

Draft Minutes
 ASC OP1 ASC OP/SC 1, BSR/OEOSC-OP1.002, Optics and Electro-Optical Instruments – Optical Elements and
 Assemblies — Wavefront Standard
 Sunday, June 25, 2006, 1:30 p.m. — 6:00 p.m.
 Research Electro-Optics, Inc. 5505 Airport Blvd, Boulder, CO 80301

Attending

<input checked="" type="checkbox"/>	Committee Members (8 of 12)	Representing
<input checked="" type="checkbox"/>	David Aikens	Zygo Corporation.
<input checked="" type="checkbox"/>	Gordon Boulthbee	JDSU
<input checked="" type="checkbox"/>	Benjamin Catching (Alternate)	JDSU
<input checked="" type="checkbox"/>	Walter Czajkowski	APOMA (Edmund Optics)
<input checked="" type="checkbox"/>	Marla Dowell	IEEE/LEOS (NIST)
<input type="checkbox"/>	Andrei Brunfeld	Xyratex
<input checked="" type="checkbox"/>	Lincoln Endelman	SPIE
<input type="checkbox"/>	John M. Hamilton	Northrop Grumman Corporation
<input type="checkbox"/>	Hal Johnson	Harold Johnson Optical Lab
<input type="checkbox"/>	Michael Morrill	Lockheed Martin Space Systems Co.
<input checked="" type="checkbox"/>	Trey Turner	Research Electro-Optics, Inc.
<input checked="" type="checkbox"/>	Steven VanKerkhove	Corning Tropel
Observers (4)		
<input checked="" type="checkbox"/>	Lahsen Assoufid	Argonne National Laboratory
<input checked="" type="checkbox"/>	Gene Kohlenberg	OEOSC
<input checked="" type="checkbox"/>	Peter Z. Takacs	Brookhaven National Lab
<input checked="" type="checkbox"/>	Michael McBurney	Lawrence Livermore National Laboratory

Auditor's Summary of Meeting

Michael McBurney from the Lawrence Livermore National Laboratory brought a Power Point presentation concerning the LLNL specification of surface slope and power spectrum. Then the task force examined several ISO/TC 172/SC 1 documents in order to decide if the US should participate in the continued development of those documents while writing US versions in parallel. Finally the task force looked at several issues that were going to be addressed at ISO/TC 172/SC 1 meetings during the next four days in Boulder, CO, to decide what the US delegate position should be.

1. Welcome and Introductions

S. VanKerkhove opened the meeting at 1:35 p.m. with a round of introductions.

2. Adoption of Agenda

D. Aikens moved that the draft agenda revisions 1 that was posted on the web site be adopted. M. Dowell seconded the motion. The motion carried unanimously.

3. Approval of draft minutes of January 21, 2006

M. Dowell moved that the minutes of the previous meeting be approved as presented on the OEOSC web site. L. Endelman seconded the motion. The motion carried unanimously.

4. Lawrence Livermore system for specifying slope and power spectrum

M. McBurney presented Power Point slides showing what instruments are used and measurements that are taken. In order to control surface roughness features, the NIFS specifications are divided into four regions. They have large-aperture 24 in. interferometers with mega-pixel cameras, and some micro-interferometers with different fields of view.

They consider anything 33 mm (0.03 mm^{-1}) and below (the RMS gradient), which includes Zernike polynomials, to be the long region. The mid spatial-frequency range covers (PSD 1) 33 mm to 2.5 mm and (PSD 2) 2.5 mm to .12 mm. The roughness region is .12 mm to .01 mm.

They have a simple RMS phase specification. They calculate 1D PSD (power spectral density) using 2D data to get results similar to profilometers.

Following the presentation the group discussed the implementation of PSD calculations in commercial interferometers to account for surface roughness characteristics. S. VanKerkhove asked if the task force was going to write a standard that the optics community would actually use, or will the standard only cover 40% of the process, and then companies would have to complete the task for themselves? M. Dowell suggested that OEOSC could license a Math Cad routine for users to determine whether an interferometer manufacturer was correctly computing the PSD.

L. Endelman observed that the task force was supposed to be developing a wavefront standard. When he thinks of a wavefront standard, he thinks about an application that any manufacturer or user can employ to define what they want to have as a product. He observed that the task force does not yet know what it wants to do. He had not heard anyone say, “this is what we require, and this is how we are going to do it.”

S. VanKerkhove said that many wavefront standards are not ambiguous, but this aspect is ambiguous. If everyone used pitch polishing, then there would not be this problem, but now there are automated polishing machines that leave behind on optical surfaces features that never existed before.

D. Aikens stated that what we are trying to write down is power, astigmatism or RMS wavefront error. The ISO document does a decent job cover those aspects. The ISO document breaks down in the mid-frequency regime.

