



Laboratory and portable contact roughness measurement

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Article describes experiences with contact measurement of surface roughness by two instruments, laboratory and portable. Some characteristics are common to both instruments and some embody differences.

Keywords: roughness, measurement.

1 Introduction

Resulting quality of surface is important for evaluation cutting experiments. Special single - purpose measuring device "stylus instrument" that make possible scan profile by measuring surface be in use to measuring surface texture. Scanned data can evaluate either directly by instrument, which bears only limit possibilities or by connected computer that makes possible to obtain data from measuring instrument and their processing by special software.

We have two possibilities of measurement of surface texture on the Department of Machining and Assembly in Technical University of Liberec – portable mobile instrument Hommel Tester T500 and laboratory instrument Mitutoyo Surfptest SV-2000. Both instruments operate on contact method principle and choose instrument to get required results isn't easy. Each of possibility bears advantages and disadvantages.

2 Instruments

2.1 Mitutoyo Surfptest SV-2000

Main parts of equipment are granite board with stand that makes possible to upright movement of instrument at intervals 300 mm, instrument SV- 2000 that moves horizontally by stylus at intervals 50 mm and evaluation apparatus that transfers signal and edits it for PC needs. Basic accessories of Mitutoyo Surfptest SV-2000 are standard stylus No. 12AAB403 (range 5 μ m, vertical angle 90°), standard nosepiece No. 12AAC753 for this type of stylus, detector No.178 397- 2 for this type of stylus, surface roughness etalon No.178-601A (Ra = 3,05 μ m, Rmax = 9,9 μ m), software Surfpack that control whole measuring process and evaluates result of measurement by three norms (ISO, DIN and JIS). Equipment contains also other flaring accessories (styluses and nosepieces) for measurement of grooves, holes, gears and blade, because by the help of basic accessories is possible to measure only easy accessible surfaces.

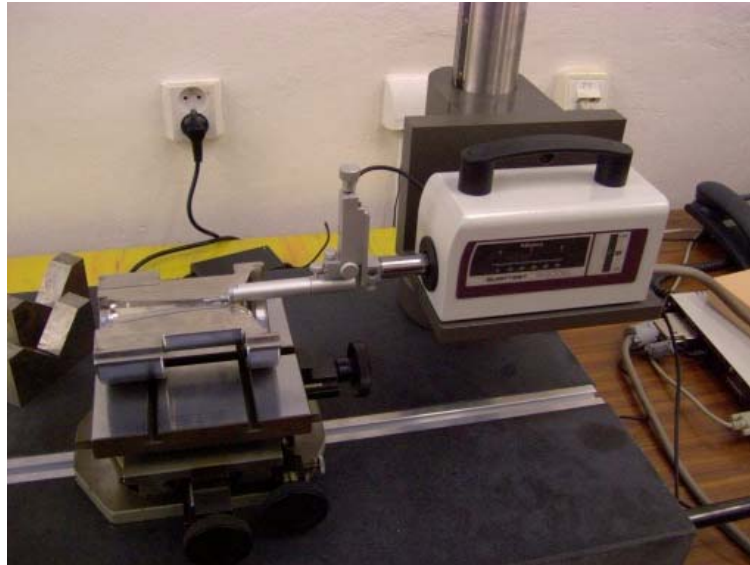


Fig. 1 Mitutoyo SurfTest SV-2000

2.2 Hommel Tester T500

Main part of equipment is instrument T500. Basic accessories of Hommel Tester T500 is standard stylus T5E (range $5\mu\text{m}$, vertical angle 90°). Evaluation of results of measurement is possible by norms ISO, DIN and JIS.

Another accessories are stand for upright movement and software for more detailed data processing.

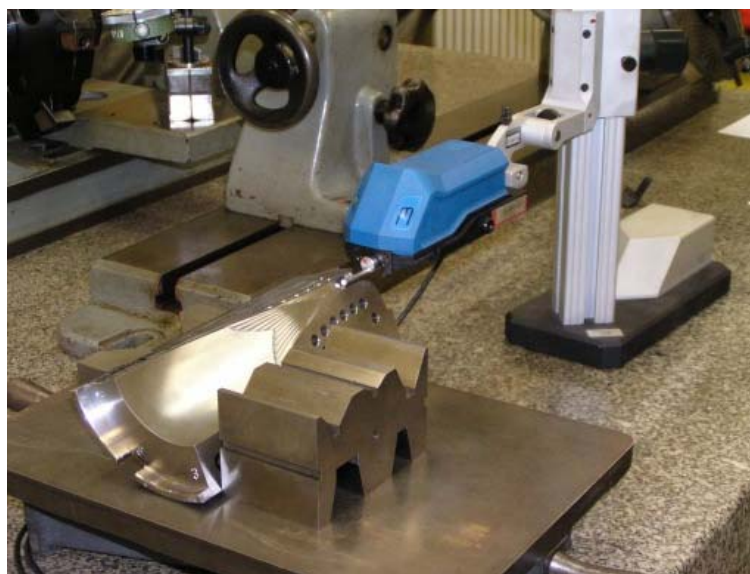


Fig. 2 Hommel Tester T500

3 Methodology

Surface texture is necessary to measure perpendicularly to direction of unevenness, because otherwise happens to distortion of view of surface that look better, than really is. This is possible apply with parts made by chip-forming process (turning, milling, drilling, grinding, planing...), where tool creates on finish surface scratches and direction of these scratches is visible. If part is made e.g. by casting or mounting and tool take effect on finish surface by different way, direction of scratches are not strictly visible, direction of scan can be random, but this direction is necessary to change during measurement.

