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Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results (rev. Ed.)
Doubt-Free Uncertainty In Measurement
Estimating Uncertainty in Measurements Made on Materials AP-T79-08
How to Deal with Uncertainty in Estimates
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Measurement Uncertainty and Probability
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Code Complete

TIANA GUADALUPE

Uncertainty Supreet Singh Bahga
Quantification, Validation and Uncertainty in Analytical Sciences Companion guide explaining all processes in measuring uncertainty in quantitative analytical results Quantification, Validation and Uncertainty in Analytical Sciences provides basic and expert knowledge by building on the sequence of operations starting from the quantification in analytical sciences by defining the analyte and linking it to the calibration function. Proposing a comprehensive approach to MU (Measurement Uncertainty) estimation, it empowers the reader to apply Method Accuracy Profile (MAP) efficiently as a statistical tool in measuring uncertainty. The text elucidates several examples and template worksheets explaining the theoretical aspects of the procedure and includes novel method validation procedures that can accurately estimate the data obtained in measurements. It also enables the reader to provide practical insights to improve decision making by accurately evaluating and comparing different analytical methods. Brings together an interdisciplinary approach with statistical tools and algorithms applied in analytical chemistry and written by two international experts with long-standing experience in the field of Analytical measurements and Uncertainty, Quantification, Validation and Uncertainty in Analytical Sciences includes information on: The know-how of methods in an analytical laboratory, effective usage of a spurious measurement and methods to estimate errors. Quantification, calibration, precision, trueness, MAP addons, estimating MU for analytical sciences, and uncertainty functions Employing measurement uncertainty, sampling uncertainty, quantification limits, and sample conformity assessment Decision making, uncertainty and standard addition method, and accuracy profile for method comparison Quantification, Validation and Uncertainty in Analytical Sciences is an ideal resource for every individual quantifying or studying analytes. With several chapters dedicated to MU’s practical use in decision making demonstrating its advantages, the book is primarily intended for professional analysts, although researchers and students will also find it of interest.
Uncertainty, Calibration and Probability Morgan & Claypool Publishers
A timeless classic of economic theory that remains fascinating and pertinent today, this is Frank Knight's famous explanation of why perfect competition cannot eliminate profits, the important differences between "risk" and "uncertainty," and the vital role of the entrepreneur in profitmaking. Based on Knight's PhD dissertation, this 1921 work, balancing theory with fact to come to stunning insights, is a distinct pleasure to read. FRANK H. KNIGHT (1885-1972) is considered by some the greatest American scholar of economics of the 20th century. An economics professor at the University of Chicago from 1927 until 1955, he was one of the founders of the Chicago school of economics, which influenced Milton Friedman and George Stigler.
Probability and Bayesian Modeling John Wiley & Sons
The public depends on competent risk assessment from the federal government and the scientific community to grapple with the threat of pollution. When risk reports turn out to be overblownâ€"or when risks are overlookedâ€"public skepticism abounds. This comprehensive and readable book explores how the U.S. Environmental Protection Agency (EPA) can improve its risk assessment practices, with a focus on implementation of the 1990 Clean Air Act Amendments. With a wealth of detailed information, pertinent examples, and revealing analysis, the volume explores the "default option" and other basic concepts. It offers two views of EPA operations: The first examines how EPA currently assesses exposure to hazardous air pollutants, evaluates the toxicity of a substance, and characterizes the risk to the public. The second, more holistic, view explores how EPA can improve in several critical areas of risk assessment by focusing on cross-cutting themes and incorporating more scientific judgment. This comprehensive volume will be important to the EPA and other agencies, risk managers, environmental advocates, scientists, faculty, students, and concerned individuals.
The Uncertainty in Physical Measurements Routledge
All measurements include some error. Whether measurements are used for accountability, environmental programs or process support, they are of little value unless accompanied by an estimate of the measurements uncertainty. This fact is often overlooked by the individuals who need measurements to make decisions. This paper will discuss the concepts of measurement, measurements errors (accuracy or bias and precision or random error), physical and error models, measurement control programs, examples of measurement uncertainty, and uncertainty as related to measurement quality. Measurements are comparisons of unknowns to knowns, estimates of some true value plus uncertainty; and are no better than the standards to which they are compared. Direct comparisons of unknowns that match the composition of known standards will normally have small uncertainties. In the real world, measurements usually involve indirect comparisons of significantly different materials (e.g., measuring a physical property of a chemical element in a sample having a matrix that is significantly different from calibration standards matrix). Consequently, there are many sources of error involved in measurement processes that can affect the quality of a measurement and its associated uncertainty. How the uncertainty estimates are determined and what they mean is as important as the measurement. The process of calculating the uncertainty of a measurement itself has uncertainties that must be handled correctly. Examples of chemistry laboratory measurement will be reviewed in this report and recommendations made for improving measurement uncertainties.
Experimental Uncertainty Analysis: A Textbook for Science and Engineering Students National Academies Press
Summary: "This document provides some guidelines on the estimation of measurement uncertainty and sampling variation. The procedures are demonstrated through a worked example based on a soil moisture content test. Estimation of the standard deviation for each source of uncertainty and the sensitivity of the source of uncertainty are discussed extensively. Additional examples are used to illustrate some of the concepts. In addition to working through the example, some ideas are proposed on how readers may obtain estimates of sensitivities to variables that do not directly impact on the calculation of the measurand. Three appendices are included covering, methods of calculating the total uncertainty, analysis of inter-laboratory trials and sampling variance when estimating a lot average."--Publisher description.
Measurement Uncertainty Springer Science & Business Media
Probability and Bayesian Modeling is an introduction to probability and Bayesian thinking for undergraduate students with a calculus background. The first part of the book provides a broad view of probability including foundations, conditional probability, discrete and continuous distributions, and joint distributions. Statistical inference is presented completely from a Bayesian perspective. The text introduces inference and prediction for a single proportion and a single mean from Normal sampling. After fundamentals of Markov Chain Monte Carlo algorithms are introduced, Bayesian inference is described for hierarchical and regression models including logistic regression. The book presents several case studies motivated by some historical Bayesian studies and the authors’ research. This text reflects modern Bayesian statistical practice. Simulation is introduced in all the probability chapters and extensively used in the Bayesian material to simulate from the posterior and predictive distributions. One chapter describes the basic tenets of Metropolis and Gibbs sampling algorithms; however several chapters introduce the fundamentals of Bayesian inference for conjugate priors to deepen understanding. Strategies for constructing prior distributions are described in situations when one has substantial prior information and for cases where one has weak prior knowledge. One chapter introduces hierarchical Bayesian modeling as a practical way of combining data from different groups. There is an extensive discussion of Bayesian regression

