Mathematical reference standards for validating software for calculating surface texture parameters

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Abstract ***(Intro)*** Surface texture parameters are widely used in the precision engineering and manufacturing industries for the characterisation of surfaces, and to enable meaningful comparison between surfaces and their functional properties [1]. Software packages used to calculate surface texture parameters require validation to ensure obtained values are in line with standardised parameter definitions. The current state of the art for validating software used for surface texture parameter calculation involves comparing the parameter values obtained by the software under test with the values obtained by a reference software package developed by a National Measurement Institute [2,3]. Previous work has shown that the algorithms implemented by such reference software packages can depend on how the standardised parameter definitions are interpreted, and consequently such packages can produce different results [4]. It follows that third-party software cannot be validated in a truly traceable manner using such an approach. ***(Methodology)*** A new method for the validation of areal surface texture parameter software is introduced that utilises a mathematical approach to provide traceable reference datasets and corresponding parameter values. Surfaces, or their related properties, are defined algebraically using a range of mathematical functions. The mathematically-defined surface can then be evaluated using a series of operations to obtain traceable, mathematical values for surface texture parameters. The derived mathematical values can then be used as traceable reference values against which third-party software values can be compared. ***(Case study)*** Functional surface texture parameters are derived from a series of five mathematically-defined material ratio curves as a showcase for the new validation method. The material ratio curves are numerically evaluated to generate corresponding discrete surface datasets for use with third-party software. The software obtained parameter values are compared with the traceable mathematical parameter values, enabling an assessment of the performance of the software. Differences between the software-obtained parameter values and mathematical values are highlighted, as shown in figure 1. ***(Dataset verification)*** An assessment of the difference between using a continuous mathematical surface or a discrete dataset is performed. A series of datasets with different numbers of points are generated and input into the parameter calculation software to assess the effect of

discretisation on the calculated functional parameter values. ***(Conclusion)*** The approach described offers a reliable way to assess the performance of surface texture parameter calculation software that is not dependent on a specific interpretation of standard parameter definition. The approach improves upon the current state of the art, comparing third-party software to reference software, by removing the dependence on specific algorithms and implementations, and moving toward a fully traceable method. The results given show working examples of mathematically-obtained parameter values, and the ways in which they can be compared to software obtained values. Future work aims to expand the range of surface texture parameters covered using this approach, and develop performance metrics for a meaningful quantitative assessment of surface texture parameter software.

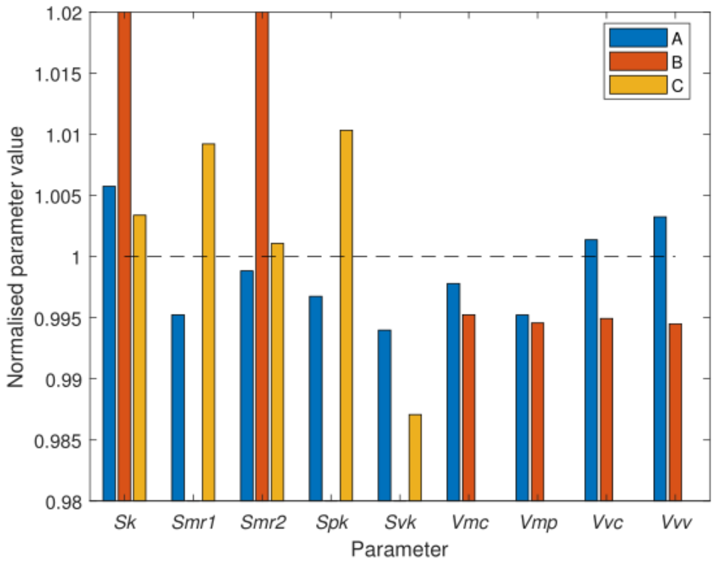

Figure 1. Comparison of functional parameter values obtained by three third-party software packages. The values have ben normalised to the mathematical parameter values.

Main References

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