Estimates Of Uncertainty Of The Calibration Of Balances

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 overblown--or when risks are overlooked--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.

"This introduction to measurement uncertainty is intended for metrology professionals working in calibration laboratories and metrology institutes, as well as students in tertiary-level science and engineering programmes. The subject matter is presented with an emphasis on developing models of the physical measurement process. The level of mathematics and statistics used is basic and is typically covered by high school studies"--Distributor's website.

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.

Using the GUM (Guide to the Expression of Uncertainty in Measurement)

History

The Effects of Incorporating Dynamic Data on Estimates of Uncertainty

Biological Variation

Problems after each chapter

Uncertainty in structural dynamics is of growing concern to numerous industries. Significant attention has previously been devoted to the study of frequency response functions, however the uncertainty associated with excitation of structures by structureborne sound sources has received little attention. In this work, the uncertainty in the structure borne sound power transmitted from a vibration source into a receiving structure is considered. A method is presented whereby the uncertainties in the active and dynamic properties of a structure borne sound source and its receiver structure are propagated through to the injected power. Consideration is given to the case where the data describing the source and receiver is incomplete and is therefore termed?granular?. An approach for the estimation of the mean and uncertainty of granular variables is developed and it is shown that by estimating the mean and uncertainty of the missing elements the uncertainty propagation approach can be used for a?granular? case. This approach is illustrated using an example in which the free velocity phase data is assumed to be unavailable. Idealised structure borne sound sources are created analytically in order to examine the validity of the presented methods. Good correlation is observed between the estimated uncertainties in the transmitted power and the uncertainties obtained through a Monte Carlo analysis. Insight into the frequency regions where large uncertainties can be expected in the transmitted structure borne sound power is obtained. It is argued that by providing estimates for the uncertainty of a prediction of the transmitted power, an insight into the reliability of the estimate is achieved, allowing engineering decisions to be made with greater confidence.

Probability Methods for Cost Uncertainty Analysis: A Systems Engineering Perspective, Second Edition gives you a thorough grounding in the analytical methods needed for modeling and measuring uncertainty in the cost of engineering systems. This includes the treatment of correlation between the cost of system elements, how to present the analysis to

Uncertainties in Numerical Weather Prediction

Experimental Uncertainty Analysis: A Textbook for Science and Engineering Students

An Introduction to Risk and Uncertainty in the Evaluation of Environmental Investments

An Introduction to Measurement Uncertainty

An Introduction to Error Analysis

Quantifying uncertainty and error bounds is a key outstanding challenge in ocean state estimation and climate research. It is particularly difficult due to the large dimensionality of this nonlinear estimation problem and the number of uncertain variables involved. The "Estimating the Circulation and Climate of the Oceans" (ECCO) consortium has developed a scalable system for dynamically consistent estimation of global time-evolving ocean state by optimal combination of ocean general circulation model (GCM) with diverse ocean observations. The estimation system is based on the "adjoint method" solution of an unconstrained least-squares optimization problem formulated with the method of Lagrange multipliers for fitting the dynamical ocean model to observations. The dynamical consistency requirement of ocean state estimation necessitates this approach over sequential data assimilation and reanalysis smoothing techniques. In addition, it is computationally advantageous because calculation and storage of large covariance matrices is not required. However, this is also a drawback of the adjoint method, which lacks a native formalism for error propagation and quantification of assimilated uncertainty. The objective of this dissertation is to resolve that limitation by developing a feasible computational methodology for uncertainty analysis in dynamically consistent state estimation, applicable to the large dimensionality of global ocean models. Hessian (second derivative-based) methodology is developed for Uncertainty Quantification (UQ) in large-scale ocean state estimation, extending the gradient-based adjoint method to employ the second order geometry information of the model-data misfit function in a high-dimensional control space. Large error covariance matrices are evaluated by inverting the Hessian matrix with the developed scalable matrix-free numerical linear algebra algorithms. Hessian-vector product and Jacobian derivative codes of the MIT general circulation model (MITgcm) are generated by means of algorithmic differentiation (AD). Computational complexity of the Hessian code is reduced by tangent linear differentiation of the adjoint code, which preserves the speedup of adjoint checkpointing schemes in the second derivative calculation. A Lanczos algorithm is applied for extracting the leading rank eigenvectors and eigenvalues of the Hessian matrix. The eigenvectors represent the constrained uncertainty patterns. The inverse eigenvalues are the corresponding uncertainties. The dimensionality of UQ calculations is reduced by eliminating the uncertainty null-space unconstrained by the supplied observations. Inverse and forward uncertainty propagation schemes are designed for assimilating observation and control variable uncertainties, and for projecting these uncertainties onto oceanographic target quantities. Two versions of these schemes are developed: one evaluates reduction of prior uncertainties, while another does not require prior assumptions. The analysis of uncertainty propagation in the ocean model is time-resolving. It captures the dynamics of uncertainty evolution and reveals transient and stationary uncertainty regimes. The system is applied to quantifying uncertainties of Antarctic Circumpolar Current (ACC) transport in a global barotropic configuration of the MITgcm. The model is constrained by synthetic observations of sea surface height and velocities. The control space consists of two-dimensional maps of initial and boundary conditions and model parameters. The size of the Hessian matrix is 0(1010) elements, which would require 0(60GB) of uncompressed storage. It is demonstrated how the choice of observations and their geographic coverage determines the reduction in uncertainties of the estimated transport. The system also yields information on how well the control fields are constrained by the observations. The effects of controls uncertainty reduction due to decrease of diagonal covariance terms are compared to dynamical coupling of controls through off-diagonal covariance terms. The correlations of controls introduced by observation uncertainty assimilation are found to dominate the reduction of uncertainty of transport. An idealized analytical model of ACC guides a detailed time-resolving understanding of uncertainty dynamics. Keywords: Adjoint model uncertainty, sensitivity, posterior error reduction, reduced rank Hessian matrix, Automatic Differentiation, ocean state estimation, barotropic model, Drake Passage transport.

