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MEASURING OF SURFACE STRUCTURE AND THEIR ANALYSIS

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ABSTRACT
The article describes analyze of surface texture by 2D and 3D systems. The surface was evaluated by standard 2D profilometer which provides surface roughness measurement on one profile and 3D profilometer which measures surface area. Evaluation of surface was provided by chosen parameters which describe roughness profile and roughness surface. I was performed their comparing and estimation, for their next development in the research and production praxis.
Keywords: surface analysis, 2D surface profile, 3D surface topography, surface structure

1. INTRODUCTION
Surface texture has a decisive influence on the performance features and behaviour of component and together with the surface layer properties is crucial for the useful life and functional reliability. Evaluation of surface texture getting on technical requests of developed manufacturing. Surface texture was evaluated 3D profiling analysis which gives new parameters of surface. These parameters could be useful for evaluation of functional properties. The results of 3D measuring describe more objectively surface texture. We can describe and evaluate defects on the surface of work piece and predict relations between surface texture and his functional properties.

2. SPACE PARAMETERS OF SURFACE PROFILE
Figure 1 shows problem of space measurement and evaluation of surface.
The cutting operation is technological process, at which comes up a new surface by separation elements of material in form of chips. Cutting is process of plastic deformation whose process is influenced by features of cutting material and conditions behind which is proceeds.
From this point of view are information from 3D surface topography measurement very useful at sighting state and cutting conditions of machine tools.3D analysis, are important at adjust mutual intercourse of surfaces. From surface profile we can obtain detail local information, which are crucial to behaviour intercourses surfaces.

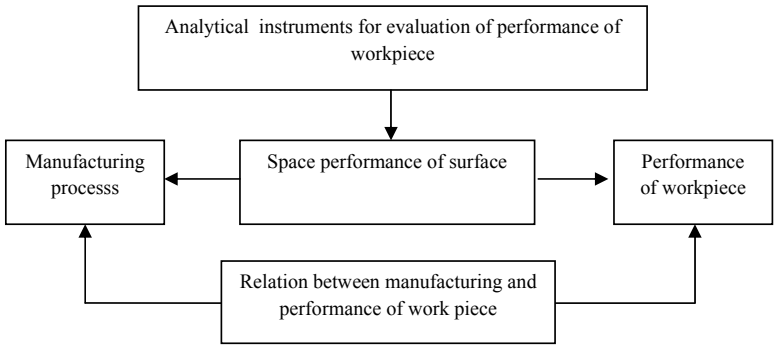

Figure 1. Diagram of relations between surface, his performance and measurements of its characteristics

Defined parameters of evaluation surface texture have this specify:

- Areal – 2D – evaluation parameters of profile – (average arithmetical deviation of profile R_a)
- Space – 3D – evaluation parameters of profile – (average arithmetical deviation of area Sa)

3. MEASUREMENT AND EVALUATION ROUGHNESS AREA AND PROFILE OF SURFACE

In this article is solved problem of 2D and 3D evaluation surface roughness by available instruments for evaluation surfaces.

3D area was measured absolute methodin instrument Talysurf CLI 1000. Measurement of surface roughness (3D) was realized on the area 4,5 x 2,5 mm by inductive gauge ranging 522µm in axis Z and resolution 8,1 nm, with step 0,5µm.

2D measurement of surface roughness was realized in instrument Surtronic 3+. Measurement of roughness profile (2D) was realized on length 4,0 mm by inductive gauges with similar parameters of resolution.

Measurement was realised on blades of turbine engine on three areas:

1. Lock of blade
2. Profile of blade
3. Banding of blade

Data evaluation of roughness parameters was performed by program *Talymap Platinum (3D)* or *Talyprofile Platinum (2D)* according to standards:

1. Tilt correction
2. Magnification
3. Profile shape correction
4. Assessment of sensitivity threshold
5. Filtration between unfiltered area or profile
6. Display 3D or 2D profile
7. Values computation

Surfaces was evaluated by whole row parameters according to (1) and (2), in the article are introduced just this parameters

Sa – roughness average
Ra – arithmetical mean deviation of the assessed roughness profile

Measurement of R_a parameter was provided in the same area, minimal three cuts was measured side by side with span about 0,5 mm and was defined the arithmetic mean and standard deviation.

Parameter Sa was measured on area just on time. Because measurement takes around tens of minutes, and volume of gain data is very difficult to evaluate.

Results are shown in these graphs.