models including the construction of informative priors, inference about functions of the parameters of interest, prediction, and model selection. The text uses JAGS (Just Another Gibbs Sampler) as a general-purpose computational method for simulating from posterior distributions for a variety of Bayesian models. An R package ProbBayes is available containing all of the book datasets and special functions for illustrating concepts from the book. A complete solutions manual is available for instructors who adopt the book in the Additional Resources section.

Data and Error Analysis Microsoft Press

The book is devoted to one of the important areas of theoretical and experimental physics—the calculation of the accuracy of measurements of fundamental physical constants. To achieve this goal, numerous methods and criteria have been proposed. However, all of them are focused on identifying a posteriori uncertainty caused by the idealization of the model and its subsequent computerization in comparison with the physical system. This book focuses on formulating an a priori interaction between the level of a detailed description of a material object (the number of registered quantities) and the lowest uncertainty in measuring a physical constant. It contains the materials necessary for the optimal design of models describing a physical phenomenon. It will appeal to scientists and engineers, as well as university students.

Uncertainty Estimates for Derivatives and Intercepts Springer

Straight line least squares fits of experimental data are widely used in the analysis of test results to provide derivatives and intercepts. A method for evaluating the uncertainty in these parameters is described. The method utilizes conventional least squares results and is applicable to experiments where the independent variable is controlled, but not necessarily free of error. A Monte Carlo verification of the method is given.

Measurement of Fluid Flow Cambridge University Press

Measurements and experiments are made each and every day, in fields as disparate as particle physics, chemistry, economics and medicine, but have you ever wondered why it is that a particular experiment has been designed to be the way it is. Indeed, how do you design an experiment to measure something whose value is unknown, and what should your considerations be on deciding whether an experiment has yielded the sought after, or indeed any useful result? These are old questions, and they are the reason behind this volume. We will explore the origins of the methods of data analysis that are today routinely applied to all measurements, but which were unknown before the mid-19th Century. Anyone who is interested in the relationship between the precision and accuracy of measurements will find this volume useful. Whether you are a physicist, a chemist, a social scientist, or a student studying one of these subjects, you will discover that the basis of measurement is the struggle to identify the needle of useful data hidden in the haystack of obscuring background noise.

