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Challenges of high slopes and complex features in the metrology of structured and freeform surfaces

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Abstract

Many modern products require surfaces with highly complex surface topographies, often involving high slope angles, a mix of random and deterministic texture and freeform underlying geometries (see Fig. 1). In this presentation, we will show a range of recent developments that allow such complex features to be measured and highlight some remaining issues for the research community. We will also discuss work being carried out in ISO technical committee 213 working group 16 to establish a calibration framework for surface topography measuring instruments. One of the more challenging characteristics to evaluate is what is being referred to in ISO draft documents as "topographical measurement fidelity", currently defined as the closeness of agreement between a measured topography and the "true" topography of the surface. This characteristic captures those deviations and uncertainty contributions that are often encountered when measuring complex topography and that are not considered when determining measurement scales, linearity, flatness deviation, noise and other characteristics for which there are well-known calibration techniques. We will present some recent results that show how topographic measurement fidelity can be addressed using more traditional metrology practices and, looking to the future, using more rigorous modelling in order to better approach the "true" surface by optical measurements, and estimate the remaining uncertainties.

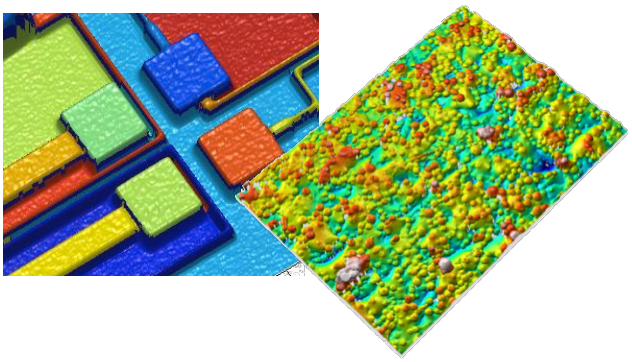

Figure 1: Example surfaces, showing some typical surface features on modern products