Uncertainties in Numerical Weather Prediction is a comprehensive work on the most current understandings of uncertainties and predictability in numerical simulations of the atmosphere. It provides general knowledge on all aspects of uncertainties in the weather prediction models in a single, easy to use reference. The book illustrates particular uncertainties in observations and data assimilation, as well as the errors associated with numerical integration methods. Stochastic methods in parameterization of subgrid processes are also assessed, as are uncertainties associated with surface-atmosphere exchange, orographic flows and processes in the atmospheric boundary layer. Through a better understanding of the uncertainties to watch for, readers will be able to produce more precise and accurate forecasts. This is an essential work for anyone who wants to improve the accuracy of weather and climate forecasting and interested parties developing tools to enhance the quality of such forecasts. Provides a comprehensive overview of the state of numerical weather prediction at spatial scales, from hundreds of meters, to thousands of kilometers Focuses on short-term 1-15 day atmospheric predictions, with some coverage appropriate for longer-term forecasts Includes references to climate prediction models to allow applications of these techniques for climate simulations

Numerical models of flow and transport processes are heavily employed in the fields of surface, soil, and groundwater hydrology. They are used to interpret field observations, analyze complex and coupled processes, or to support decision making related to large societal issues such as the water-energy nexus or sustainable water management and food production. Parameter estimation and uncertainty quantification are two key features of modern science-based predictions. When applied to water resources, these tasks must cope with many degrees of freedom and large datasets. Both are challenging and require novel theoretical and computational approaches to handle complex models with large number of unknown parameters.

Estimating Uncertainties in Integrated Reservoir Studies

Sensitivity and Uncertainty Analysis to Burn-up Estimates on ADS Using ACAB Code

Some Aspects of Uncertainty in Computing Hypersonic Flight Estimates

Decision Making under Uncertainty

Estimating Uncertainty of Inference for Validation

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).

This book is published open access under a CC BY 4.0 license. Predicting the time needed to complete a project, task or daily activity can be difficult and people frequently underestimate how long an activity will take. This book sheds light on why and when this happens, what we should do to avoid it and how to give more realistic time predictions. It describes methods for predicting time usage in situations with high uncertainty, explains why two plus two is usually more than four in time prediction contexts, reports on research on time prediction biases, and summarizes the evidence in support of different time prediction methods and principles. Based on a comprehensive review of the research, it is the first book summarizing what we know about judgment-based time predictions. Large parts of the book are directed toward people wishing to achieve better time predictions in their professional life, such as project managers, graphic designers, architects, engineers, film producers, consultants, software developers, or anyone else in need of realistic time usage predictions. It is also of benefit to those with a general interest in judgment and decision-making or those who want to improve their ability to predict and plan ahead in daily life.