Surface of part have to balance before measurement of surface texture by stylus instrument, to no happen bevel of profile curve and distortion of this measurement, because of don't moving stylus perpendicularly to finished surface. This process isn't simple, because we balance at intervals of several micrometers very often. Next obvious procedure is cleaning and grease removal of part.

Instrument Mitutoyo is designed in such a way that the only possible way of its run is by the help of connected PC with mentioned software. Software makes possible to run stylus only in case that everything is really ready to measure.

Hommel offers „ more" in this respect, because it is able to work without connected PC and it can run separately just by button on instrument. Hommel Tester is portable instrument and its use in operating conditions without PC is of course necessary.

Contact method means immediate contact with measured part. It bears advantages and disadvantages. Advantage is ability of stylus to shift aside small remains of dirt at imperfect clearing of part and prevention of influence of this dirt to results of measurement. Contact indeed means also interference of measured surface as grooves in scanning direction.

4 Measurement of Surface Texture

How results from previous, during cutting, as main activity of Department of Machining and Assembly, rise distinct trace after tool on surface of parts. There is necessary to move of stylus perpendicularly to direction of these trace. If we use Hommel, we can measure directly on machine, but workplace mostly don't make possible to use stand for better positioning of stylus and we have to use nosepiece for measurement of shafts.

If we shall want to examine surface more detailed, we will use instrument Mitutoyo. For this instrument is necessary take out part from machine and measure it in workspace of instrument. We obtain extensive data file that is possible to process directly by intended software or export data to *.csv file and process it externally.

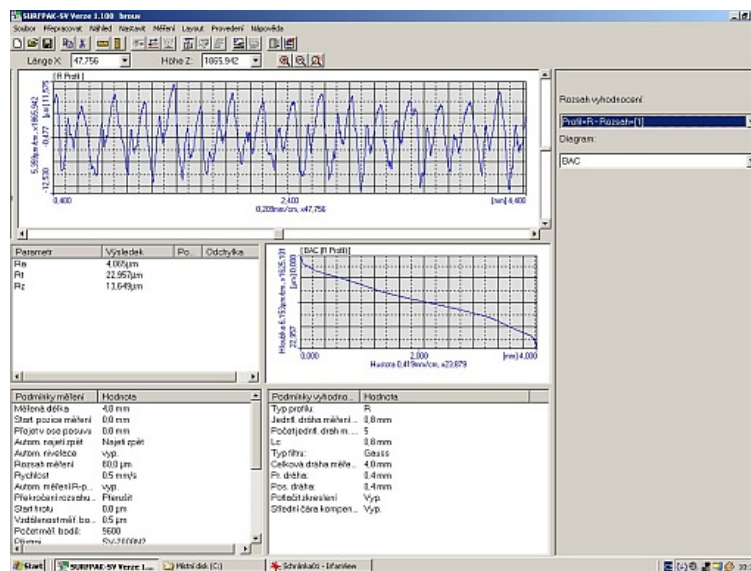


Fig. 3 Surfpak screen

Mitutoyo have got big apply at measurement of thickness of spotting layers just thanks to possibility to export data to *.csv file. Hommel makes possible to measure spotting layers too, but only with limit possibility of export. DOS software make possible to draw P-profile that we can print and measure thickness just on paper by set-square. This operation is no accepted nowadays and thanks to instrument Mitutoyo we already don't need to do

it. Exported data (x-line and z-line) we can further process by the help of software MathCad or Excel.

Depths of scratches are possible to measure in same way like thickness of spotting layers. Stylus moves perpendicularly to direction of creation of scratch during measurement. Further is required to choose correct length of scan, because of good drawing, because surroundings of scratch used to be influenced by its creation. Material on edge that was „lift up” during creation of scratch and increases position of basic surface. There is necessary to get position of stylus behind these places for correct results. If is scratch slim and interference of surroundings is biggish, contact measurement is in danger, because stylus doesn't need to get into scratch.

5 Conclusion

Mitutoyo SurfTest SV- 2000 makes possible evaluation a lot of parameters of roughness according to ISO, DIN and JIS norms by help of software SurfPak. Further we can display profile in different settings and views by help of select diagram. Big advantage of this software is possibility to export coordinates of points in *.csv format that is possible to process by another software. Thanks to extensive accessories we can evaluate structure of different surfaces. Everything is possible just in workplace of instrument. Some kind of portability instrument makes possible, but start it without connected computer is impossible.

Hommel Tester T500 thanks to its portability and thanks to batteries also electrical independence makes possible to measure surface almost anywhere. Basic measurement by independent instrument can evaluate only three basic parameters of surface roughness according to ISO, DIN and JIS norms. We can also display profile of surface roughness and share of material, but just with PC support. Hommel Tester is suitable for most experiments on departmental laboratories, because values Ra, Rz and Rt are sufficient for basic results.

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6 Literature

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