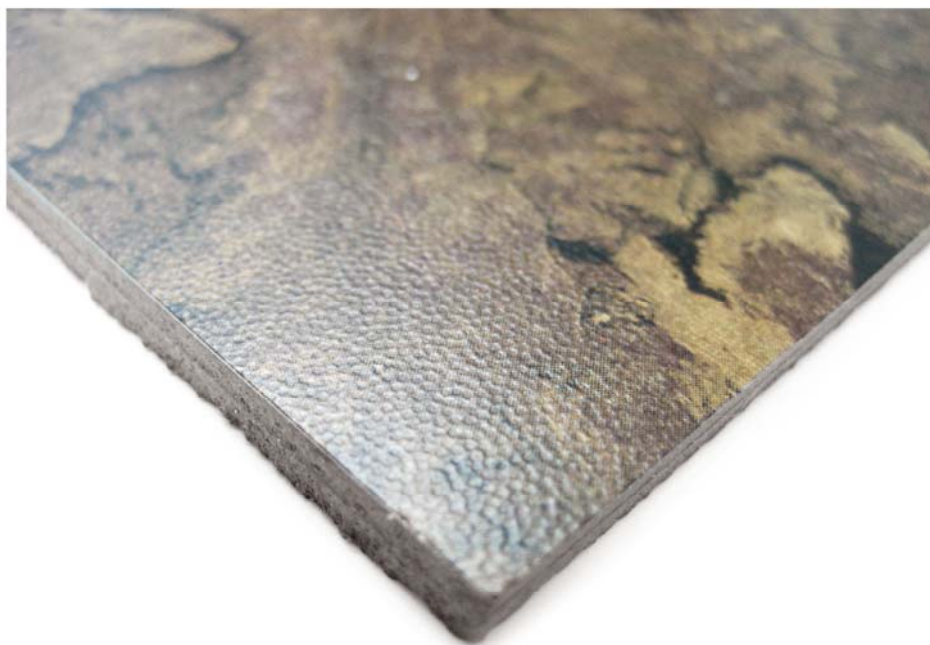


**SURFACE TEXTURE CONSISTENCY
USING 3D PROFILOMETRY**



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INTRODUCTION:

Throughout many industries surface texture is an important aspect of product design. Surface texture not only provides the ability to refine the physical appearance of an application, but also for usage with applications requiring a controlled level of friction or grip, such as flooring. It is for this reason that machined and molded surface texture production environments are increasingly seeking ways to improve and enhance the control of the intended surface texture.

IMPORTANCE OF 3D NON CONTACT PROFILOMETER FOR TEXTURE CONSISTENCY

Unlike other techniques such as touch probes or interferometry, the 3D Non Contact Profilometer, using axial chromatism, can measure nearly any surface, sample sizes can vary widely due to open staging and there is no sample preparation needed. Nano through macro range is obtained during surface profile measurement with zero influence from sample reflectivity or absorption, has advanced ability to measure high surface angles and there is no software manipulation of results. Easily measure any material: transparent, opaque, specular, diffusive, polished, rough etc. The technique of the Non Contact Profilometer provides an ideal, broad and user friendly capability to maximize surface studies when surface texture analysis will be needed; along with the benefits of combined 2D & 3D capability.

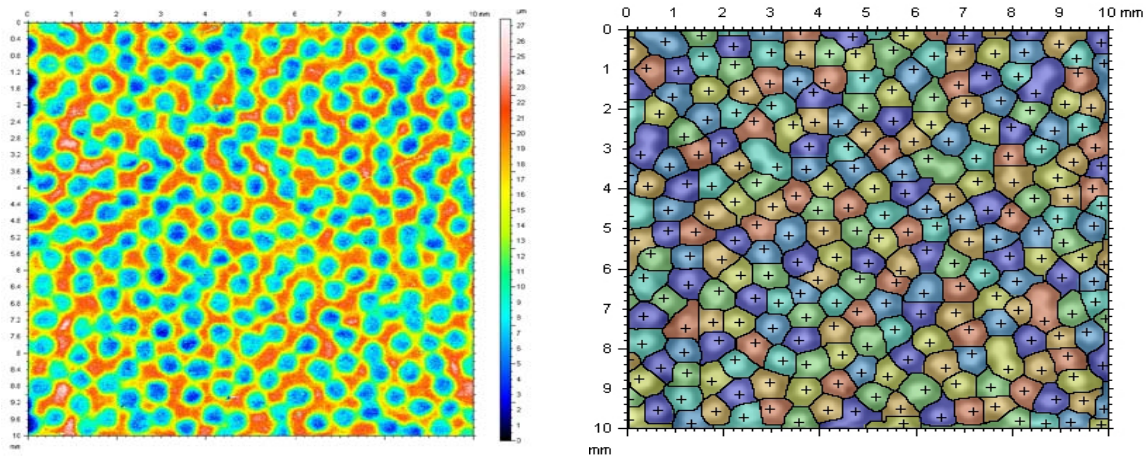
MEASUREMENT OBJECTIVE

In this application the Nanovea ST400 Profilometer is used to measure the surface area of linoleum flooring. The intended surface texture here should be a repetitive structure with the same relative size. Measuring a small area should show how consistent this texture is being produced.