Forlagets beskrivelse: NCRP Report No. 171, Uncertainties in the Estimation of Radiation Risks and Probability of Disease Causation, considers the types and magnitude of the several uncertainties that are a component of the risk assessment process for cancer, heritable and noncancer effects following radiation exposure. These uncertainties can result from the nature of the input data as well as from the specific analysis and models used for developing the risk estimates. Topics addressed in this Report include: (a) uncertainties associated with extrapolation of dose-response relationships observed in primary epidemiological studies to estimate the risk per unit dose (i.e., organ dose or whole-body dose) in the U.S. population and other exposed populations; (b) applications of meta-analyses or pooled analyses to increase the statistical power in evaluating uncertainties in dose-response relationships for exposed human populations; (c) uncertainties associated with extrapolation of dose-response relationships observed for populations exposed to acute doses of high-energy gamma rays to estimate the risk per unit dose in populations exposed to fractionated or low-dose rate chronic exposures; (d) uncertainties associated with extrapolation of the dose-response relationships observed for populations exposed to high-energy gamma rays to estimate the risk per unit dose in populations exposed to low-energy photons, low-energy electrons, alpha particles, and neutrons with various energies; (e) comparison of uncertainties associated with risk estimated for individual tissue or organ sites with the uncertainties associated with estimating risk of all tumors combined due to whole-body exposure; (f) evaluation of opportunities for using additional epidemiological and laboratory-based biological information to modify estimates of uncertainty in risk estimation for cancer, noncancer effects, and severe heritable disorders; (f) procedures for accounting for dose uncertainty in epidemiological dose-response analyses; and (g) evaluation of the combined effect of uncertainty in dose estimation with the uncertainty in estimation of risk per unit dose in estimating the overall risk. This Report also provides a comprehensive analysis of uncertainties on the estimation of probability of radiation-induced disease, including: (1) application of organ doses and associated uncertainties in estimation of probability of disease causation; (2) evaluation of inherent uncertainties in calculating the probability of disease causation (in an individual), or assigned share of excess relative risk for various types of cancer attributable to radiation exposure; and (3) methods of improving existing procedures for estimating disease probability based on input organ doses and their uncertainties. The issue of uncertainty in estimation of radiation-induced risks of cancer, noncancer diseases, and heritable genetic effects analyzed in this Report is of great importance in evaluating the effects of ionizing radiation on human health, in decisions involving the safe use of ionizing radiation and in addressing public controversy. Uncertainty analyses should become increasingly important in the future as the sophisticated methodologies continue to develop and become more available.

Statistical Methods for Estimating the Uncertainty in the Best Basis Inventories

Cost-Effectiveness in Health and Medicine

From Principles to Practice

Influence of Evaporation, Ground Water, and Uncertainty in the Hydrologic Budget of Lake Lucerne, a Seepage Lake in Polk County, Florida

Measurement Uncertainty in Chemical Analysis

Preceded by: Cost-effectiveness in health and medicine / edited by Marthe R. Gold ... [et al.]. New York: Oxford University Press, 1996.

Within the scope of the Accelerator Driven System (ADS) concept for nuclear waste management applications, the burnup uncertainty estimates due to uncertainty in the activation cross sections (XSs) are important regarding both the safety and the efficiency of the waste burning process. We have applied both sensitivity analysis and Monte Carlo methodology to actinides burnup calculations in a lead-bismuth cooled subcritical ADS. The sensitivity analysis is used to identify the reaction XSs and the dominant chains that contribute most significantly to the uncertainty. The Monte Carlo methodology gives the burnup uncertainty estimates due to the synergetic/global effect of the complete set of XS uncertainties. These uncertainty estimates are valuable to assess the need of any experimental or systematic reevaluation of some uncertainty XSs for ADS.

