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Reference algorithms and softgauges for areal surface texture metrology on 3D objects

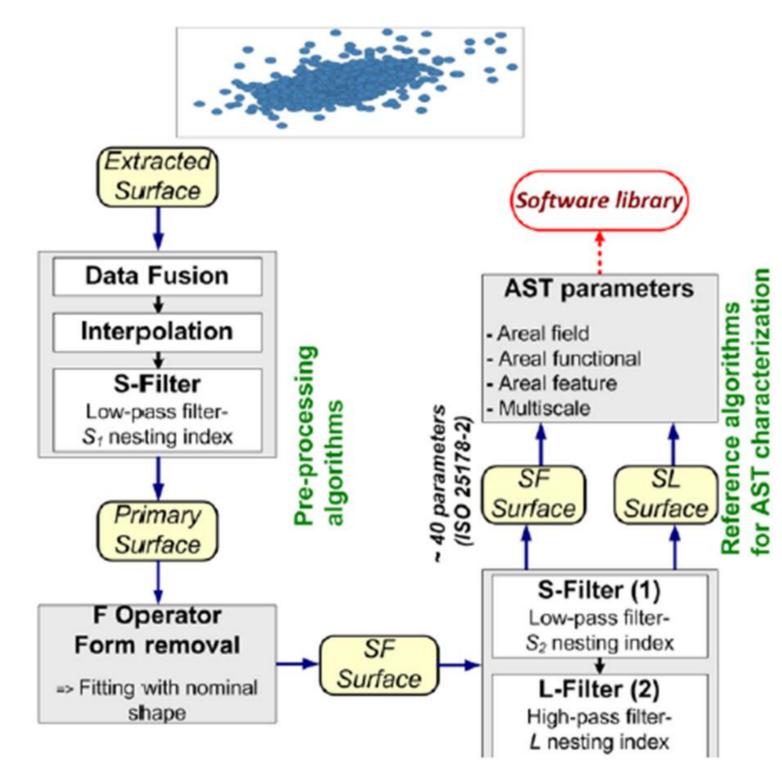
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Abstract

The PhD project themed "Reference algorithms and softgauges for areal surface texture metrology on 3D objects" has been started in collaboration between LNE, Paris and LURPA, Paris-saclay and Cetim in order to generate new Reference algorithms and softgauges for areal surface texture metrology on 3D complex objects and to validate them.

