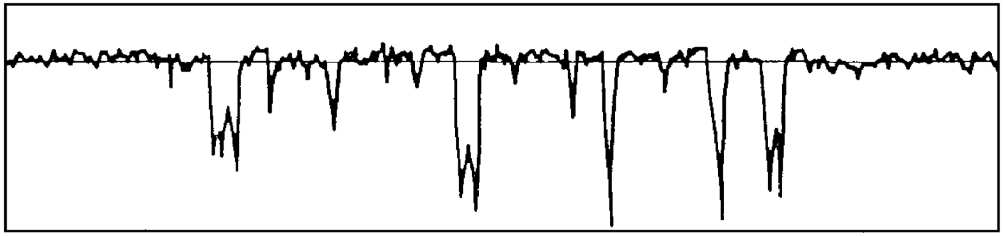
Actual profile
with mean line:



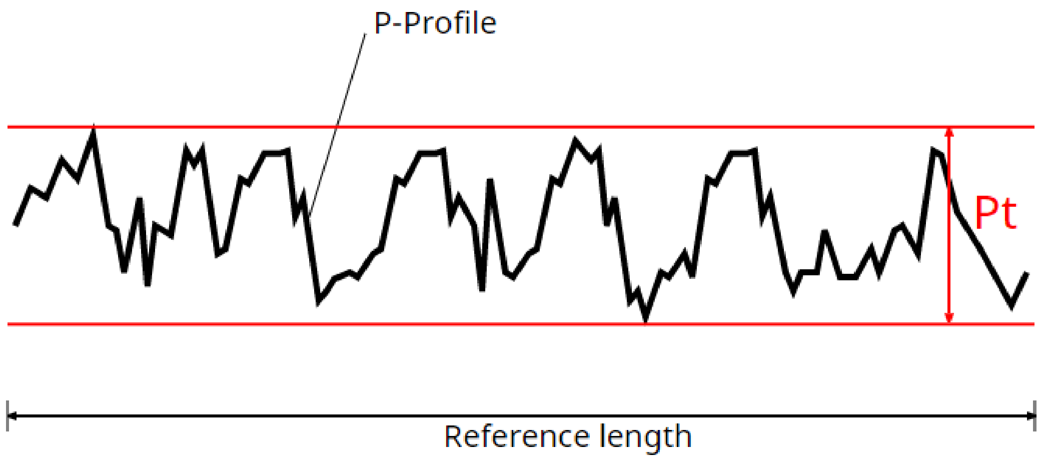
Actual profile
without valleys:



Filtered profile
with valleys:



Pt profile depth– parameters according EN ISO 4287

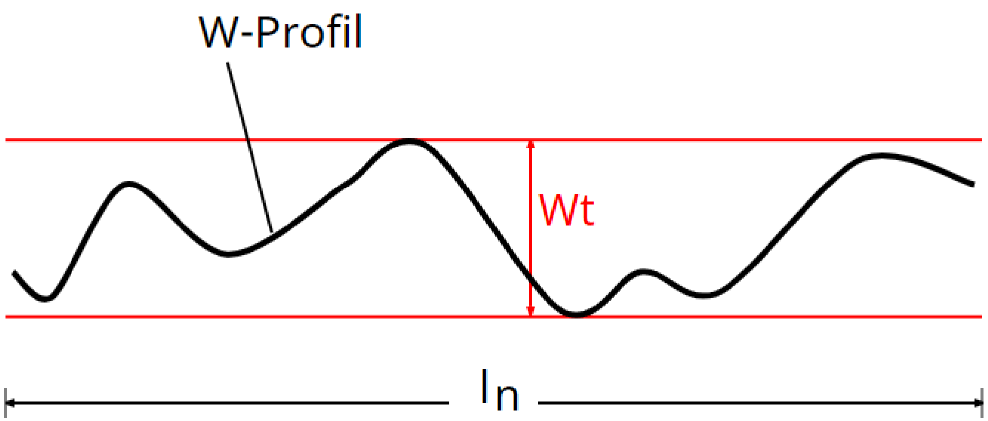


Profile depth Pt (total height of P-profile) is the sum of the largest profile peak height and the largest profile valley depth of the P-profile within the evaluation length ln

P-profile (primary profile) is computed from the traced profile

by excluding the nominal form by using the method of best fit least squares of the type indicated in the drawing

Wt waviness height
EN ISO 4287, ASME B46.1



Waviness height Wt (total height of W-profile) is the sum of the largest profile peak height and the largest profile valley depth of the W-profile within the evaluation length ln.