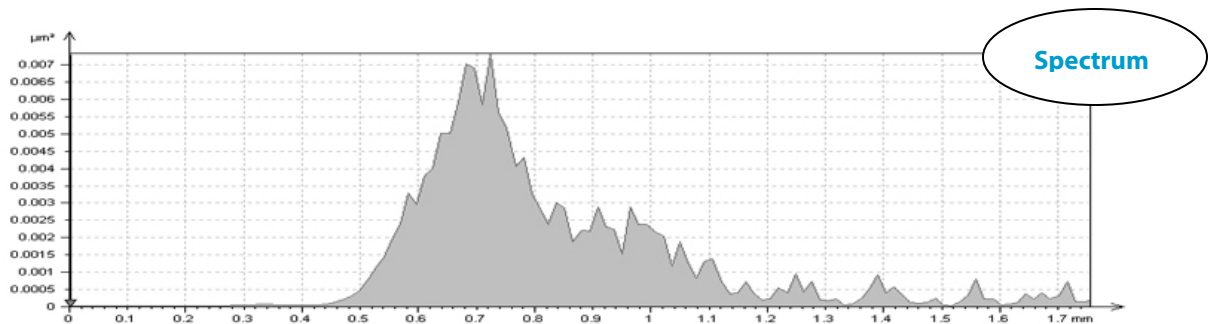


RESULTS:

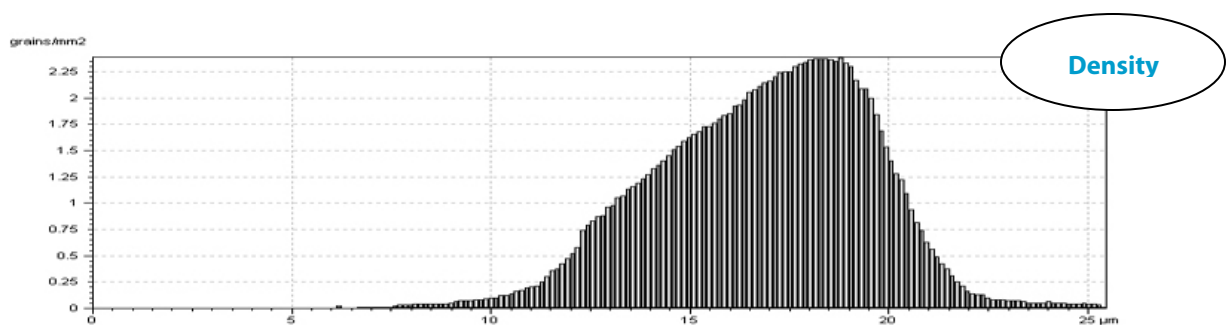
Images below show topography of a 10mm x 10mm surface (left) and each individual depression along with their deepest point (right). From this the mean data for the depressions can be calculated as follows.



Mean Area: 0.394016mm² | Mean Volume: 0.000408109mm³
Mean of Mean Diameters: 0.683262mm | Mean Form Factor: 0.638741
Mean Aspect Ratio: 1.67253 | Mean Roundness: 0.636164

