Objective Real World Uncertainty Analysis

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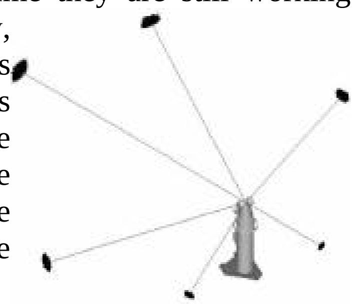
The ISO (International Organization for Standardization) standards focusing on "Global Product Specification" require that part measurements be described by two numbers. The first is the result of the measurement and the second is the stated uncertainty. This uncertainty statement represents the estimated variability in the result.

Users often combine measurement systems by tying individual measurement systems together based on common reference points, and then assume they are still working within the instrument's published uncertainty. Alternatively, many users apply heuristics to determine the uncertainty as they progress along a chain of measurements. These methods provide very poor approximations of uncertainty in all but the most simplistic cases. Even in cases where only a single placement of an instrument is used, its measurements are typically tied in to a reference coordinate system. The uncertainty from this tie-in process is often ignored.



This paper addresses a number of practical metrology questions:

- What is the uncertainty of my instruments in the "real-world"?
- What is the effect of uncertainty propagation on the quality of my measurements?
- How can I make optimal use of my measurements to minimize uncertainty?
- Ok, it's nice to know the uncertainty of a point, but I'm fitting a sphere. What is the uncertainty of my fit?
- What about my hidden point bar?

The presentation provides answers to the questions

- Combine measurement systems to minimize your measurement uncertainty
- Characterize instrument uncertainty on the job. Extract component uncertainties from residuals. (Type A evaluation)
- Verify instrument performance before and after a job
- Determine point uncertainty fields
- How to take advantage of the relative uncertainty of the measurement components.
- Geometric fitting uncertainty (sphere, line, plane, cylinder, etc)

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