W-profile (waviness profile) is the mean line generated from the P-profile by the lc profile filter. The long wave profile components which belong to the form are excluded.

Poster (English)
available from Marketing ACCRETECH Munich

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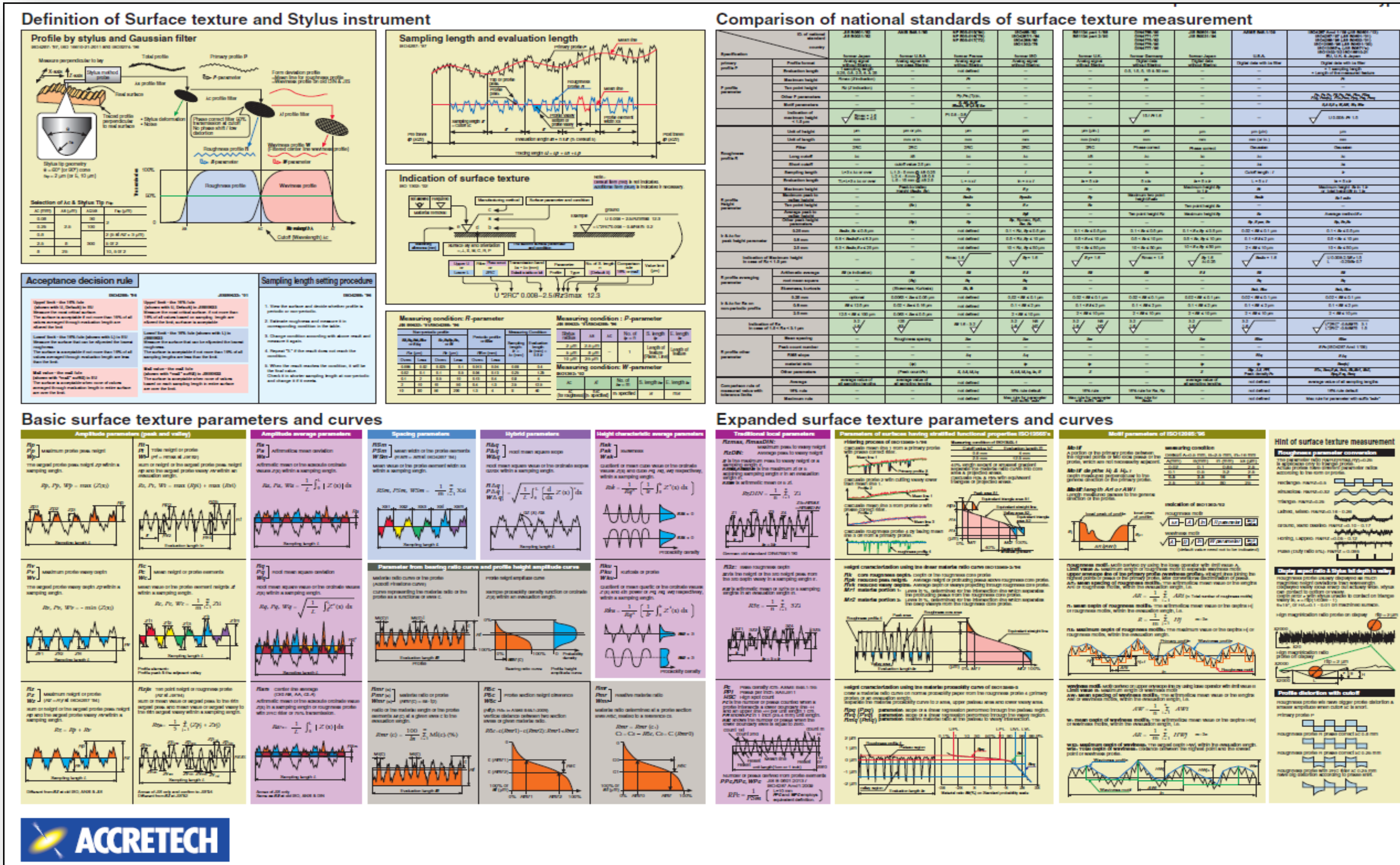