Reference Algorithms

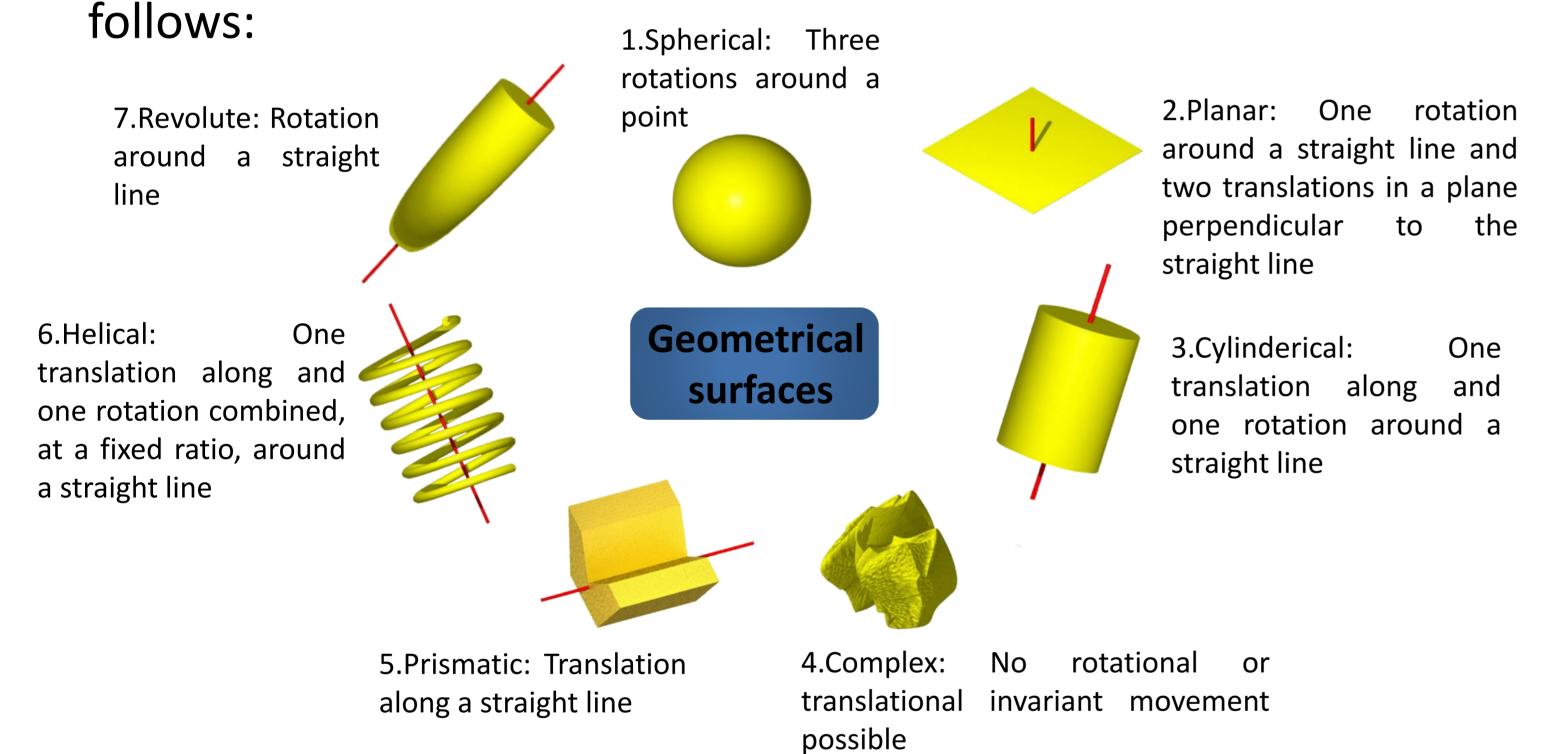


Project work and aims

• L. Pagani, Q. Qi, X. Jiang, P. J. Scott in [3] have provided a new definition and algorithm for areal surface texture where the manufactured surface can be described with a regular surface

Classification of geometrical surfaces

• The classification of surfaces is provided by the invariance class concept where each class is defined by the motions (translations and rotations) that leave the geometrical surface invariant as

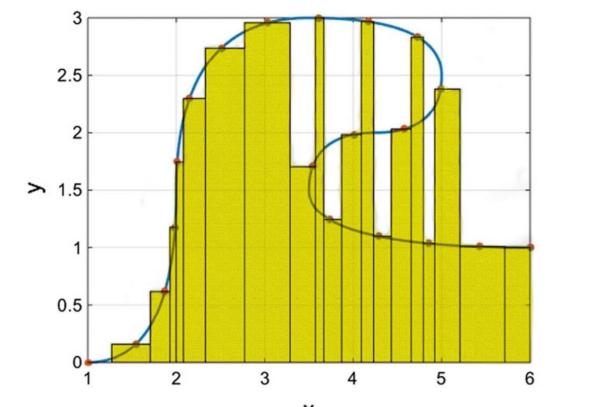


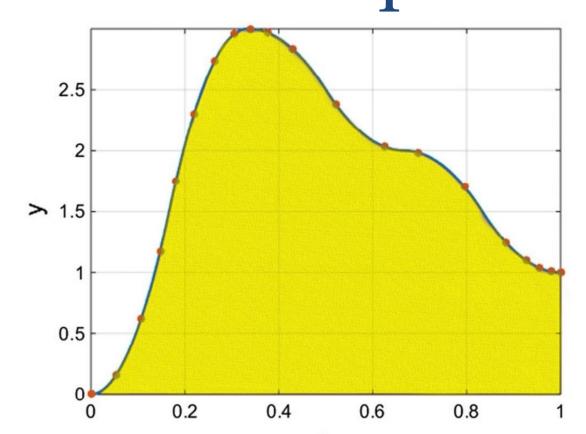
 $\Sigma \subset \mathbb{R}^3$ as:

$$r(u,v) = \begin{cases} x = x(u,v) \\ y = y(u,v) \\ z = z(u,v) \end{cases}$$

And it can be decomposed into to parts $r(u, v) = r_{form}(u, v) + r_{res}(u, v)$

 $\sum_{form} : r_{form}(u, v)$ represents the form surface and $\sum_{res} : r_{res}(u, v)$ represents the residual surface.





