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MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 40TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2022

Springer Nature Model Validation and Uncertainty Quantification, Volume 3: Proceedings of the 40th IMAC, A Conference and Exposition on Structural Dynamics, 2022, the third volume of nine from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Model Validation and Uncertainty Quantification, including papers on: Uncertainty Quantification and Propagation in Structural Dynamics Bayesian Analysis for Real-Time Monitoring and Maintenance Uncertainty in Early Stage Design Quantification of Model-Form Uncertainties Fusion of Test and Analysis MVUQ in Action

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 39TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2021

Springer Nature

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 38TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2020

Springer Nature Model Validation and Uncertainty Quantification, Volume 3: Proceedings of the 38th IMAC, A Conference and Exposition on Structural Dynamics, 2020, the third volume of nine from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Model Validation and Uncertainty Quantification, including papers on: Uncertainty Quantification in Material Models Uncertainty Propagation in Structural Dynamics Practical Applications of MVUQ Advances in Model Validation & Uncertainty Quantification: Model Updating Model Validation & Uncertainty Quantification: Industrial Applications Controlling Uncertainty Uncertainty in Early Stage Design Modeling of Musical Instruments Overview of Model Validation and Uncertainty

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 37TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2019

Model Validation and Uncertainty Quantification, Volume 3: Proceedings of the 37th IMAC, A Conference and Exposition on Structural Dynamics, 2019, the third volume of eight from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Model Validation and Uncertainty Quantification, including papers on: Inverse Problems and Uncertainty Quantification Controlling Uncertainty Validation of Models for Operating Environments Model Validation & Uncertainty Quantification: Decision Making Uncertainty Quantification in Structural Dynamics Uncertainty in Early Stage Design Computational and Uncertainty Quantification Tools.

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 35TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2017

Springer Model Validation and Uncertainty Quantification, Volume 3: Proceedings of the 35th IMAC, A Conference and Exposition on Structural Dynamics, 2017, the third volume of ten from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Model Validation and Uncertainty Quantification, including papers on: Uncertainty Quantification in Material Models Uncertainty Propagation in Structural Dynamics Practical Applications of MVUQ Advances in Model Validation & Uncertainty Quantification: Model Updating Model Validation & Uncertainty Quantification: Industrial Applications Controlling Uncertainty Uncertainty in Early Stage Design Modeling of Musical Instruments Overview of Model Validation and Uncertainty

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 36TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2018

Springer Model Validation and Uncertainty Quantification, Volume 3: Proceedings of the 36th IMAC, A Conference and Exposition on Structural Dynamics, 2018, the third volume of nine from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Model Validation and Uncertainty Quantification, including papers on: Uncertainty Quantification in Material Models Uncertainty Propagation in Structural Dynamics Practical Applications of MVUQ Advances in Model Validation & Uncertainty Quantification: Model Updating Model Validation & Uncertainty Quantification: Industrial Applications Controlling Uncertainty Uncertainty in Early Stage Design Modeling of Musical Instruments Overview of Model Validation and Uncertainty

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 34TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2016

Springer Model Validation and Uncertainty Quantifi cation, Volume 3. Proceedings of the 34th IMAC, A Conference and Exposition on Dynamics of Multiphysical Systems: From Active Materials to Vibroacoustics, 2016, the third volume of ten from the Conference brings together contributions to this

important area of research and engineering. Th e collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: • Uncertainty Quantifi cation & Model Validation • Uncertainty Propagation in Structural Dynamics • Bayesian & Markov Chain Monte Carlo Methods • Practical Applications of MVUQ • Advances in MVUQ & Model Updating • Robustness in Design & Validation • Verifi cation & Validation Methods

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 37TH IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS 2019

Springer Model Validation and Uncertainty Quantification, Volume 3: Proceedings of the 37th IMAC, A Conference and Exposition on Structural Dynamics, 2019, the third volume of eight from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Model Validation and Uncertainty Quantification, including papers on: Inverse Problems and Uncertainty Quantification Controlling Uncertainty Validation of Models for Operating Environments Model Validation & Uncertainty Quantification: Decision Making Uncertainty Quantification in Structural Dynamics Uncertainty in Early Stage Design Computational and Uncertainty Quantification Tools

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 33RD IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS, 2015

Springer Model Validation and Uncertainty Quantification, Volume 3. Proceedings of the 33rd IMAC, A Conference and Exposition on Balancing Simulation and Testing, 2015, the third volume of ten from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: Uncertainty Quantification & Model Validation Uncertainty Propagation in Structural Dynamics Bayesian & Markov Chain Monte Carlo Methods Practical Applications of MVUQ Advances in MVUQ & Model Updating

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION, VOLUME 3

PROCEEDINGS OF THE 32ND IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS, 2014

Springer Science & Business Media This third volume of eight from the IMAC - XXXII Conference, brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: Linear Systems Substructure Modelling Adaptive Structures Experimental Techniques Analytical Methods Damage Detection Damping of Materials & Members Modal Parameter Identification Modal Testing Methods System Identification Active Control Modal Parameter Estimation Processing Modal Data

UNCERTAINTY MODELING FOR ENGINEERING APPLICATIONS

Springer This book provides an overview of state-of-the-art uncertainty quantification (UQ) methodologies and applications, and covers a wide range of current research, future challenges and applications in various domains, such as aerospace and mechanical applications, structure health and seismic hazard, electromagnetic energy (its impact on systems and humans) and global environmental state change. Written by leading international experts from different fields, the book demonstrates the unifying property of UQ theme that can be profitably adopted to solve problems of different domains. The collection in one place of different methodologies for different applications has the great value of stimulating the cross-fertilization and alleviate the language barrier among areas sharing a common background of mathematical modeling for problem solution. The book is designed for researchers, professionals and graduate students interested in quantitatively assessing the effects of uncertainties in their fields of application. The contents build upon the workshop “Uncertainty Modeling for Engineering Applications” (UMEMA 2017), held in Torino, Italy in November 2017.

