

# Comparison of Commercial Software Packages for Calculating Surface Texture Parameters

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## Abstract

Surface texture parameters have been used in industry to characterise surfaces since the early twentieth century but, despite the maturity of the subject, instrument comparisons still show large spreads in results. A significant contribution to these spreads is the effect of the software used to calculate the surface texture parameters. This paper presents the results of a comparison of a number of commercial software packages used to calculate surface texture parameters (profile parameters). The inputs to the software packages were reference measurement datasets and the results were compared to those obtained from reference algorithms available on the websites of NPL, PTB, and NIST.

## 1 Introduction

To address the effect of software when calculating surface profile parameters, the concept of the software measurement standard has been developed by ISO [1]. Software measurement standards, in the form of reference datasets (type F1) and reference parameter algorithms (type F2), have been separately realised by NPL [2], NIST [3], and PTB [4]. A recent comparison [5] showed that all three realisations could be used as metrological tools to calibrate the commercial software for some of the most widely used parameters. Reference [5] also reported on some issues with ISO standard documents and commercial packages, for example ambiguity in the parameter definitions.

This paper reports the results of a comparison between four commercial software packages, developed in four different countries, and the software measurement standards of NPL, PTB, and NIST.

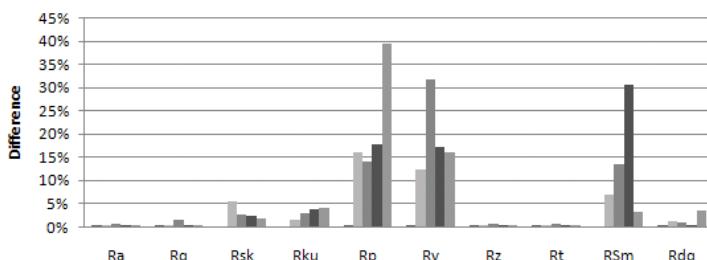
## 2 The comparison

Four commercial software packages were used in this comparison. They are named as CA, CB, CC, and CD for commercial protection. We have used two versions of CB, named as CB (v1) – the old version used in [5] – and CB (v2) – the latest commercially available version. The reference dataset includes one simulated data file and four measured data files (from EDM, milled, polished, and ground surfaces). The reference values of the simulated data file are produced analytically and the reference values of the measured data files are produced from the mean of the three reference values determined by NPL, NIST, and PTB. The measurement conditions specified in ISO 5436-2 were adhered to and are detailed in [5].

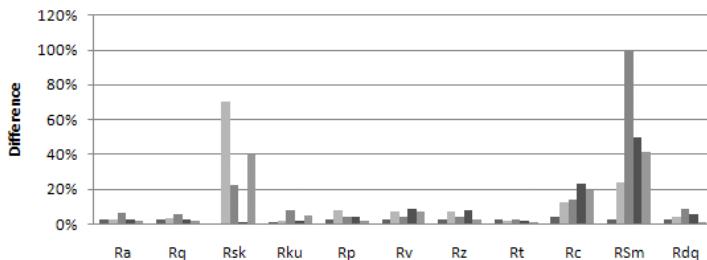
## 3 Evaluation and discussion

Figure 1 illustrates the relative differences between the results obtained from the commercial packages and the reference values.

**CA**



**CB (v1)**



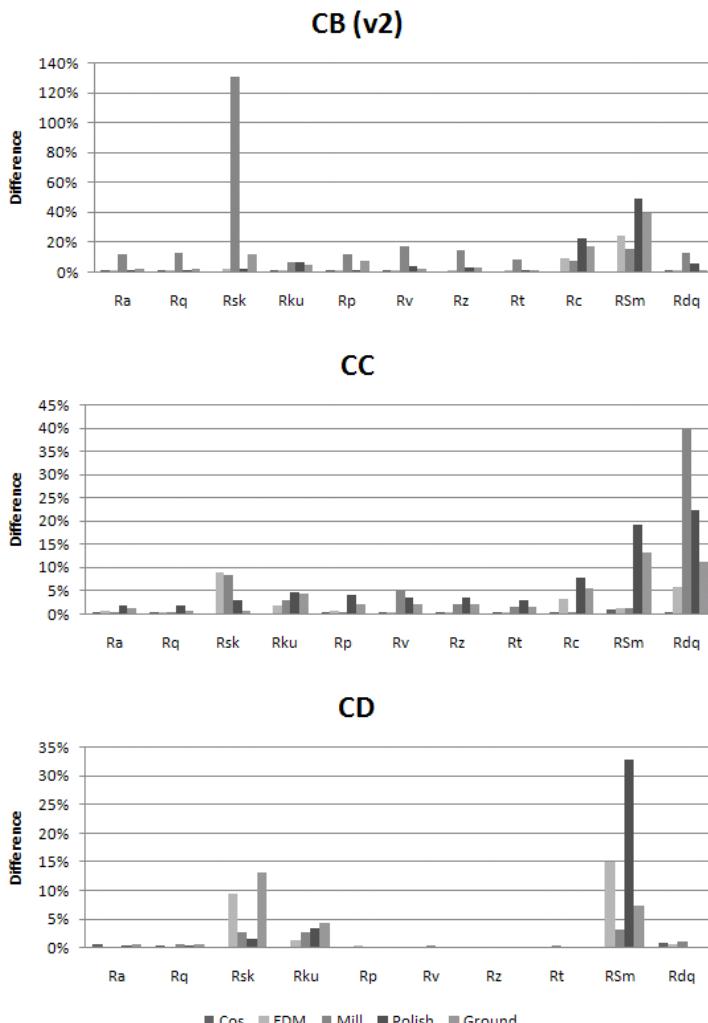


Figure 1: Results of the comparison between four commercial software packages for surface profile measurement

Table 1 presents the stability of parameters by comparing the results obtained from a simulated ground surface with itself but with the data order reversed to simulate different measurement directions.

Table 1: Percentage of relative difference between results obtained from the same software on the same profile with reversed order of data points. (Note: \* signifies that the result is not available).

	<i>Ra</i>	<i>Rq</i>	<i>Rsk</i>	<i>Rku</i>	<i>Rp</i>	<i>Rv</i>	<i>Rz</i>	<i>Rt</i>	<i>Rc</i>	<i>RSm</i>	<i>Rdq</i>
CA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*	<b>1.1</b>	0.0
CB (v1)	<b>2.1</b>	<b>2.4</b>	<b>39.4</b>	<b>2.4</b>	<b>10.9</b>	<b>3.4</b>	<b>7.1</b>	<b>0.0</b>	<b>1.4</b>	<b>4.3</b>	<b>0.5</b>
CB (v2)	<b>2.0</b>	<b>2.9</b>	<b>108.1</b>	<b>3.0</b>	<b>15.8</b>	<b>5.2</b>	<b>4.2</b>	<b>0.0</b>	<b>1.1</b>	<b>1.2</b>	<b>1.6</b>
CC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.6</b>	<b>0.6</b>	0.0
CD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*	<b>0.9</b>	0.0

#### 4 Conclusions

In general the results for *R*-parameters obtained from the four commercial software packages show significant disagreement. Two major reasons for these disagreements are: 1) the ambiguous and unstable definitions given within ISO standards, for example the definition of *RSm* in ISO 5436-1 [6]; and 2) unstable software implementations, for example CB (v1) and CB (v2). This comparison highlights the need to verify surface texture software using software measurement standards. Also, when carrying out comparisons of surface texture measuring instruments, it would make sense to use the same software package to filter the data and to calculate all parameters.

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