Fachbereich 04
Produktionstechnik

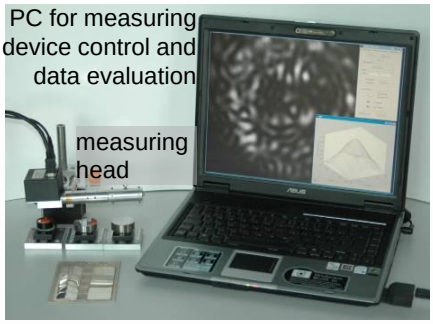
Fachgebiet 08
Messtechnik, Automatisierung und Qualitätswissenschaft

BIMAQ

Bachelor / Master Thesis

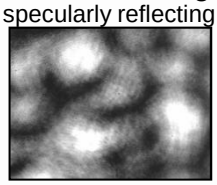
Laser optical surface measurement – expansion of the measuring process model

Optical measuring system

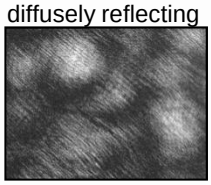


Scattered light speckle patterns of different rough surfaces

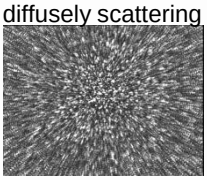
specularly reflecting



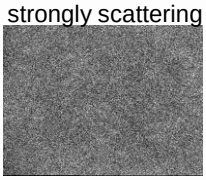
diffusely reflecting



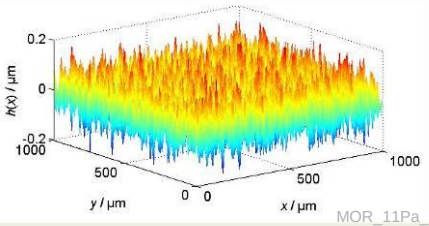
diffusely scattering



strongly scattering



Microtopography characterization



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Scattered light surface measuring devices characterize roughness of technical parts area-measured, fast and contactless. They are eligible for measurements in running production processes. Modeling of the scattered light measuring process based on raytracing methods and on Kirchhoff's diffraction theory allows to calculate scattered light intensity distributions, i.e. speckle patterns. However, the conformity of calculated and measured speckle patterns is still not investigated.

The thesis targets the measurement and calculation of scattered light patterns of real surfaces and, finally, the assessment of the measuring process model based on the comparison of measurement and simulation results. This is only possible in connection with modern computers. Spatially high resolution measurements produce a large amount of data and require a lot of memory capacities and high processing power.

The task is to expand the scattered light measuring process model by measuring parameters, which specify the illumination laser beam (e.g., beam intensity profile, wave front geometry, illumination spot geometry). Large areas of real surfaces with different topography characteristics (roughness, lateral correlation length) have to be measured with a white light interferometer (stitching mode). The resulting topography data is the basis for the measuring process simulation. Appropriate illumination and simulation parameters should result in similar measured and calculated speckle patterns. The accordance of both will be validated for example by correlation or subtraction methods.

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