Measurement Uncertainty Analysis

This course is designed for those who perform or use measurements taken on optical components or systems. More specifically, it is for anyone who has been asked, **"how accurate is your measurement data?"**

Learners will be introduced to a formal method of determining the uncertainty in a measurement, such as radius of curvature, wavefront error, image contrast, or the length of a brick! The use of these methods is becoming more popular, particularly for products that have agency oversight, and can be applied to any type of measurement.

Methods presented are in the spirit of the Joint Committee for Guides in Metrology (JCGM) document *Evaluation of measurement data – Guide to the expression of uncertainty in measurement*, as well as other available standards. The result of the analysis boils down to one sentence, such as, "there is a 95% probability that the measured result is within ±0.002 mm of the actual value."

This course is practical, with plenty of examples. There are no equations; math skills are not required. A basic understanding of (descriptive) statistics is helpful. The learner will walk away with a solid understanding of the process of performing a measurement uncertainty analysis.

Format: The course length is 2 hours. There are 8 video modules, with an average length of 15 minutes. Learners will be sent the video links.

Cost: $100 per learner

About the Instructor

Jennifer is a University of Rochester trained optical engineer who has worked with and around optical systems since 1986. Jennifer has worked at Eastman Kodak, IMAX, and Optimax Systems. She has also taught statistics at SUNY Brockport, and performed data analysis and publication preparation at University of Rochester Medical Center.

Contact

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Measurement Uncertainty Analysis
VIDEO CHECKLIST

- ☐ **Module 1:** Introduction and Why? (7 minutes)
  Short course description
  Why perform a measurement uncertainty analysis?

- ☐ **Module 2:** Background and the Brick (12 minutes)
  Background
  The GUM
  Latest news for JCGM WG1
  JCGM and ISO/IEC publications
  Vocabulary (the VIM)
  The case of the brick and ruler
  Common questions and comments

- ☐ **Module 3:** Definitions (18 minutes)
  Basic terms
  Systematic and random errors
  Repeatability and reproducibility

- ☐ **Module 4:** More Definitions (16 minutes)
  Type A and Type B errors
  Statistics
  Coverage probability
  Definition of reliability

- ☐ **Module 5:** Measurement Uncertainty Analysis (18 minutes)
  A STEP-BY-STEP plan for determining measurement uncertainty
  STEP 1: Systematic measurement errors

- ☐ **Module 6:** Measurement Uncertainty Analysis STEP 2 (16 minutes)
  STEP 2: Random measurement errors

- ☐ **Module 7:** Measurement Uncertainty Analysis STEPS 2 and 3 (13 minutes)
  STEP 2: Combined measurement uncertainty
  STEP 3: Measurement results

- ☐ **Module 8:** Measurement Uncertainty Analysis STEP4 and Conclusion (20 minutes)
  STEP 4: Calculated measurement uncertainty
  Topics not covered
  Measuring n times