# *Standardizing Interferometric Measurement*

Because the U.S. supplies much of the interferometric measurement hardware and software used these days, the ANSI/NAPM IT.11 Subcommittee on Interferometric Testing has been asked to take the lead in formulating standards for interferometric measurement of wavefront error and surface roughness. As *OPN* went to press, the committee was scheduled to discuss several related isssues at the OSA Annual Meeting Oct. 3-8 in Toronto.

One item the committee is considering is the rather mundane question of how to define "peak-to-valley" error. The widely used but naive answer is the lowest valley subtracted from the highest peak. A little thought shows that finding these two extremes depends on the spatial sampling density and the alignment of the sampling grid with the surface in question.

An obvious way out would be to ask, "Who needs such a definition anyway?" Peak-to-valley errors have virtually nothing to do with optical system performance. On the other hand, a peak-to-valley difference indication is what one gets when observing Newton's fringes between two optically mating surfaces, and this has been typical optical shop practice for centuries. Also, mechanical tolerances are given in terms of a surface being bounded by two parallel planes touching the extreme features on the surface. Here there is a definite practical consequence, because if the distance between the tolerance planes is too large, the physical part will not fit in a mating slot.

In the mechanical, as well as optical case, determination of the distance between two parallel planes just touching the extremes of an arbitrary real surface has no closed form solution and is a computationally intense process. Ultimately, the definition set by this committee should be practical and should consider the optical and mechanical metrology aspects of the problem.

Some of the same concerns apply to the definition of rms (or $R_q$, as the mechanical people refer to it) wavefront errors and surface roughness. In optics, many aspects of system performance relate directly to rms wavefront errors, or surface roughness. In mechanics, people are also concerned about surface roughness but from the point of whether the physical parts will mate. Thus, they prefer to talk about roughness in terms of $R_a$, a measure closely related to peak-to-valley. Now, does it make sense to have two different ways of specifying surface roughness, particularly since some mechanical parts are being produced with surfaces so smooth it takes optical techniques to make surface roughness measurements?

Finally, the committee is considering the consequences of ISO 9000 on interferometric figure measurement. Typically, the reference flats on interferometers are good enough that they are assumed to be perfect and the total error is taken as the error in the part being measured. ISO 9000 explicitly says this cannot be assumed and the known errors in the reference flat must be included in the measurement results. This is going to make some nominally tenth wave optics look worse than previously thought.

If you would like to help with this important ongoing work, call the subcommittee chair, Kathy Creath, at 602/621-8688.

—*Robert Parks*

**BOOKS FOR REVIEW**

- *Progress in Optics*, Emil Wolf, ed., Elsevier Science Publishers B.V., 1993
- *Fiber Optics*, R.J. Hoss and E.A. Lacy, Prentice Hall, 1993
- *Vision: Coding and Efficiency*, Colin Blakemore, ed., Cambridge University Press, 1993
- *Photonics in Switching Vol. 1: Background and Components*, John E. Midwinter, ed., Academic Press Inc., 1993
- *Photonics in Switching Vol. 2: Switching*, John E. Midwinter, ed., Academic Press Inc., 1993
- *Optical Fiber Amplifiers: Design and System Applications*, Anders Bjarklev, Artech House, 1993
- *Semiconductor Quantum Dots*, L. Bányai and S.W. Koch, World Scientific, 1993
- *Handbook of Infrared Standards II*, G. Guelachvili, K.N. Rao, Academic Press Inc., 1993
- *Germanate Glasses: Structure, Spectroscopy, and Properties*, A. Margaryan and M.A. Piliavin, Artech House, 1993
- *Optical Transmission for the Subscriber Loop*, N. Kashima, Artech House, 1993
- *Global High-Tech Marketing: An Introduction for Technical Managers and Engineers*, J.E. Kadish, Artech House, 1993

If you are interested in reviewing one of these books, please call Jill O'Rourke, at 202/416-1971.