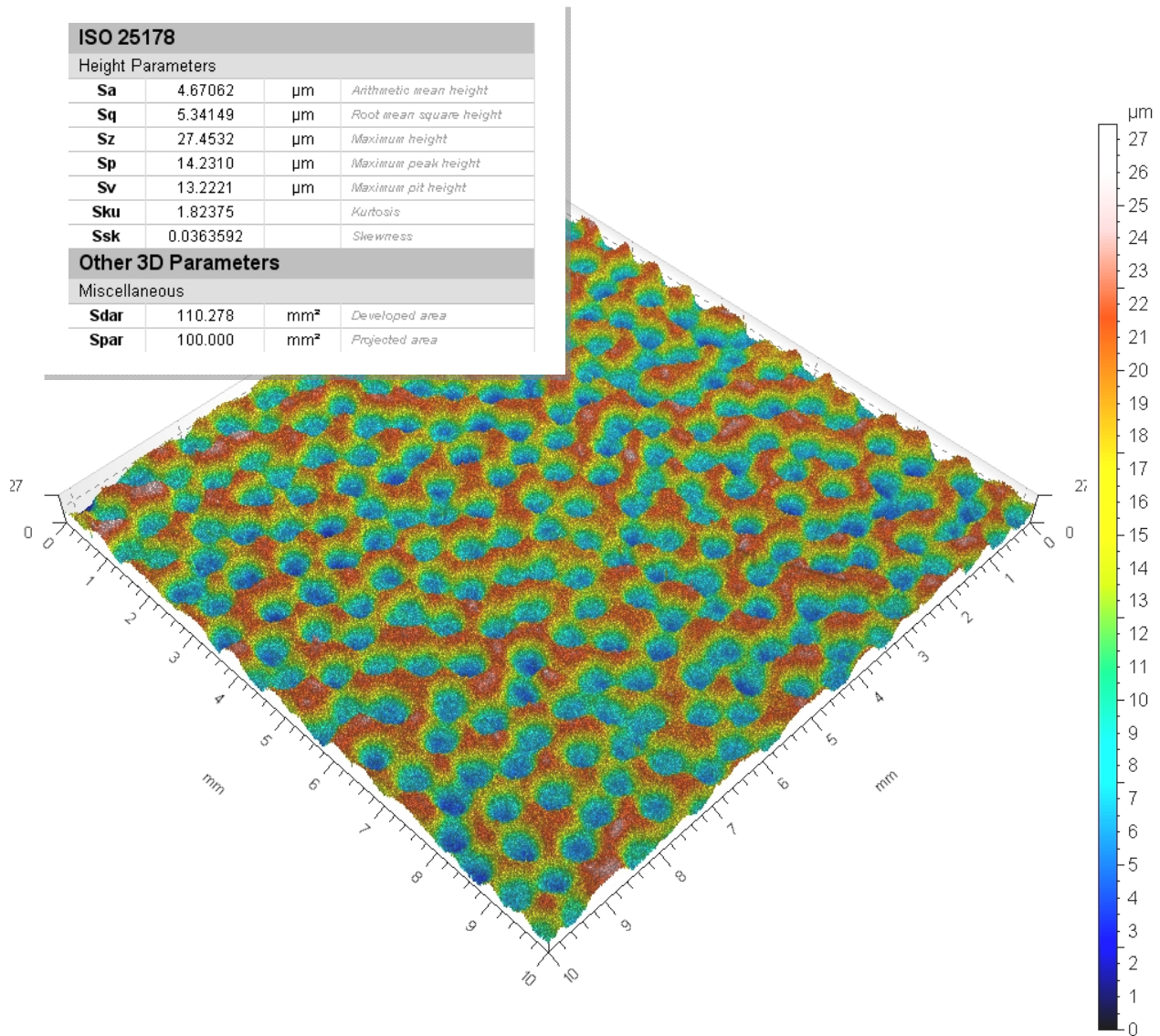


Power spectrum density is displayed here to show dominate wavelengths around 0.68mm and 0.74mm, with minor peaks up to 1.72mm.



Density of depressions shows a fairly even distribution with a peak around 2.3 per mm².

Surface roughness and surface area calculations based on 3D measured area.

