

Fast and cheap prototyping of non-standard optical components for sensing speckle dynamics - DTU Orbit (09/11/2017)

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As a part of the work carried out a project supported by the Danish council for technology and innovation, we have investigated the option of smoothening standard CNC machined surfaces. In the process of constructing optical prototypes, involving custom-designed optics, the development price and time can become a prohibitively large part of a research budget. Machining the optical surfaces of a molding tool may be done directly using diamond turning, but it is expensive and time consuming. Alternatively, a more standardized and cheaper machining method can be used, however, calling for manual polishing afterwards. Particularly, this last process is expensive as well, and will introduce an uncertainty in precisely how much material the polishing process will remove, introducing roughness on a larger lateral scale, such as waviness. Therefore, we have investigated the possibilities of smoothening surfaces of various shapes succeeding a standard CNC machining process. Different coatings have been tested for their abilities to fill and smoothen out structures of larger scales, while removing the small-scale roughness, which is critical for optical uses. In this work we will present an optical element, designed for optical spatial filtering velocimetry. The spatial filter is the key component in an optical sensor for non-contact measurement of surface vibrations, based on speckle dynamics. The optical element is casted in silicon. The results of smoothing an optical element will be demonstrated, and the sensor will be demonstrated for real-time measurements.

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