

Mathematical approach to the validation of form removal software



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Abstract

Characterisation of surface texture is a critical metrological process which enables an understanding of the topographical features of a surface to facilitate greater control of functional part properties. Surface texture characterisation is comprised of three main post-processing operations: form removal, filtration and parameter calculation. Each of these steps require traceable software validation methods to ensure accurate surface texture analysis and international comparisons can be performed.

This work introduces a methodology for the calculation of mathematically-defined reference pairs for form removal software validation, for both profile and areal surfaces. Mathematical surface expressions are defined for pre-operation surfaces with form included. A mathematical total least-squares operation is performed on the surface to obtain a linear, second order polynomial or spherical fit. The formal expression for the form of the surface is subtracted from the input surface to obtain a post-form surface, which, in combination with the original surface, forms a reference pair that can be used to assess the performance of form removal software.

The reference pairs created using this new approach are mathematically traceable, and allow high-precision reference datasets to be generated that can fully assess the performance of form removal software. By moving away from reference software and adopting mathematical references, weaknesses in software can be more reliably identified, leading to more accurate surface texture characterisation.

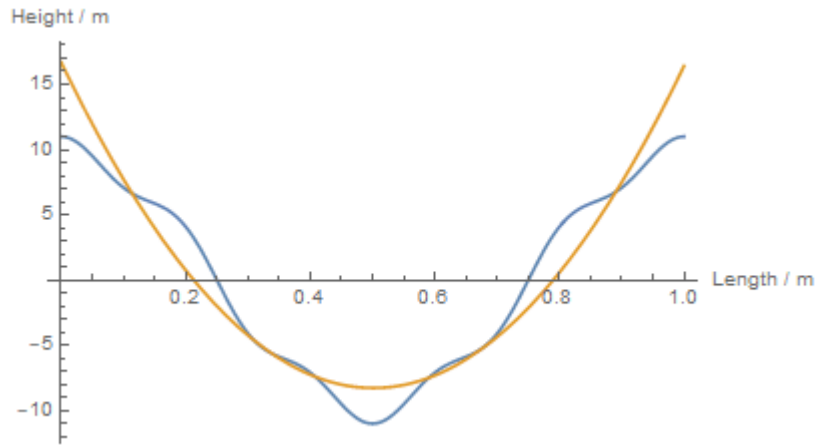


Figure 1: Mathematical total least-squares form removal using a second order polynomial. *Blue*: Original surface. *Orange*: Surface form.