Collin Delker, PSL Sandia National Laboratories.

Albuquerque

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The NCSL International Albuquerque Section held its winter meeting on January 10, 2018 at the Juan Tabo Public Library. The meeting lasted for approximately two hours and had 22 attendees. One of our speakers, Joshua Stanford was not able to attend. His presentation titled, "Gage R&R Study on New LCR Measurement System Software," will be moved to a future NCSLI Albuquerque Section meeting.

The meeting began with an announcement of upcoming NCSLI events such as the upcoming Technical Exchange in February and the Workshop & Symposium held in late August. Attendees were then encouraged to become NCSLI members, if they were not already.

After the introduction, the first speaker was introduced. Since the original speaker was unable to attend, we were able to have Collin Delker of the Primary Standards Laboratory (PSL) at Sandia National Laboratories, present in his place. Collin provided a presentation titled,

"Combined Uncertainty Analysis Using PSL Calculator for Computing GUM and Monte Carlo Methods." Collin discussed his Python based software which uses a measurement model along with information regarding each random variable within the model such as the probability distribution, shape parameters of each probability distribution and correlation between input variables to calculate the combined uncertainty. The primary output of the software is the mean value of the output of the measurement model and its associated standard uncertainty. The uncertainty is computed by the law of propagation of uncertainty that is discussed in the Guide to the Expression of Uncertainty in Measurement (GUM) and the Monte Carlo method discussed in the first supplement to the GUM. Other outputs of the software include input and output random variable histograms, sensitivity calculations, and breakdown of uncertainty component proportions to the standard uncertainty. Some other features of this program include, analysis using non-normal distributions, multiple functions per calculation, chaining functions together, symbolic equation output, calculating Type A uncertainties from data

in a text file, and report generation which includes the resulting expanded uncertainty.

In summary, the PSL Calculator can determine the combined uncertainty using the GUM and Monte Carlo methods. It is currently only available to Sandia National Laboratories, but licensing is being worked on for a broader audience. The program has been tested and validated against numerous examples from the GUM and various NIST publications.

The second speaker was Randy Mendoza with a presentation titled, "Traceable High-Frequency Vibration Calibration of Accelerometers in the Temperature Range of -60 °C to 90 °C." Randy's presentation discussed the calibration, in a back to back configuration, of a reference accelerometer and a device under test (DUT) on a shaker table. Depending on use conditions, accelerometers can be influenced by harsh environmental conditions such as extreme temperature variation. Up until the implementation of this system, the reference accelerometer was traceable to the SI only under ambient environmental conditions. The implementation of this system allows the reference to be traceable to the SI throughout a wider temperature range.

The PSL at Sandia National Laboratories now has a system that can provide traceable calibration of accelerometers from frequencies of 10 Hz to 10 kHz in the temperature range of -60 °C to 90 °C. This new system was specifically designed for vibration calibrations at extreme temperatures. The uncertainties for this system (with a level of confidence of 95.45 % and coverage factor of k=2) are ±3 % at ambient and ±7 % at extreme temperatures.
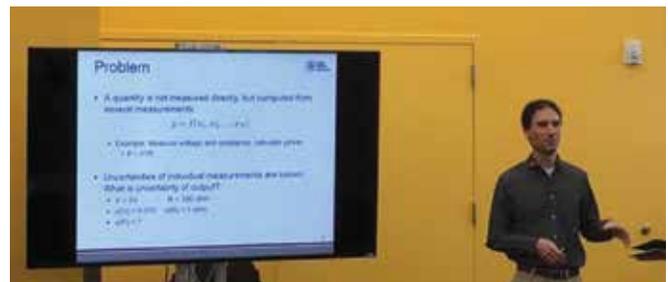
The next Albuquerque section meeting is scheduled for Monday, June 4, 2018. We will be having Dilip Shah of E=mc3 present on calculating measurement uncertainties and risk analysis associated with the new revision of *ISO/IEC 17025:2017*. The hands-on measurement uncertainty class will discuss why measurement uncertainty is required and the different contributors that should be considered when performing an analysis. We will take the data from the uncertainty workshop and will look at how we can apply it to real-world applications during the managing risk workshop. We will focus on the *ISO/IEC 17025:2017* Clauses 7.8.4, 7.8.5 and 7.8.6 and apply this risk-based thinking. The meeting announcement is to follow on the NCSL International website.

Randy Mendoza, Sandia National Laboratories.
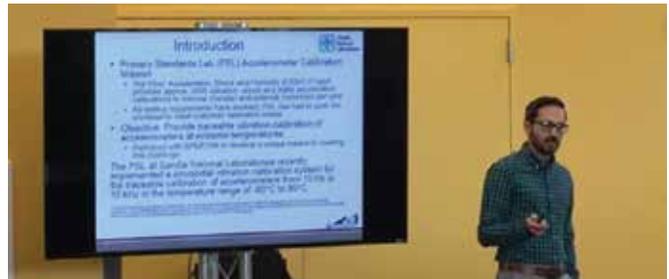
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