Paper 39 Proceedings of 8th International Engineering Symposium at Bánki [PDF] (ISBN: 978-615-5460-95-1), 2016

The effect of the sampling distance of the roughness parameters in a case of abrasive worn microtopographies

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Abstract. In a case of topographic measurements the proper selection of the sample distance reduces the measurement time. This parameter is not defined in standards when abrasive worn surfaces will be evaluated. In this article the authors make a recommendation which is assessed using a properly in a case of the roughness measurements of worn abrasive surface topography.

Keywords: sample distance; roughness parameters; wear;

1 Introduction

The profile roughness measuring technology in a case of machined parts has been well regulated by the standards. These roughness features has been changed during the life of the product on account of tribological processes. These processes can be recognised and classified by the wear marks which have been described by SEM technology. On the other hand these changes can be specified by roughness measuring system. Sukumaran et al [1] accurate their work the importance of the online and offline measuring systems and use profile parameters and high speed imaging process to determine the tribology system in a case of plastic and steel pairs. Luc et al [2] demonstrates a new evaluation technology to characterise a hot rolled topography representatively. Hongtao et al [3] simulate the sliding wear and the topography modification with the help of test result and the identified the wear marks from the topography modifications. Westlund [4] measurements prove to the optimal sample distance help the researchers to characterise a nano- and microtopography, and after that the material transfer too.

According to the literature we can see to researchers prefer the image based data for the worn surface. These data can be solved by two ways: for image processing or topography measuring. The using of the second solution can takes more time, but for this technology able to give more information for the further calculations. These data represent the surface quality depending a measuring resolution (sample distance and the measured area).

In this article the authors presents a special investigation where the roughness parameters can be solved for the simulated topography. The base of this simulation can be determined for the measurement data and the sample distance.

2 Experimental

For the calculation abrasive worn microtopography was used. The C45 steel topography was destroyed in pin-on-plate arrangement with 600N force and 4200 mm sliding distance. The contact surface was 30 mmx30mm, and the abrasion paper fineness was 1200. Lubrication wasn't used. The topography (Figure 1.a) was measured by Mahr stylus instrument (Sa=0.5918 µm, Sq=0.7787 µm, Ssk=-1.3619, Sku=4.0915).

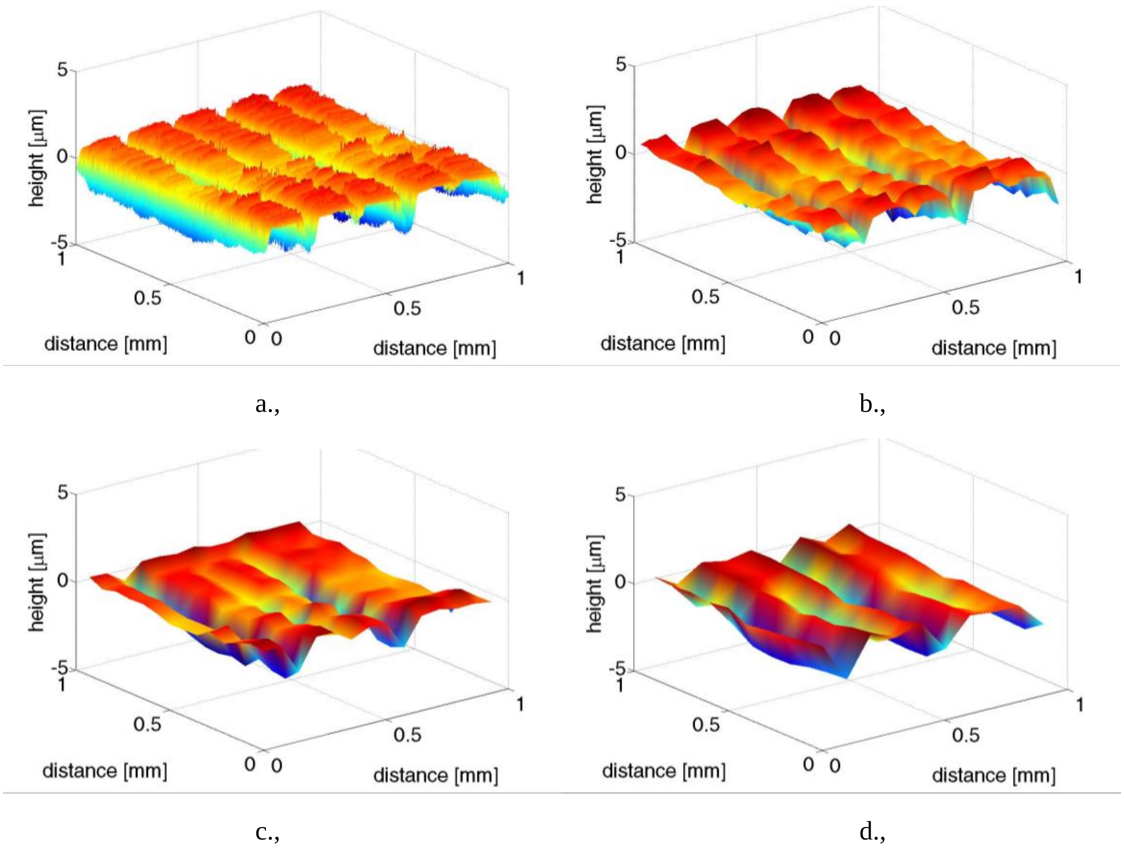


Fig. 1. Use 'The original (a) and the simulated microtopography with 34 micron (b), 68 micron (c) and 100 micron (d) sample distance.

