An analysis of Type F2 software measurement standards for profile surface texture parameters

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Abstract

This paper reports on an in-depth analysis of ISO 5436 part 2 type F2 reference software for the calculation of profile surface texture parameters. The analysis has been performed on the input, implementation and output results of the reference software developed by the National Physical Laboratory (NPL, UK), the National Institute of Standards and Technology (NIST, USA) and Physikalisch-Technische Bundesanstalt (PTB, Germany). Surface texture parameters have been calculated for a selection of seventeen test data sets obtained from the type F1 reference data sets on offer from NPL and NIST. The results of the parameter calculations show some disagreements between the software of the national metrology institutes (NMIs). These disagreements have been investigated further, and some possible explanations are given.

Algorithm flow diagrams have been produced for each of the NMI software packages that detail the different algorithmic routes through the software and choices available to the user. These flow diagrams deliver insight into the the workings of the software, and give a visual comparison. A common route through each software package has been identified to allow for similar settings to be applied for a more relevant comparison of results.

While the results obtained by the software packages show good agreement overall, several disagreements have been highlighted. This work presents the areas of disagreement between the NMI software packages and

gives suggestions as to why such disagreements occur. Each disagreement in results is analysed and traced back to an implementation choice taken by an NMI. This choice is then linked to an alternative interpretation of a specification standard, if relevant.

An example is shown in figure 1, in which normalised parameter values obtained by NPL and PTB are shown for a square wave test file. The results show consistent overestimation by NPL for primary and roughness profile peak/valley parameters. Further investigation found this was due to NPL using a cubic spline interpolation on the data causing an 'overshooting' effect to occur around sharp steps. PTB and NIST, on the other hand, worked with the discrete data points directly. Figure 1 also shows large overestimations of some waviness parameters by PTB, which is due to another effect discussed in more detail in the paper.

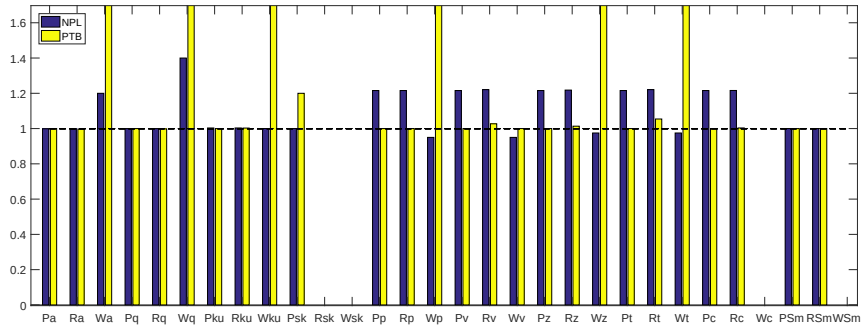

Fig. 1. Normalised parameter values obtained by NPL and PTB for the *square* test data set. The parameter values have been normalised against the NIST parameter values; all NIST parameters were normalised to unity, as indicated by the dashed horizontal line.