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	Surface Metrology Part II 04.June 2020
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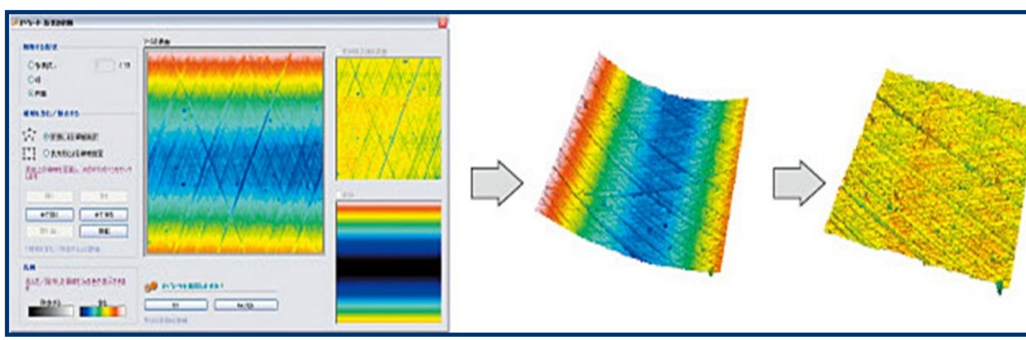
7	Non-contact Surface

3D parameters
ISO 25178

The first manufacturers of areal surface texture measurement instruments initially proposed characterization methods that were mainly based upon a simple extrapolation of 2D methods.

In the absence of official documentation, the manufacturers made up solutions that were more or less felicitous, with surface parameters sometimes calculated as the simple mean of profile parameters evaluated for each line on the surface, or for radial profiles extracted from a circle with its origin at the center of the image.



3D parameters
ISO 25178

The naming rules for the parameters were also derived from the 2D parameters (sRa, sWa...) and were calculated using proprietary algorithms leading to different values on different instruments.

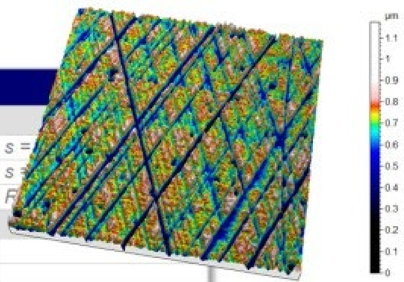
The first important work on 3D surface texture was carried out by a European program, from Birmingham university.

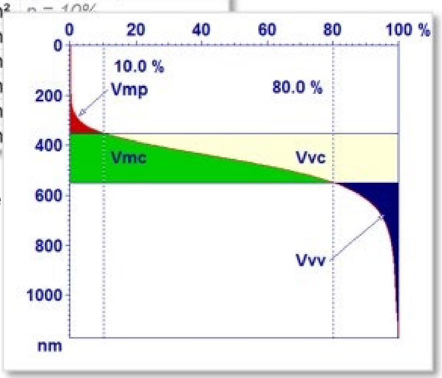
End of 2005, the ISO secretary allocated the number ISO 25178 to this areal surface standard

ISO 25178 support contact and non-contact stylus method

ISO 25178			
Height Parameters			
Sq	22.263	µm	*Root mean square height*
Ssk	0.0098607		*Skewness*
Sku	1.6195		*Kurtosis*
Sp	37.759	µm	*Maximum peak height*
Sv	40.338	µm	*Maximum pit height*
Sz	78.097	µm	*Maximum height*
Sa	19.863	µm	*Arithmetic mean height*

ISO 25178		
Spatial Parameters		
Sal	24206	nm
Str	0.0253	
Std	67.5	°
Hybrid Parameters		
Sdq	0.00964	
Sdr	0.00465	%
Functional Parameters (Volume)		
Vm	3.90	nm³/nm²
Vv	129	nm³/nm
Vmp	3.90	nm³/nm
Vmc	90.6	nm³/nm
Vvc	107	nm³/nm
Vvv	21.3	nm³/nm