We present a validation process based upon the concept that validation is an inference-making activity. This has always been true, but the association has not been as important before as it is now. Previously, theory had been confirmed by more data, and predictions were possible based on data. The process today is to infer from theory to code and from code to prediction, making the role of prediction somewhat automatic, and a machine function. Validation is defined as determining the degree to which a model and code is an accurate representation of experimental test data. Imbedded in validation is the intention to use the computer code to predict. To predict is to accept the conclusion that an observable final state will manifest; therefore, prediction is an inference whose goodness relies on the validity of the code. Quantifying the uncertainty of a prediction amounts to quantifying the uncertainty of validation, and this involves the characterization of uncertainties inherent in theory/models/codes and the corresponding data. An introduction to inference making and its associated uncertainty is provided as a foundation for the validation problem. A mathematical construction for estimating the uncertainty in the validation inference is then presented, including a possibility distribution constructed to represent the inference uncertainty for validation under uncertainty. The estimation of inference uncertainty for validation is illustrated using data and calculations from Inertial Confinement Fusion (ICF). The ICF measurements of neutron yield and ion temperature were obtained for direct-drive inertial fusion capsules at the Omega laser facility. The glass capsules, containing the fusion gas, were systematically selected with the intent of establishing a reproducible baseline of high-yield 1013-1014 neutron output. The deuterium-tritium ratio in these experiments was varied to study its influence upon yield. This paper on validation inference is the first in a series of inference uncertainty estimations. While the methods demonstrated are primarily statistical, these do not preclude the use of nonprobabilistic methods for uncertainty characterization. The methods presented permit accurate determinations for validation and eventual prediction. It is a goal that these methods establish a standard against which best practice may evolve for determining degree of validation.

Environmental Radiation Data

Uncertainty Quantification in Ocean State Estimation

Measurement Uncertainty in Forensic Science

State Estimation, Planning, and Behavior Selection Under Uncertainty for Autonomous Robotic Exploration in Dynamic Environments

The Effects of Uncertainty in the Time Estimates for PERT

This report is the summary of a workshop conducted by the National Research Council in order to learn from both forecast makers and forecast users about improvements that can be made in understanding the markets for doctoral scientists and engineers. The workshop commissioned papers examined (1) the history and problems with models of demand and supply for scientists and engineers, (2) objectives and approaches to forecasting models, (3) margins of adjustment that have been neglected in models, especially substitution and quality, (4) the presentation of uncertainty, and (5) whether these forecasts of supply and demand are worthwhile, given all their shortcomings. The focus of the report was to provide guidance to the NSF and to scholars in this area on how models and the forecasts derived from them might be improved, and what role NSF should play in their improvement. In addition, the report examined issues of reporting forecasts to policymakers.

The purpose of this book is to introduce researchers and practitioners to recent advances and applications of Monte Carlo Simulation (MCS). Random sampling is the key of the MCS technique. The 11 chapters of this book collectively illustrates how such a sampling technique is exploited to solve difficult problems or analyze complex systems in various engineering and science domains. Issues related to the use of MCS including goodness-of-fit, uncertainty evaluation, variance reduction, optimization, and statistical estimation are discussed and examples of solutions are given. Novel applications of MCS are demonstrated in financial systems modeling, estimation of transition behavior of organic molecules, chemical reaction, particle diffusion, kinetic simulation of biophysics and biological data, and healthcare practices. To enlarge the accessibility of this book, both field-specific background materials and field-specific usages of MCS are introduced in most chapters. The aim of this book is to unify knowledge of MCS from different fields to facilitate research and new applications of MCS.

This document describes the statistical methods used to determine sample-based uncertainty estimates for the Best Basis Inventory (BBI). For each waste phase, the equation for the inventory of an analyte in a tank is Inventory (Kg or Ci) = Concentration x Density x Waste Volume. the total inventory is the sum of the inventories in the different waste phases. Using tanks sample data: statistical methods are used to obtain estimates of the mean concentration of an analyte the density of the waste, and their standard deviations. The volumes of waste in the different phases, and their standard deviations, are estimated based on other types of data. The three estimates are multiplied to obtain the inventory estimate. The standard deviations are combined to obtain a standard deviation of the inventory. The uncertainty estimate for the Best Basis Inventory (BBI) is the approximate 95% confidence interval on the inventory.