This measured microtopography was modified with the help of the sample distance. The original distance was 2 micron, and the simulated microtopography sample distance was increased between 4 micron and 100 micron by 2 micron steps. The initial stage of the measurement was modified by using all of the missed points in both direction. Some of the simulated microtopography can be shows in Fig 1 b., c., and d.,.

The simulation was evaluated by topography parameters named average roughness, root mean square roughness, skewness and kurtosis. Filter not used.

The values of theses parameters depends on the number of the points and the point height coordinate.

3 Results

The result of the percentagle modification of the average roughness values compared to the 2 micron smaple distance can be shown in Fig 2.

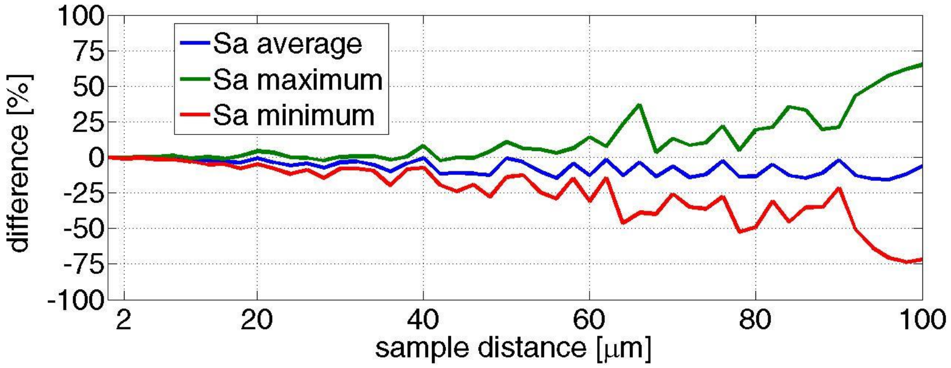
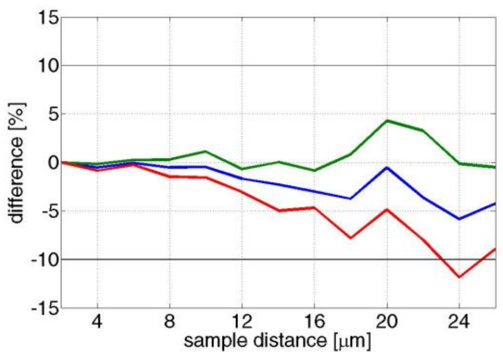
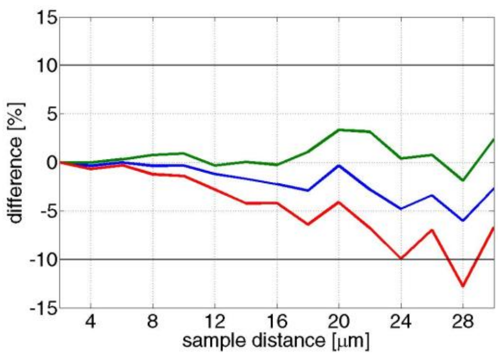


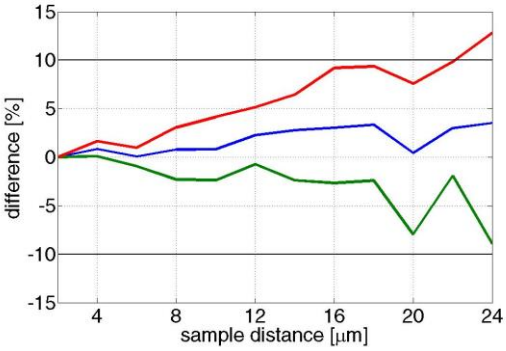
Fig. 2. The minimum, maximum and average Sa values in a function of sample distance



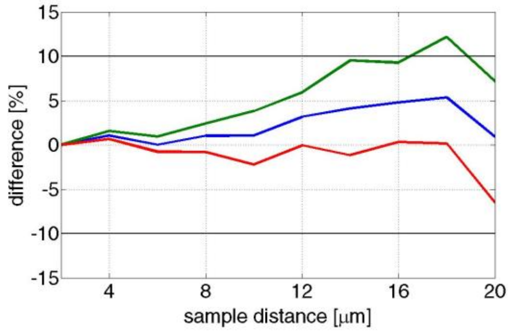
a.,



b.,



c.,



d.,

Fig. 3. The minimum, maximum and average Sa (a) Sq (b) Ssk (c) and Sku (d) values in a function of sample distance

As Fig 2. shows the average value of this parameter characterise exactly the topography, but the minimum and the maximum curve indicate up to 50% difference. Fig 3 demonstrate the sample distance for ±10% difference.

4 Conclusions

As the result shows the roughness measuring time can be optimised with the help of the optimal sample distance. According to the result an algorithm made which can be calculate the optimal measure parameters in a function acceptable accuracy. This algorithm can be used other types worn or machined topographies too.

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