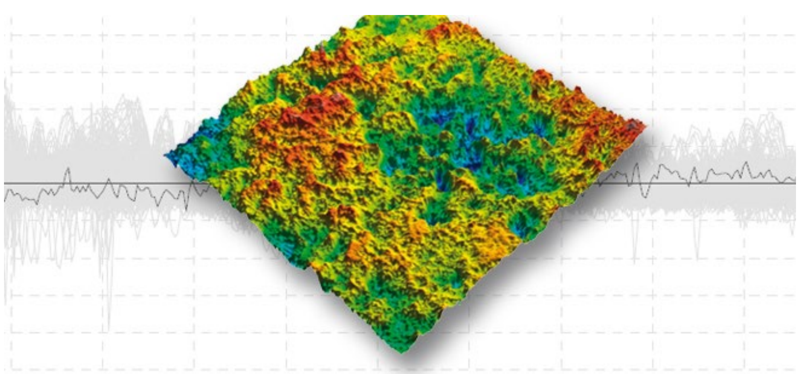




ACCRETECH Surfcom Map – 3DF Software

Area Roughness Parameter
ISO 25178

Height	**Sa (arithmetical mean height)**
	Sz (Maximum height)
	Sq (Root mean square height)
	Ssk (Skewness)
	Sku (Kurtosis)
	Sp (Maximum peak height)
	Sv (Maximum pit height)
Spatial	Sal (Auto-correlation length) / Str (Texture aspect ratio)
	Std* (Texture direction)
Hybrid	Sdq (Root mean square gradient)
	Sdr (Developed interfacial area ratio)



Functional	Smr(c) Areal material (bearing area) ratio
	Smc(mr) Inverse areal material ratio
	Sk (Core roughness depth)
	Spk (Reduced peak height)
	Svk (reduced dale height (reduced valley depth))
	Smr (Peak material portion)
	Smr2 (Valley material portion)
	Sxp (Peak extreme height)
Functional volume	Vvv (Dale void volume)
	Vvc (Core void volume)
	Vmp (Peak material volume)
	Vmc (Core material volume)
Feature	Spd (Density of peaks)
	Spc (Arithmetic mean peak curvature)
	S10z / S5p / S5v / Sda(c) / Sha(c) / Sdv(c) / Shv(c)

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Non-Contact Roughness

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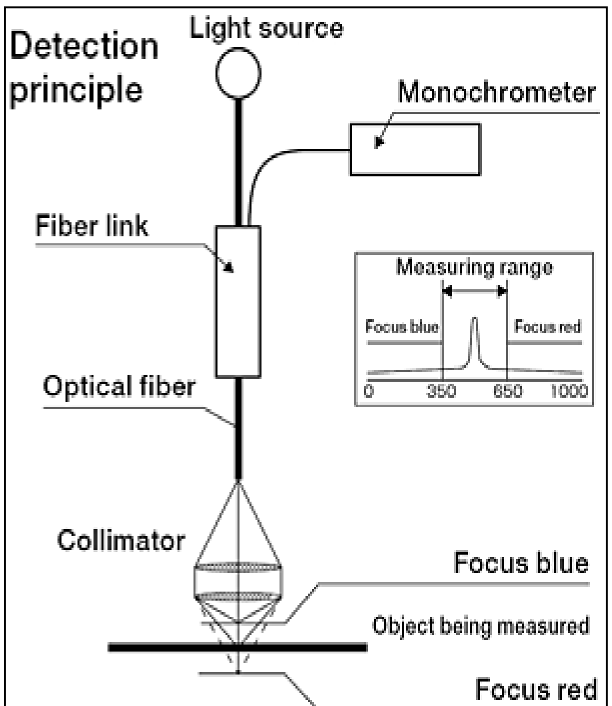
Confocal system

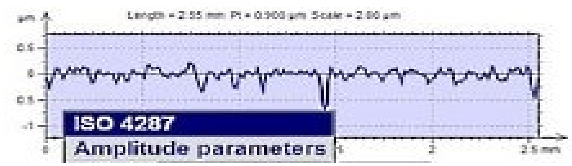
Non Contact Point Sensor

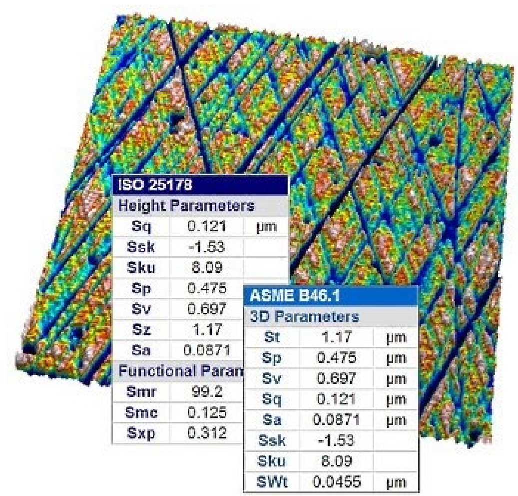
The pickup provides surface texture measuring of plastic, film, paper and other soft objects in 2D – and 3D measurements (scanning Lines in combination with Y-table).