1990 Census of Population and Housing

Parameter Estimation and Uncertainty Quantification in Water Resources Modeling

A Practical Guide

Quantifying Uncertainty in Analytical Measurement

Estimation of Uncertainty in the Structurebornesound Power Transmission from Asource to a Receiver

Petroleum exploration and development are capital intensive and smart economic decisions that need to be made to profitably extract oil and gas from the reservoirs. Accurate quantification of uncertainty in production forecasts will help in assessing risk and making good economic decisions. This study investigates the effect of combining dynamic data with the uncertainty in static data to see the effect on estimates of uncertainty in production forecasting. Fifty permeability realizations were generated for a reservoir in west Texas from available petrophysical data. We quantified the uncertainty in the production forecasts using a likelihood weighting method and an automatic history matching technique combined with linear uncertainty analysis. The results were compared with the uncertainty predicted using only static data. We also investigated approaches for best selecting a smaller number of models from a larger set of realizations to be history matched for quantification of uncertainty. We found that incorporating dynamic data in a reservoir model will result in lower estimates of uncertainty than considering only static data. However, incorporation of dynamic data does not guarantee that the forecasted ranges will encompass the true value. Reliability of the forecasted ranges depends on the method employed. When sampling multiple realizations of static data for history matching to quantify uncertainty, a sampling over the entire range of realization likelihoods shows larger confidence intervals and is more likely to encompass the true value for predicted fluid recoveries, as compared to selecting the best models.

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.

Most decisions in life are based on incomplete information and have uncertain consequences. To successfully cope with real-life situations, the nervous system has to estimate, represent and eventually resolve uncertainty at various levels. A common tradeoff in such decisions involves those between the magnitude of the expected rewards and the uncertainty of obtaining the rewards. For instance, a decision maker may choose to forgo the high expected rewards of investing in the stock market and settle instead for the lower expected reward and much less uncertainty of a savings account. Little is known about how different forms of uncertainty, such as risk or ambiguity, are processed and learned about and how they are integrated with expected rewards and individual preferences throughout the decision making process. With this Research Topic we aim to provide a deeper and more detailed understanding of the processes behind decision making under uncertainty.

The Study of Uncertainties in Physical Measurements

Understanding and Avoiding Unrealism in Project Planning and Everyday Life

An Introduction to Uncertainty in Measurement

Report of a Workshop on Methodology

Bayesian Analysis and Uncertainty in Economic Theory

This paper summarizes estimates, compiled in a larger report, of the uncertainty associated with models and parameters used to assess the impact on man radionuclide releases to the environment by breeder reactor facilities. These estimates indicate that, for many sites, generic models and representative parameter values may reasonably be used to calculate doses from annual average radionuclide releases when these calculated doses are on the order of one-tenth or less of a relevant dose limit. For short-term, accidental releases, the uncertainty in the dose calculations may be much larger than an order of magnitude. As a result, it may be necessary to incorporate site-specific information into the dose calculation under such circumstances. However, even using site-specific information, inherent natural variability within human receptors, and the uncertainties in the dose conversion factor will likely result in an overall uncertainty of greater than an order of magnitude for predictions of dose following short-term releases.

Measurement shapes scientific theories, characterises improvements in manufacturing processes and promotes efficient commerce. In concert with measurement is uncertainty, and students in science and engineering need to identify and quantify uncertainties in the measurements they make. This book introduces measurement and uncertainty to second and third year students of science and engineering. Its approach relies on the internationally recognised and recommended guidelines for calculating and expressing uncertainty (known by the acronym GUM). The statistics underpinning the methods are considered and worked examples and exercises are spread throughout the text. Detailed case studies based on typical undergraduate experiments are included to reinforce the principles described in the book. This guide is also useful to professionals in industry who are expected to know the contemporary methods in this increasingly important area. Additional online resources are available to support the book at www.cambridge.org/9780521605793.

This book/disk package provides simple, handy rules and useful algorithms and programs for handling data and estimating errors -- both by graphical and analytic methods. It features unique programs for explicit, immediate use for many different pocket calculators and computers -- e.g., for estimating errors in correctly weighted regression: linear, log, exponential, exponential with counts, and power law fits. Covers: Error Analysis for One Variable; Error Analysis for More than One Variable; Finding Relations between Variables; and Using Trigonometric and Exponential Functions in the Laboratory. Provides an accompanying disk (for MAC and Windows 95) -- with Excel™ worksheets for Data Fits, cT Error Analysis Programs, Pascal, and BASIC programs. Includes error analysis programs for mean, standard deviation for grouped data; weighted and unweighted linear and unweighted linear regression. For scientists and engineers.

Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results (rev. Ed.)

