Unedited comments received for OP1.005 May 2014 version

How to Handle Regions of No Data: Masking and Data Dropouts
All the analysis assumes a rectangular array.
What is missing is how to handle data dropouts, and non-rectangular ROI.
In interferometry (i.e. large aperture) the apertures are mostly circular.
So how do we handle a Fourier transform and be in compliance?

Undefined Term
On page 9
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The definition of the term fmin is missing. We can think a several ways to define it, so a definition is needed.

5.6.3 root mean square (rms) height, band-limited

$$Rq\left[f_{lo}, f_{hi}\right]$$

Band-limited rms height values can be computed in an ROI from a PSD_Z function in frequency space by:

$$Rq\left[f_{lo}, f_{hi}\right] = \sqrt{f_{\min} \sum_{f=f_{lo}}^{f_{hi}} PSD_Z(f)}$$

where $f_{\min}$ is the fundamental frequency in the ROI and the bandwidth is denoted as in 5.4.5 by $[f_{lo}, f_{hi}]$. The equivalent expression in coordinate space for a frequency-filtered height profile is:

$$Rq\left[f_{lo}, f_{hi}\right] = \frac{1}{N}\sqrt{\sum_{i=1}^{N} Z_i^2\left[f_{lo}, f_{hi}\right]}$$

NOTE: The conventional notation for rms height used here, Rq, is as defined in ASME B46.1.

Annex C, Standard Profile Data Set is an excellent tool.
But data set is for a linear profile only.
Do you have an area profile data set, with results?
It does not have to be official just a data set with results that we can test some software against.

Terminology:

- Perhaps a small and unchangeable thing, but the document relates exclusively to FT methods (as noted in the intro), whereas the title is very general (Statistical Evaluation of Optical Surfaces). In the best of all possible worlds, the title would be more descriptive of this limited scope.

- Terminology: “areal” in this document implicitly refers to 3D data, but this is not obvious or explicit. “Areal” could apply to x,y data of any kind, including image information. In 25178, we use “areal topography” or “areal texture” to make this clear. Note that the “texture” as opposed to the more general term “topography” is, in my view, an accident of the history of these documents. 25178 includes characterization of all 3D parameters.

“Firstly, I am encouraged to see that this committee is right-off-the-bat acknowledging that data these days is made of pixels and contains holes. That is already a huge step.

I would like to encourage the committee to keep this issue of holes in mind throughout the document. The guidance in Annex A, section 8.2 (i.e. avoid including holes in your ROI), is good to have. However, unfortunately, users of metrology software like Zygo’s are used to processing holes in PSDs, and it would be convenient for makers of metrology software like Zygo if the avoid-holes guidance were either made mandatory, or if the committee would provide a standard “good enough” method to perform their fallback advice of “interpolated over the bad points”. Otherwise, our users are going to force us to dwell in the all-bets-are-off domain, but nonetheless expect their results to behave according to this nice, clean standard, which will cause us endless headaches.

In section 5.4.10, they refer to “a windowed, detrended, and sampled profile $\overline{U}(n)$”, but do not mention (outside of the diagram in Annex A, section 8.3) that the order of these operations matters a great deal, and that the best order is “sample, detrend, window”.

In section 5.4.10, $\overline{U}(n)$ is referred to as having been windowed already, but in the displayed equation they are applying a window to $\overline{U}(n)$. I’m guessing they don’t mean to say that the data should be windowed twice.

In section 5.4.10, in the definition of the “bookkeeping factor” $K(p)$, in the case where N is even, $K(p)$ is undefined when $p = N/2$. I think that the language reading “$p \in \left\{2 \ldots \frac{N}{2} - 1\right\}$” should read “$p \in \left\{2 \ldots \frac{N}{2}\right\}$”.

In section 5.6.1, band-pass filters are defined using a factor of 0 to eliminate frequencies outside the band, and a factor of 1 to preserve frequencies within the band. Annex A section 8.6.1 specifies that cutoff frequencies shall be chosen from the discrete set of frequency bins in the DFT data, but this remains problematic for the following reasons:

- This restriction is not going to fly in the marketplace.
- Jitter occurs when e.g. a cutoff is generated programmatically and happens to lie right between two allowed frequencies, so that it jumps from one to the other for different trials.
- 2D case Using two numbers to specify the frequency band doesn't make much sense, because the X and Y spacing in the frequency domain are in general not going to be equal, and so there is no single array of frequency values from which to choose. The user could choose from four numbers, specifying a rectangle in the frequency domain, but this is almost certainly not going to be the desirable way to choose a "band. Instead, the user is going to want to choose elliptical bands that are limited by the magnitude of the 2D frequency domain vector (see EUR 15178 secionts 10.5, 10.6, 10.8). And these curved edges introduce a significant amount of numerical uncertainty, since almost certainly some of those edge pixels will wink between 0 and 1 depending on who writes the software. And the user is almost certainly not going to want a jagged-edge elliptical band.

And there is a simple patch: If a given cutoff frequency lies between two indices in 1D, or lies on the edge of the elliptical band in 2D, set the weight of that "edge-bin" to a fraction between 0 and 1 corresponding to the fraction of the bin that is included in the band. This continues the behavior of the filter over all frequencies, and solves all the above problems in 1D and 2D."