Surfcom Nex 001 – optical sensor

Measuring range (Z)	300µm
Resolution (Z)	10nm
Max. measuring angle	30°*
Spot diameter	2µm
Workpiece distance	4.5mm



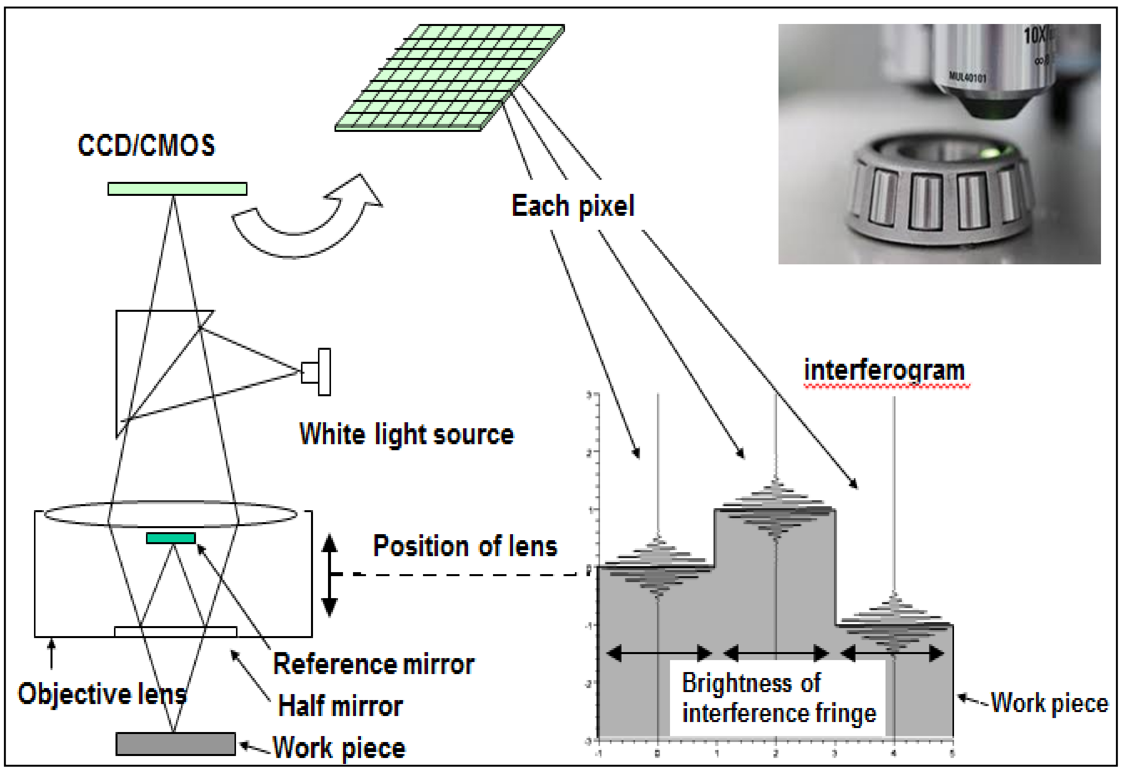


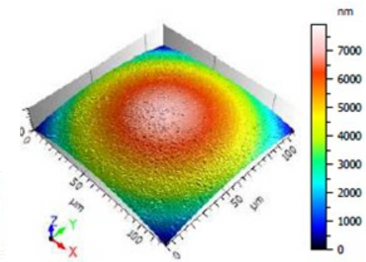
Non-Contact Roughness

White light interferometer

Non-contact, high resolution, and wide range.

Non-contact 3D evaluation of workpieces in the whole surface with reduced time for highest resolution and accuracy and all different kind of materials.





Opt-Scope

Scanning range(Z)	20 mm
Resolution(Z)	0.1 nm
Accuracy(Z)	±(0.8+2H/100) µm H: Height mm
CCD resolution	2048x2048
Measurement range (X,Y)	1.7x1.7 mm Lens: x10
Resolution(X,Y)	1.10 um Lens: x10
Max.measurement height	200 mm

Plus and minus optical surface measurements

Advantage optical surface measurements

+ possible to measure soft materials
+ possible to measure in small positions
+ easier to find defects
+ measurement oft critical surface
+ highest resolution
+ no damage the surface during measurement
+ faster area surface measurement
+ more data information's