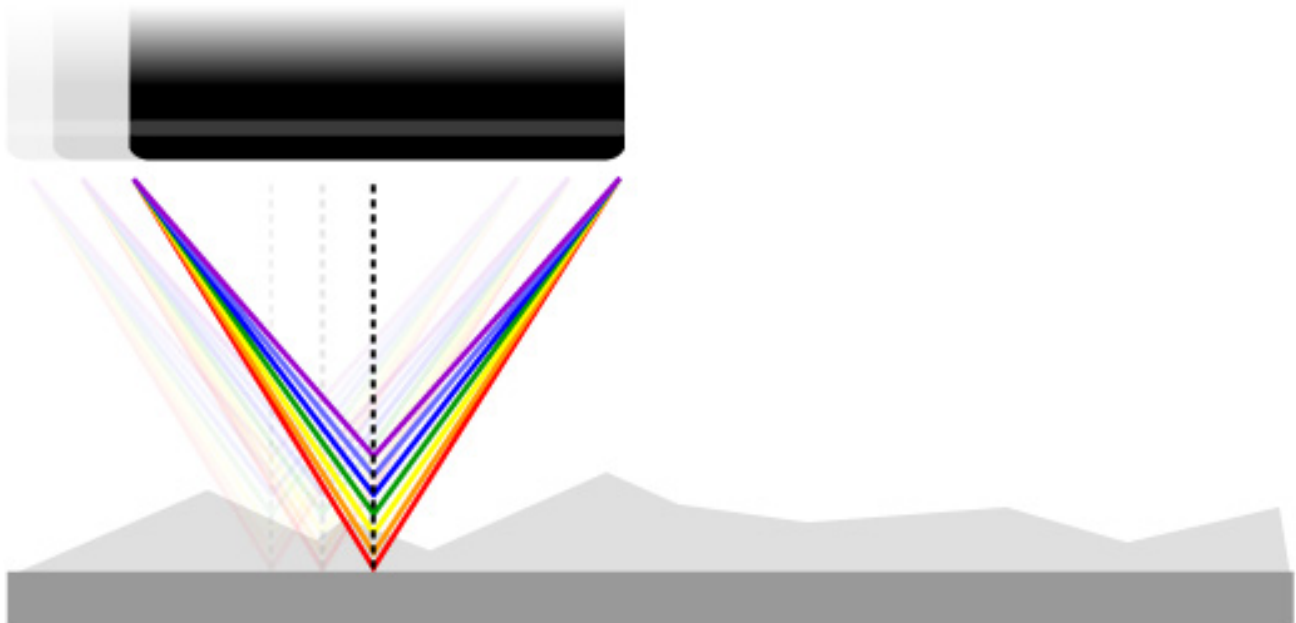


CONCLUSION:

In this application, we have shown how the Nanovea 3D Non Contact Profilometer can precisely characterize the surface texture of linoleum flooring. To check for consistency it would be helpful to measure a batch of samples and compare the parameters shown here. The values of average area occupied, wavelength and density of depressions should be particularly helpful when creating a quantitative quality control process. Surface roughness and surface area would be particularly useful when considering the average height of the peaks and valleys (Sa), the minimum and the maximum heights and depths of the peaks and valleys (Sp and Sv), as well as the increased surface area created by this texture (Sdar). Learn more: [Nanovea Profilometer](#)

MEASUREMENT PRINCIPLE:

The Chromatic Confocal technique uses a white light source, where light passes through an objective lens with a high degree of chromatic aberration. The refractive index of the objective lens will vary in relation to the wavelength of the light. In effect, each separate wavelength of the incident white light will re-focus at a different distance from the lens (different height). When the measured sample is within the range of possible heights, a single monochromatic point will be focalized to form the image. Due to the confocal configuration of the system, only the focused wavelength will pass through the spatial filter with high efficiency, thus causing all other wavelengths to be out of focus. The spectral analysis is done using a diffraction grating. This technique deviates each wavelength at a different position, intercepting a line of CCD, which in turn indicates the position of the maximum intensity and allows direct correspondence to the Z height position.



Unlike the errors caused by probe contact or the manipulative Interferometry technique, Chromatic Confocal technology measures height directly from the detection of the wavelength that hits the surface of the sample in focus. It is a direct measurement with no mathematical software manipulation. This provides unmatched accuracy on the surface measured because a data point is either measured accurately without software interpretation or not at all. The software completes the unmeasured point but the user is fully aware of it and can have confidence that there are no hidden artifacts created by software guessing.

Nanovea optical pens have zero influence from sample reflectivity or absorption. Variations require no sample preparation and have advanced ability to measure high surface angles. Capable of large Z measurement ranges. Measure any material: transparent or opaque, specular or diffusive, polished or rough. Measurement includes: Profile Dimension, Roughness Finish Texture, Shape Form Topography, Flatness Warpage Planarity, Volume Area, Step-Height Depth Thickness and many others.

DEFINITION OF HEIGHT PARAMETERS

Height Parameter		Definition
Sa	Arithmetical Mean Height	Mean surface roughness. $Sa = \frac{1}{A} \iint_A z(x, y) dx dy$
Sq	Root Mean Square Height	Standard deviation of the height distribution, or RMS surface roughness. $Sq = \sqrt{\frac{1}{A} \iint_A z^2(x, y) dx dy}$ Computes the standard deviation for the amplitudes of the surface (RMS).
Sp	Maximum Peak Height	Height between the highest peak and the mean plane.
Sv	Maximum Pit Height	Depth between the mean plane and the deepest valley.
Sz	Maximum Height	Height between the highest peak and the deepest valley.
Ssk	Skewness	Skewness of the height distribution. $Ssk = \frac{1}{Sq^3} \left[\frac{1}{A} \iint_A z^3(x, y) dx dy \right]$ Skewness qualifies the symmetry of the height distribution. A negative Ssk indicates that the surface is composed of mainly one plateau and deep and fine valleys. In this case, the distribution is sloping to the top. A positive Ssk indicates a surface with a lot of peaks on a plane. Therefore, the distribution is sloping to the bottom. Due to the large exponent used, this parameter is very sensitive to the sampling and noise of the measurement.
Sku	Kurtosis	Kurtosis of the height distribution. $Sku = \frac{1}{Sq^4} \left[\frac{1}{A} \iint_A z^4(x, y) dx dy \right]$ Kurtosis qualifies the flatness of the height distribution. Due to the large exponent used, this parameter is very sensitive to the sampling and noise of the measurement.
Spar	Projected Area	Projected surface area.
Sdar	Developed Area	Developed surface area.