A Systems Engineering Perspective, Second Edition

Estimating Uncertainty in Measurements Made on Materials AP-T79-08

Probability Methods for Cost Uncertainty Analysis

Uncertainties in the Estimation of Radiation Risks and Probability of Disease Causation

Uncertainties are inevitable in any experimental measurement. Therefore, it is essential for science and engineering graduates to design and develop reliable experiments and estimate the uncertainty in the measurements. This book describes the methods and application of uncertainty analysis during the planning, data analysis, and reporting stages of an experiment. This book is aimed at postgraduate and advanced undergraduate students of various branches of science and engineering. The book teaches methods for estimating random and systematic uncertainties and combining them to determine the overall uncertainty in a measurement. In addition, the method for propagating measurement uncertainties in the calculated result is discussed. The book also discusses methods of reducing the uncertainties through proper instrumentation, data acquisition, and experiment planning. This book provides detailed background and assumptions underlying the uncertainty analysis techniques for the reader to understand their applicability. Various solved examples are provided to demonstrate the application of the uncertainty analysis techniques. The exercises at the end of the chapters have been chosen carefully to reinforce the concepts discussed in the text.

No descriptive material is available for this title.

In the courtroom, critical and life-changing decisions are made based on quantitative forensic science data. There is often a range in which a measured value is expected to fall and, in this, an inherent uncertainty associated with such measurement. Uncertainty in this context is not error. In fact, estimations of uncertainty can add to the utility and reliability of quantitative results, be it the length of a firearm barrel, the weight of a drug sample, or the concentration of ethanol in blood. Measurement Uncertainty in Forensic Science: A Practical Guide describes and defines the concepts related to such uncertainty in the forensic context. The book provides the necessary conceptual background and framework—a baseline—for developing and deploying reasonable and defensible uncertainty estimations across forensic disciplines. Information is presented conceptually, using easily understood examples, to provide a readable, handy reference for scientists in the laboratory, as well as investigators and legal professionals who require a basic understanding of the science underpinning measurement results.

Forecasting Demand and Supply of Doctoral Scientists and Engineers

Estimation of Uncertainty for Contour Method Residual Stress Measurements

The Statistics of Scientific and Industrial Measurement

Science and Judgment in Risk Assessment

Uncertainty Estimates for Predictions of the Impact of Breeder-reactor Radionuclide Releases

To make sound investment decisions, decision makers need accurate estimates of the uncertainties present in forecasts of reservoir performance. In this work I propose a method, the integrated mismatch method, that incorporates the misfit in the history match into the estimation of uncertainty in the prediction. I applied the integrated mismatch method, which overcomes some deficiencies of existing methods, to uncertainty estimation in two reservoir studies and compared results to estimations from existing methods. The integrated mismatch method tends to generate smaller ranges of uncertainty than many existing methods. When starting from nonoptimal reservoir models, in some cases the integrated mismatch method is able to bracket the true reserves value while other methods fail to bracket it. The results show that even starting from a nonoptimal reservoir model, but as long as the experimental designs encompass the true case parameters, the integrated mismatch method brackets the true reserves value. If the experimental designs do not encompass all the true case parameters, but the true reserves value is covered by the experiments, the integrated mismatch method may still bracket the true case. This applies if there is a strong correlation between mismatch and closeness to the true reserves value. The integrated mismatch method does not need a large number of simulation runs for the uncertainty analysis, while some other methods need hundreds of runs.

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.

It is now becoming recognized in the measurement community that it is as important to communicate the uncertainty related to a specific measurement as it is to report the measurement itself. Without knowing the uncertainty, it is impossible for the users of the result to know what confidence can be placed in it; it is also impossible to assess the comparability of different measurements of the same parameter. This volume collects 20 outstanding papers on the topic, mostly published from 1999-2002 in the journal "Accreditation and Quality Assurance." They provide the rationale for why it is important to evaluate and report the uncertainty of a result in a consistent manner. They also describe the concept of uncertainty, the methodology for evaluating uncertainty, and the advantages of using suitable reference materials. Finally, the benefits to both the analytical laboratory and the user of the results are considered.

Uncertainty, Calibration and Probability

Recommendations of the National Council on Radiation Protection and Measurements

Theory and Applications of Monte Carlo Simulations

Time Predictions

Data and Error Analysis