Quantification, Validation and Uncertainty in Analytical Sciences Quality Press

This volume presents measurement uncertainty and uncertainty budgets in a form accessible to practicing engineers and engineering students from across a wide range of disciplines. The book gives a detailed explanation of the methods presented by NIST in the “GUM” – Guide to Uncertainty of Measurement. Emphasis is placed on explaining the background and meaning of the topics, while keeping the level of mathematics at the minimum level necessary. Dr. Colin Ratcliffe, USNA, and Bridget Ratcliffe, Johns Hopkins, develop uncertainty budgets and explain their use. In some examples, the budget may show a process is already adequate and where costs can be saved. In other examples, the budget may show the process is inadequate and needs improvement. The book demonstrates how uncertainty budgets help identify the most cost effective place to make changes. In addition, an extensive fully-worked case study leads readers through all issues related to an uncertainty analysis, including a variety of different types of uncertainty budgets. The book is ideal for professional engineers and students concerned with a broad range of measurement assurance challenges in applied sciences. This book also: Facilitates practicing engineers’ understanding of uncertainty budgets, essential to calculating cost-effective savings to a wide variety of processes contingent on measurement Presents uncertainty budgets in an accessible style suitable for all undergraduate STEM courses that include a laboratory component Provides a highly adaptable supplement to graduate textbooks for courses where students’ work includes reporting on experimental results Includes an expanded case study developing uncertainty from transducers though measurands and propagated to the final measurement that can be used as a template for the analysis of many processes Stands as a useful pocket reference for all engineers and experimental scientists

Quantifying Measurement ISA

Further knowledge about the bias and inaccuracies of individuals' estimates to perform tasks which havr. THE EFFECTS OF UNCERTAINTY AND MONETARY INCENTIVES ON ESTIMATION. Doctoral thesis, by Edwin Irwin Golding. 1962, 276p. incl. illus. tables, 70 refs. Unclassified report DESCRIPTORS: *Decision making, *Information theory, *Games theory, *Probability, Statis tical analysis, Reasoning, Money, Effective ness, Needs. Identifiers: Motivation. Further knowledge about the bias and inaccuracies of individuals' estimates to perform tasks which have uncertain outcomes is provided. The standard deviation of a sample distribution of discrepancies between subjects' estimates and their actual outcomes does not approach a theoretical standard deviation calculated for a straw man using a random solution strategy, irrespective of the amount of uncertainty in the task. Monetary incentives were seen to effect the direction of estimates and the amount of their discrepancy. Bonus incentives tended to drive estimates and actual outcomes closer together. Competition for one prize drove the variables further apart. Over the range of uncertainty investigated, both conditions of incentives caused substantial reduction in the variables being recorded and in the variance of their distributions. As long as chance was an element to contend with in the performance of a task, fallible estimations, irrespective of the range of uncertainty, did not cease to exist. Requiring subjects to make point estimates instead of specifying intervals which would include their actual outcomes only encouraged further fallible estimations. (Author).

Combining Interval, Probabilistic, and Other Types of Uncertainty in Engineering Applications Frontiers Media SA

Widely considered one of the best practical guides to programming, Steve McConnell’s original CODE COMPLETE has been helping developers write better software for more than a decade. Now this classic book has been fully updated and revised with leading-edge practices—and hundreds of new code samples—illustrating the art and science of software construction. Capturing the body of knowledge available from research, academia, and everyday commercial practice, McConnell synthesizes the most effective techniques and must-know principles into clear, pragmatic guidance. No matter what your experience level, development environment, or project size, this book will inform and stimulate your thinking—and help you build the highest quality code. Discover the timeless techniques and strategies that help you: Design for minimum complexity and maximum creativity Reap the benefits of collaborative development Apply defensive programming techniques to reduce and flush out errors Exploit opportunities to refactor—or evolve—code, and do it safely Use construction practices that are right-weight for your project Debug problems quickly and effectively Resolve critical construction issues early and correctly Build quality into the beginning, middle, and end of your project

The Effects of Incorporating Dynamic Data on Estimates of Uncertainty Cosimo, Inc.

A practical reference on theory and methods of estimating measurement errors and uncertainty for both scientists and engineers in industry and experimental research. Building on the fundamentals of measurement theory, this book offers a wealth of practial recommendations and procedures. It differs from the majority of books in that it balances coverage of probabilistic methods with detailed information on the characterization, calibration, standardization and limitations of measuring instruments, with specific examples from both electrical and mechanical systems. In addition to a general updating to reflect current research, new material in this edition includes increased coverage of indirect measurements, with a new, simpler, more efficient method for this class of measurements.

Uncertainty and Estimation in Economics Cambridge University Press

Assessment of error and uncertainty is a vital component of both natural and social science. This edited volume presents case studies of research practices across a wide spectrum of scientific fields. It compares methodologies and presents the ingredients needed for an overarching framework applicable to all.