S. VanKerkhove said that ISO didn't address the mid-frequency regime because it would be difficult to achieve consensus. He knows from discussions with others that the issue of how to specify on a print prohibition of artifacts and anomalies on surfaces so that an assembled product performs as expected is a concern. He said that he has not be able to come up with a usable mid-frequency specification for his company.

L. Endelman said that the discussion of the problem has been good, but the task force needs to consider what the scope of the standard should be. S. VanKerkhove agreed that the group has not concluded anything, but the task force has identified some issues concerning the specification of PSD. He thought that everyone would agree that it is a hard area to write suitable specifications without knowing the specific application. The group does need to look at the scope, but this meeting has been very enlightening.

D. Aikens said that it was useful to have representatives from Livermore, Argon, Tropel and Zygo all in one room together.

5. Adoption of ISO 10110-5, ISO 10110 – 14, ISO 14999 – 4 as a US standard

S. VanKerkhove noted four items that are important:

1. Slope requirement for a surface or wavefront
2. Smoothing
3. Datapoint Statistical Analysis
4. Universal Units Definition

He asked if there are other issues that need to be addressed in the scope of a new standard. B. Catching asked if the ISO standard talks about when to use double-pass, single-pass or transmitted wavefront measurements. D. Aikens said that there is a section that does discuss when to use single-pass or double-pass measurements.

L. Endelman asked if the task force could have a two pronged approach – work on a US standard while also working on the ISO committee editing. D. Aikens said that it is the task force's intent to work on a US standard simultaneously with the development of an ISO standard.

D. Aikens said that in terms of measurement, calibration of the measurement instrument and uncertainty of the instrument are important. Focus of the instrument is not referenced in the ISO document. How accurately should the instrument be focused during measurement.

D. Aikens said that in the ISO standard, the only place that a frequency range may be specified is for residual wavefront error. The new standard needs an RMS residual.

The 1996 ISO document referenced Zernike polynomials, while the new version does not.

S. VanKerkhove sees ambiguity between parts four and five.

The task force needs to be able to determine rotationally invariant and rotationally varying terms. D. Aikens said that the task force should put something in about power spectrum. Peak to valley can be a useful tool with appropriate smoothing, but RMS slope is a way to measure spot size. RMS slope has to be smoothed to be useful. None of the standards make any requirement for setting focus.

Temporal as well as spatial averaging must be specified. Polarization is important.

S. VanKerkhove lead a discussion concerning definitions for rotationally varying and rotationally invariant errors in Zernike terms. Bob Parks had communicated to S. VanKerkhove that there are several embodiments of Zernike notation, which can be confusing. This could be an area where the standard could propose a preferred, universal Zernike notation.

B. Catching asked if the standard should be limited to spheres and flats.

6. US position on current ISO standards, and SC1 representation

D. Aikens asked if OP agrees with the following US positions:

1. 14999-4.2: We will take a parallel approach; we will work with ISO to make it best as possible while also making an independent US version.
2. 10110-5 and -14: We will take a parallel approach; we will work with ISO to make it best as possible while also making an independent US version.
3. 10110-7: This is the purview of the other committee.
4. 10110-12: There is an open vote concerning aspheric surfaces. He asked if there is a specific position concerning aspheric surfaces, or if we have any input to the discussion of this topic. He noted that Zygo would like to specify the aspheric conformity in terms of surface normal rather than in terms of a planar surface.
5. ISO practice is to administratively cancel periodic review work items who have no work leader. D. Aikens asked if the US should sit silently, or offer to lead a project to reissue these standards. The documents are
 - 10110-6, Centering tolerances (H. Pollicove was the leader.)
 - 10110-8, Surface texture (P. Takacs may have an interest in this topic.)
 - 10110-2, Stress birefringence
 - 10110-3, Bubbles and inclusions
 - 10110-9, Surface treatment and coating
 - 10110-11, Non-tolerance data, the line type for indication of optical axes and technical drawings

D. Aikens would like to see the US take the lead on surface texture, but we have already asked a lot of the US delegation in taking on surface wavefront and surface imperfections.

S. VanKerkhove asked if the US could include a discussion on aspheric approximation ambiguity. D. Aikens asked for a clearly articulated document describing the issue. S. VanKerkhove said that there are two items that we want to address: 1) replacing fringe references with nanometers, 2) rotationally symmetric to be changed to rotationally invariant. His rotationally invariant document could be used, then argue that the aspheric approximation is a subset of those terms.

M. Dowell reported that SC 9 came across the rotationally symmetric term and replaced it with rotationally invariant.

D. Aikens concluded that we do not have any positions on these items. He would like to see the US take on surface texture and asked P. Takacs if he would consider it.

7. Time and Place for next OP1 Wavefront Meeting

M. Dowell moved that the group meet next in Rochester; NY during the OSA Annual Meeting. D. Aikens seconded the motion.

L. Endelman suggested that the committee thank T. Turner for hosting the meeting.

8. Adjournment

M. Dowell moved that the meeting be adjourned. G. Boulton seconded the motion. The meeting was adjourned at 4:45 p.m.