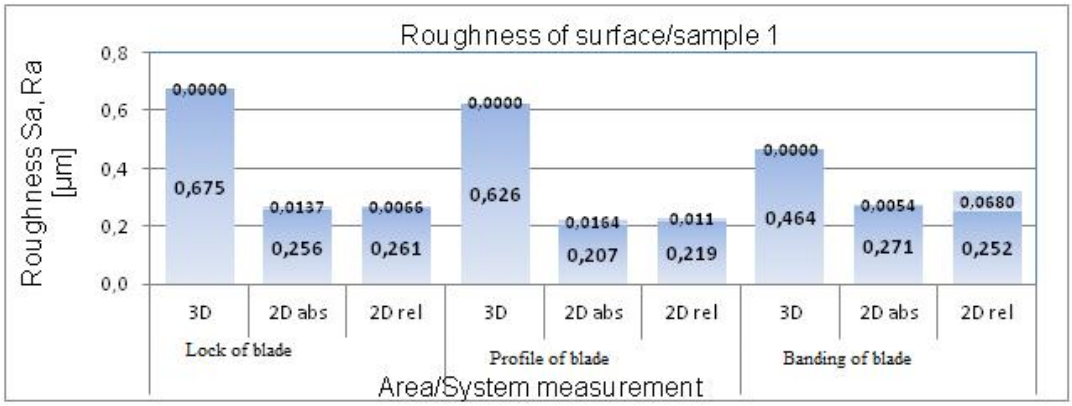

Figure 2. Roughness area Sa a surface Ra of sample 1

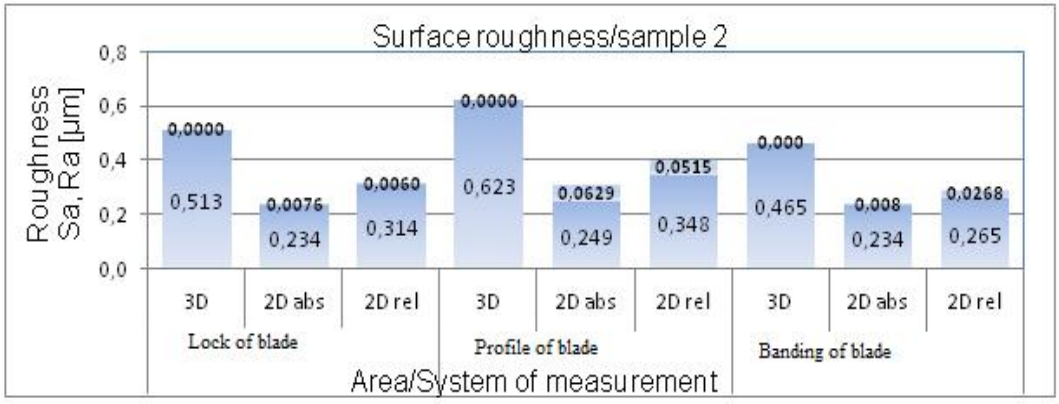

Figure 3. Roughness of area Sa and surface Ra of sample 2

Comparing parameters 2D roughness from profiles measured absolutely and relatively are shown that parameters are comparable; parameters measured absolutely have lesser values than parameters measured relatively except in banding area of blade on the sample 1.
Parameters which was measured relatively should be theoretically reach lesser values, because during measurement is applied mechanical filtration by stretcher sensor. Because values are higher it can be suppose that mechanical filtration contribute to higher parameters of surface roughness.
All areas have parameters Sa higher value than parameters of Ra measured absolutely or relatively.

Current instruments allow measure area by absolute method with spacing from 0,5µm and that respond 5000 number of cuts. In this number of particular profiles we could find surely profiles with higher peaks and lower valley, which cause higher value of parameter Sa.

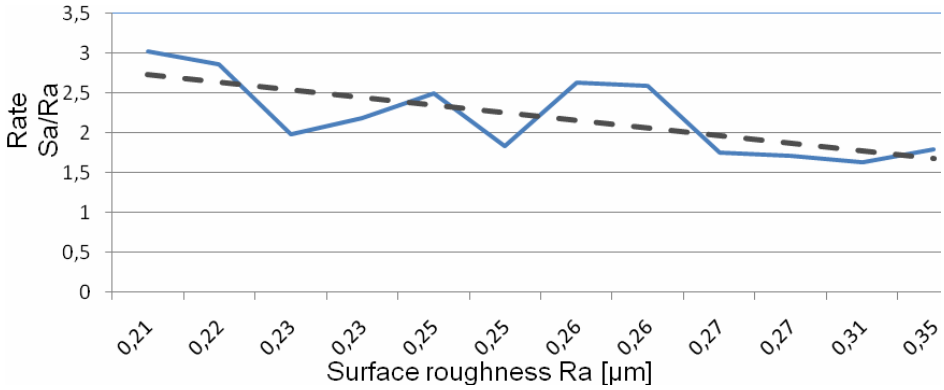

Figure 4. Rate Sa/Ra regarding to parameter Ra

The results are shown in Figure 2 and 3. Relation between surface roughness and profile, but for practical use is better display rate Sa/Ra shown in Figure 4. There is documented dependence between particularly parameters, which can be practically express in this relationship

$$Sa = (1{,}63 \div 3{,}02)\ Ra.$$

This equation allows count values of Ra to Sa and back to. In both of causes is applied, that lesser values in coefficient of recount applies to higher values surface roughness and higher value of coefficient is applied for lesser roughness of surface Ra.

4. CONCLUSIONS

We can generally suppose that parameters of area will reach higher values, than other similar parameters gained from profile. Information obtained from 3D topography spread possibilities of analytical view surfaces as a function area. This article is just start up phase in next research in this area.

5. ACKNOWLEDGMENT

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6. REFERENCES

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