An Introduction to Error Analysis Cambridge Scholars Publishing

Results of measurements and conclusions derived from them constitute much of the technical information produced by the National Institute of Standards and Technology (NIST). In July 1992 the Director of NIST appointed an Ad Hoc Committee on Uncertainty Statements and charged it with recommending a policy on this important topic. The Committee concluded that the CIPM approach could be used to provide quantitative expression of measurement that would satisfy NIST¿s customers¿ requirements. NIST initially published a Technical Note on this issue in Jan. 1993. This 1994 edition addresses the most important questions raised by recipients concerning some of the points it addressed and some it did not. Illustrations.

Estimation of Uncertainty for Contour Method Residual Stress Measurements Univ Science Books

This paper describes a methodology for the estimation of measurement uncertainty for the contour method, where the contour method is an experimental technique for measuring a two-dimensional map of residual stress over a plane. Random error sources including the error arising from noise in displacement measurements and the smoothing of the displacement surfaces are accounted for in the uncertainty analysis. The output is a two-dimensional, spatially varying uncertainty estimate such that every point on the cross-section where residual stress is determined has a corresponding uncertainty value. Both numerical and physical experiments are reported, which are used to support the usefulness of the proposed uncertainty estimator. The uncertainty estimator shows the contour method to have larger uncertainty near the perimeter of the measurement plane. For the experiments, which were performed on a quenched aluminum bar with a cross section of 51 × 76 mm, the estimated uncertainty was approximately 5 MPa ([sigma]/E = 7 · 10−5) over the majority of the cross-section, with localized areas of higher uncertainty, up to 10 MPa ([sigma]/E = 14 · 10−5).

Software Estimation DIANE Publishing

A measurement result is incomplete without a statement of its 'uncertainty' or 'margin of error'. But what does this statement actually tell us? By examining the practical meaning of probability, this book discusses what is meant by a '95 percent interval of measurement uncertainty', and how such an interval can be calculated. The book argues that the concept of an unknown 'target value' is essential if probability is to be used as a tool for evaluating measurement uncertainty. It uses statistical concepts, such as a conditional confidence interval, to present 'extended' classical methods for evaluating measurement uncertainty. The use of the Monte Carlo principle for the simulation of experiments is described. Useful for researchers and graduate students, the book also discusses other philosophies relating to the evaluation of measurement uncertainty. It employs clear notation and language to avoid the confusion that exists in this controversial field of science"

Measurement Uncertainty Pearson Education

For the lab/experimentation course in physics depts. and/or any course in physics, chemistry, geology, etc. with a lab component focusing on data and error analysis. Designed to help science students process data without lengthy and boring computations, this text/disk package provides useful algorithms and programs that allow students to do analysis more quickly than was previously possible. Using a "learn by doing" approach, it provides simple, handy rules for handling data and estimating errors both by graphical and analytic methods without long discussions and involved theoretical derivations.

Combining Interval, Probabilistic, and Other Types of Uncertainty in Engineering Applications Springer Science & Business Media

All measurements are subject to error because no quantity can be known exactly; hence, any measurement has a probability of lying within a certain range. The more precise the measurement, the smaller the range of uncertainty. Uncertainty, Calibration and Probability is a comprehensive treatment of the statistics and methods of estimating these calibration uncertainties. The book features the general theory of uncertainty involving the combination (convolution) of non-Gaussian, student t, and Gaussian distributions; the use of rectangular distributions to represent systematic uncertainties; and measurable and nonmeasurable uncertainties that require estimation. The author also discusses sources of measurement errors and curve fitting with numerous examples of uncertainty case studies. Many useful tables and computational formulae are included as well. All formulations are discussed and demonstrated with the minimum of mathematical knowledge assumed. This second edition offers additional examples in each chapter, and detailed additions and alterations made to the text. New chapters consist of the general theory of uncertainty and applications to industry and a new section discusses the use of orthogonal polynomials in curve fitting. Focusing on practical problems of measurement, Uncertainty, Calibration and Probability is an invaluable reference tool for R&D laboratories in the engineering/manufacturing industries and for undergraduate and graduate students in physics, engineering, and metrology.

Uncertainty Analysis for Engineers and Scientists Springer Science & Business Media

How can we solve engineering problems while taking into account data characterized by different types of measurement and estimation uncertainty: interval, probabilistic, fuzzy, etc.? This book provides a theoretical basis for arriving at such solutions, as well as case studies demonstrating how these theoretical ideas can be translated into practical applications in the geosciences, pavement engineering, etc. In all these developments, the authors’ objectives were to provide accurate estimates of the resulting uncertainty; to offer solutions that require reasonably short computation times; to offer content that is accessible for engineers; and to be sufficiently general - so that readers can use the book for many different problems. The authors also describe how to make decisions under different types of uncertainty. The book offers a valuable resource for all practical engineers interested in better ways of gauging uncertainty, for students eager to learn and apply the new techniques, and for researchers interested in processing heterogeneous uncertainty.