G E Mattingly, J Aeronaut Aerospace Eng 2014, 3:2
http://dx.doi.org/10.4172/2168-9792.S1.001

OMICS Group Conferences
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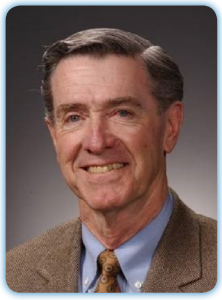
2nd International Conference and Exhibition on
Mechanical & Aerospace Engineering
September 08-10, 2014 Hilton Philadelphia Airport, USA



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Assessing engineering uncertainties

Critical to engineering results are data and measurements. These are used for decisions to build or not to build, to buy or to sell, to approve or to reject, and to win or to lose a technical competition. Because of the critical nature of data and measurements, it is important to quantify their quality, a process that relies on uncertainty assessments. In the mid 1990s, a new uncertainty assessment methodology, described in the VIM (the International Vocabulary for Metrology) and the GUM (the Guide to the Expression of Uncertainty in Measurement), was put forth internationally by the International Organization for Standardardization (ISO) and other agencies. This methodology, which is different from the many and confusing methods that preceded it, was immediately adopted by the world's National Metrology Institutes (NMIs) including the National Institute for Standards and Technology (NIST) in the U.S. The method is based on three critical elements: a) how the random and systematic characteristics of the component measurements are categorized and processed; b) how the notation for these components might logically change in successive uncertainty assessments; and c) how final results should be interpreted.The VIM & GUM methodology is simple, easy to apply, logical. The quality of engineering measurements and data can now be enhanced with two new features. The first uses the concept of measurement traceability.This traceability connects the measurement with recognized reference standards, such as those maintained at NIST. The NIST standards, in turn, are traceable to the seven fundamental measurements: mass, length, time, temperature, electric current, the mole, and light intensity. The second is that measurement labs can now be accredited by recognized agencies. The better accrediting agencies, such as NVLAP (the National Voluntary Laboratory Accreditation Program), conducted by NISTis generally considered the best of these as it stipulates that Proficiency Testing be done to validate all uncertainty quotes for the respective measurement. This keynote talk will describe VIM and GUM methodology. The traceability and accreditation features willgive several examples with interpreted results, as well as an uncertainty tabulation format. This tabulation shows the whole uncertainty assessment process and where improvements can be made to improve matters, where this may be desirable. In today's world where engineering results are critical not only in our domestic market places but also in our global economies, the VIM and GUM procedures need to be applied to all engineering measurements, thereby ensuring results both understandable and acceptable-nationally and internationally.

Biography

G E Mattingly received his PhD in Aerospace and Mechanical Sciences from Princeton University and then joined the Princeton faculty to teach fluid dynamics and hydraulics. After a sabbatical year in France, he accepted an offer from the National Bureau of Standards (NBS, later named the National Institute of Standards and Technology - NIST) where he led the Fluid Metrology Group for 25 years. In this position he was responsible for the US national standards for the flow of water, hydrocarbon liquids, gas, air speed and liquid volume and density, and the dissemination of these standards via calibration services and proficiency testing programs for US industry, academia, and other government agencies. He retired from NIST in 2004.Through these years he served on the paper standards writing committees - both national (ASME) and international. Additionally he served as a NVLAP Accreditor for flow measurements. At present, he is the Chairman for the Subcommittee writing the ASME paper standard on Flow Measurement Uncertainty. Currently, he is also an Adjunct Professor of Mechanical Engineering at The Catholic University of America in Washington, DC, and he is an engineering consultant to US and foreign companies and national standards institutions on flow measurement and measurement uncertainty topics.

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