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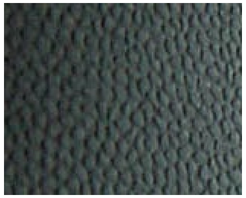
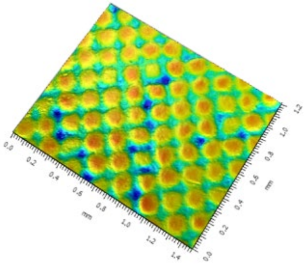
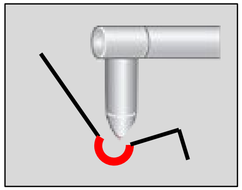
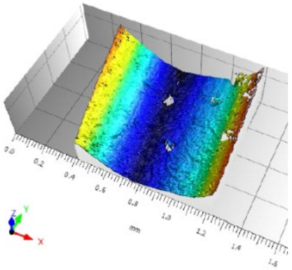
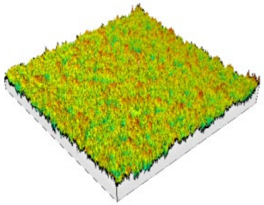




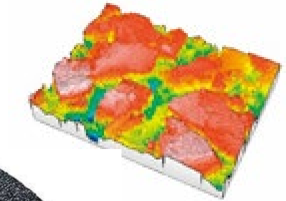


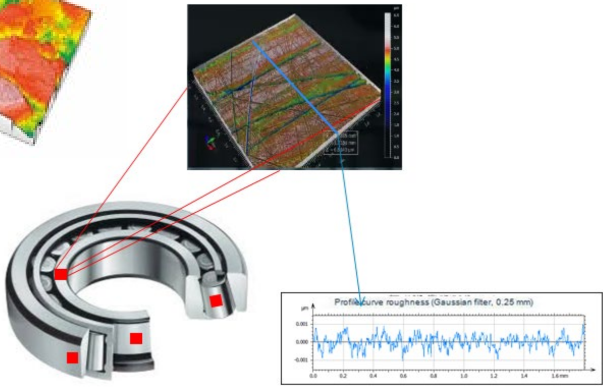




Identification cards
30 cm _ silicon wafers _ 1 2014/11/30 18:16:56

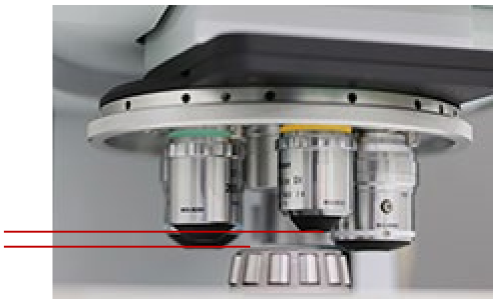
ISO4287			
Height direction parameter - roughness			
Ra	0.000233	µm	Gaussian filter, 0.25 mm
Rz	0.00142	µm	Gaussian filter, 0.25 mm





Plus and minus optical surface measurements

Disadvantage optical surface measurements



- workpiece distance
- difficult in small holes or inside measurements
- Higher purchasing costs
- depends of the sensor technology
  - difficult to measure different material
    based on necessary light reflection
- Difficult to measure sharp edge

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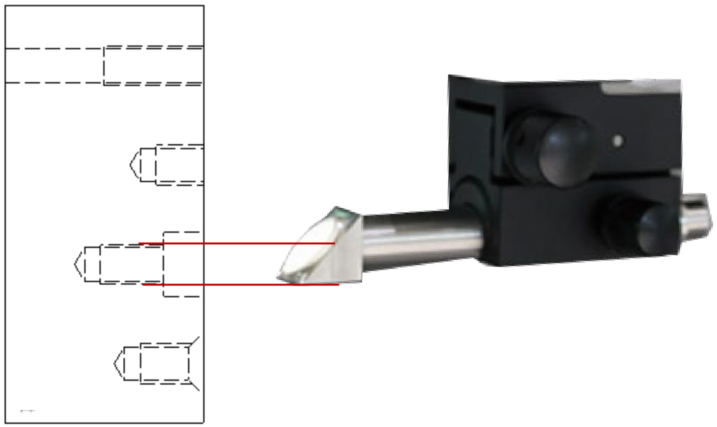

Thank you for your attention !!!

ACCRETECH | EUROPE

CORPORATE MOTTO

WIN-WIN RELATIONSHIPS
CREATE THE WORLD'S No.1 PRODUCTS

Our corporate brand "ACCRETECH" was created from the words "accrete," which means grow together, and "technology." The brand thus expresses in a single word our corporate philosophy: growing together with partners and customers by collaborating technology, knowledge and information from internal and external sources to create the world's No. 1 products.