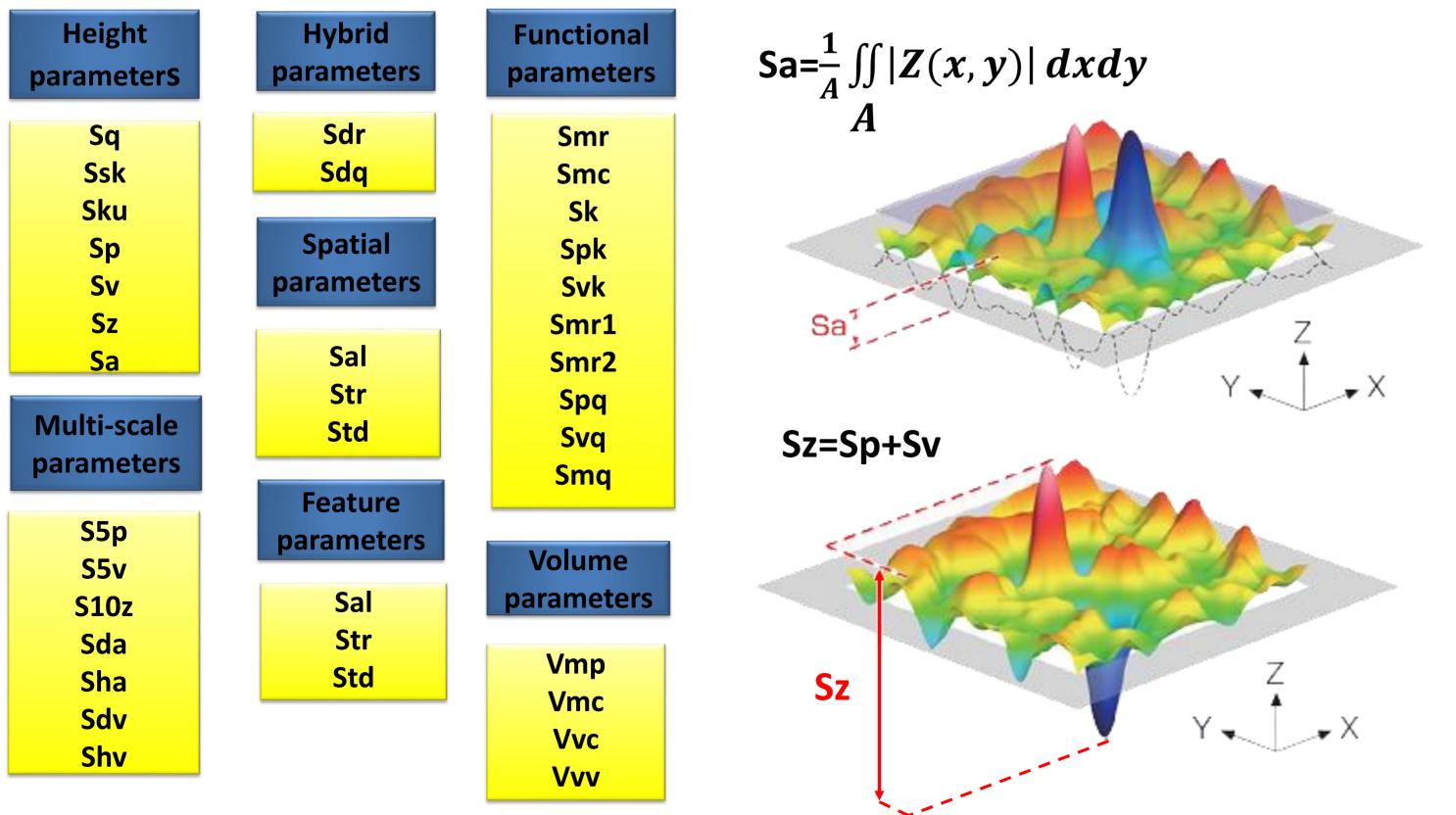
F0

Lform

P₂

Surface parameters

- Specification of areal surface parameters are given in ISO 25178-2 (see[1]) and Areal texture software measurement standards are covered in ISO 25178-71(see[2]).
- Some of these parameters are shown below:



Ra computation with discrete approximation.

t Ra computation with the proposed method.

- Computing the surface parameters with the provided algorithm is based on the primary surface without any filtration, but such algorithm could be improved which represents a challenging research, and despite that the existing software works for simple profile, it is still a major challenge when considering areal surface texture for 3D objects with complex geometries.
- The goal of this PhD project is working on 3D objects with complex geometries to:
- Generate reference algorithms for 3D pre-processing.
 Generate reference algorithms for areal surface texture characterization.
- □ Innovative reference material measures (RMMs).
- Calibration of the developed reference material measures/standards with reference to nominal specifications in terms of areal surface texture.
- The generated reference algorithms will be validated by comparing it with a reference software, this comparison will be

performed by inputting a common data set into both the software and comparing the results.

References

[1] ISO 25178-2 2012 Geometrical product specifications (GPS) - Surface texture: Areal Part 2: Terms, definitions and surface texture parameters.
[2] ISO 25178-71 2012 Geometrical product specifications (GPS) - Surface texture: Areal - Part 71: Software measurement standards.
[3] L. Pagani, Q. Qi, X. Jiang, P. J. Scott, Towards a new definition of areal surface texture parameters on freeform surface, Measurement 109 (2017) 281–291.

