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Scale issue in length metrology

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In the paper the issue of scale in length metrology was presented. The meaning of the term 'scale' ralates to frequency characteristics of signal obtained from topography data. Considering that, one can have small scale or large one, including all the band pass effects as well. For this in surface topography measurements standards [1] there is S-filter, which removes small scale lateral components from the surface resulting in the primary surface and L-filter, which removes large scale lateral components from the primary surface or S-F surface. In such an approach, all the 3D topography parameters are calculated for a scale-limited surface, which in the simpliest meaning can be a S-F surface or a S-L surface. Any field parameter is than defined from all the points, but only on a scale-limited surface. The scale is concerned with length, so a length scale of observation would be a length scale at which the calculations for volume-scale or relative area functions are made and crossover scale is a length scale of observation at which there is a change in the slope of relative area or volume-scale functions. To distinguish relativity of scale a smooth-rough crossover scale which is a first crossover scale encountered going from relatively larger scales where the surface appears to be smooth to finer scales where the surface appears to be rough is defined.

This kind of decomposition can be applied not only for a simple distinguishing of frequencies and not only for surface topography. Form large scale metrology scale issue can be used for comparison of maximum permissible errors and performance. For mezo scale this can be combined with surface metrology. And for the finest scale (micro) this technique is the most essential, also for analyzing performance when slope measurements are concerned or e.g replica materials are compared [2].

The most common techniques to decompose signals are Gaussian Filtering (GF) or other types of filtering, Discrete Wavelet Transform (DWT) and Discrete Modal Decomposition (DMD) [3]. Still, the easiest way is applying filters, e.g. Robust Gaussian, Daubechies or Modal. For this also cut-off lengths (i.e. the wavelengths from which the filter starts filtering) can be used in order to follow a geometric progression. For the band-pass filter, only the first-cut-off length of the filter is indicated and the bandwidth can be found by subtracting equal this value to the next larger cut-off length [4].

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