Course Catalog Number: Tdm-1
Course Track: Dimensional Measurements
Course Topic: Uncertainty
Course Career Level: Beginner/Intermediate

Saturday & Sunday, August 24 & August 25 | 8:00 AM - 5:00 PM

2-Day (16 Hours)

Course Title: Dimensional Uncertainties Hands-on Course

Instructors: Dr. Ted Doiron and Eric Stanfield, National Institute of Standards and Technology (NIST)

Abstract: The basic principles of dimensional metrology are the same for nearly every calibration made in typical labs. This course teaches these principles through guided hand-on characterization of the most typical dimensional measurement instrument; the Universal Length Measuring Machine (ULM). Topics covered in the course will include uncertainty budgets, thermal effects, scale calibration with gage blocks, cylinders, and rings, elastic deformation and calibration of contact forces, gage and contact geometry effects, measurements of sub-pitch interpolation errors in the encoder system, R&R on end standards, cylinders and ring gages. Participants are encouraged to bring uncertainty budget details for dimensional measurements they make in their lab that they would like to discuss.

Learning Objectives:

1. Identify and quantify error sources associated with length measurement using a universal length measurement machine (ULM) to measure different artifacts.
2. Learn about sub-divisional errors commonly found in many ULM's and other dimensional instruments equipped with line scales and a simple approached to measuring it.
3. Develop an understanding of elastic deformation, specifically, under what conditions it exists and when it can and cannot be ignored, how to quantify the potential errors when conditions are not the same for the reference and unknown, easily accessible tools to help you, and how to calibrate the applied contact force on a ULM.
4. Learn about the different thermal related uncertainty sources, how to evaluate them, and different approaches to minimizing their impact.
5. How gage and contact geometry affect your uncertainty and some simple ways to quantify them.

Instructor Curriculum Vitae (CV):

Dr. Ted Doiron is the Leader of the Dimensional Metrology Group at NIST. He has been a dimensional metrologist at NIST for30 years and has experience in both NMI and manufacturing level measurements. As the Quality Manager for his Division and over 100 assessments of laboratories to ISO 17025 he has seen the problems of determining calibration uncertainty at all levels of the national measurement system.

Mr. Stanfield is a Dimensional Metrologist/Mechanical Engineer within the Dimensional Metrology Group (DMG) and has been at NIST for 24 years. He has an A.A.S. in Metrology which he obtained in 1991 and a B.S. in Mechanical Engineering which he earned, with honors, from George Washington University on a part-time basis while working at NIST as a technician. In addition to receiving his degree in 2004, he received the Judson C. French Award for "Outstanding Leadership in the Development of Improved Dimensional Calibration Services with High Efficiency, Accuracy, and Customer Satisfaction." Since earning his degree in Mechanical Engineering in 2004. he has served as Project Leader for a 4-year DOE sponsored effort titled "Metrology or Fuel Cell Manufacturing" where he managed three subprojects addressing process control related solutions to enable fuel cell manufacturing. He is a graduate of both the NIST Project Management and Leadership Program and the NIST New Leaders Program. For the last two years, he served as the Project Leader for Dimensional Measurement Services but has most recently taken a special assignment to focus on getting DMG's 3rd M48 CMM operational and characterized.