ASSESSING THE RELIABILITY OF COMPLEX MODELS

MATHEMATICAL AND STATISTICAL FOUNDATIONS OF VERIFICATION, VALIDATION, AND UNCERTAINTY QUANTIFICATION

National Academies Press Advances in computing hardware and algorithms have dramatically improved the ability to simulate complex processes computationally. Today's simulation capabilities offer the prospect of addressing questions that in the past could be addressed only by resource-intensive experimentation, if at all. Assessing the Reliability of Complex Models recognizes the ubiquity of uncertainty in computational estimates of reality and the necessity for its quantification. As computational science and engineering have matured, the process of quantifying or bounding uncertainties in a computational estimate of a physical quality of interest has evolved into a small set of interdependent tasks: verification, validation, and uncertainty of quantification (VVUQ). In recognition of the increasing importance of computational simulation and the increasing need to assess uncertainties in computational results, the National Research Council was asked to study the mathematical foundations of VVUQ and to recommend steps that will ultimately lead to improved processes. Assessing the Reliability of Complex Models discusses changes in education of professionals and dissemination of information that should enhance the ability of future VVUQ practitioners to improve and properly apply VVUQ methodologies to difficult problems, enhance the ability of VVUQ customers to understand VVUQ results and use them to make informed decisions, and enhance the ability of all VVUQ stakeholders to communicate with each other. This report is an essential resource for all decision and policy makers in the field, students, stakeholders, UQ experts, and VVUQ educators and practitioners.

UNCERTAINTY IN MECHANICAL ENGINEERING II

Trans Tech Publications Ltd Collection of selected, peer reviewed papers from the 2nd International Conference on Uncertainty in Mechanical Engineering (ICUME 2015), November 19 – 20, 2015, Darmstadt, Germany. The 24 papers are grouped as follows: Chapter 1: Uncertainty in Mechanical Engineering Chapter 2: Uncertainty of Structural Dynamic Improvements in Light Weight Design Chapter 3: Modular Design and Scaling for Reduced Uncertainties in the Design Process Chapter 4: Improved Product Quality by Online Monitoring and Closed-Loop Control of Manufacturing Processes Chapter 5: Uncertainty in High Precision Manufacturing Processes Chapter 6: Modelling Uncertainty Information by Means of Semantics Chapter 7: Uncertainty Quantification Chapter 8: Optimization under Uncertainty Chapter 9: Binary Decisions under Uncertainty

VERIFICATION AND VALIDATION IN SCIENTIFIC COMPUTING

Cambridge University Press Advances in scientific computing have made modelling and simulation an important part of the decision-making process in engineering, science, and public policy. This book provides a comprehensive and systematic development of the basic concepts, principles, and procedures for verification and validation of models and simulations. The emphasis is placed on models that are described by partial differential and integral equations and the simulations that result from their numerical solution. The methods described can be applied to a wide range of technical fields, from the physical sciences, engineering and technology and industry, through to environmental regulations and safety, product and plant safety, financial investing, and governmental regulations. This book will be genuinely welcomed by researchers, practitioners, and decision makers in a broad range of fields, who seek to improve the credibility and reliability of simulation results. It will also be appropriate either for university courses or for independent study.

SENSORS AND INSTRUMENTATION, VOLUME 5

PROCEEDINGS OF THE 33RD IMAC, A CONFERENCE AND EXPOSITION ON STRUCTURAL DYNAMICS, 2015

Springer Model Validation and Uncertainty Quantification, Volume 3. Proceedings of the 33rd IMAC, A Conference and Exposition on Balancing Simulation and Testing, 2015, the third volume of ten from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: Uncertainty Quantification & Model Validation Uncertainty Propagation in Structural Dynamics Bayesian & Markov Chain Monte Carlo Methods Practical Applications of MVUQ Advances in MVUQ & Model Updating

UNCERTAINTY QUANTIFICATION IN MULTISCALE MATERIALS MODELING

Woodhead Publishing Limited Uncertainty Quantification in Multiscale Materials Modeling provides a complete overview of uncertainty quantification (UQ) in computational materials science. It provides practical tools and methods along with examples of their application to problems in materials modeling. UQ methods are applied to various multiscale models ranging from the nanoscale to macroscale. This book presents a thorough synthesis of the state-of-the-art in UQ methods for materials modeling, including Bayesian inference, surrogate modeling, random fields, interval analysis, and sensitivity analysis, providing insight into the unique characteristics of models framed at each scale, as well as common issues in modeling across scales.

HANDBOOK OF UNCERTAINTY QUANTIFICATION

Springer The topic of Uncertainty Quantification (UQ) has witnessed massive developments in response to the promise of achieving risk mitigation through scientific prediction. It has led to the integration of ideas from mathematics, statistics and engineering being used to lend credence to predictive assessments of risk but also to design actions (by engineers, scientists and investors) that are consistent with risk aversion. The objective of this Handbook is to facilitate the dissemination of the forefront of UQ ideas to their audiences. We recognize that these audiences are varied, with interests ranging from theory to application, and from research to development and even execution.

UNCERTAINTY IN ENGINEERING

INTRODUCTION TO METHODS AND APPLICATIONS

Springer Nature

UNCERTAINTY QUANTIFICATION

THEORY, IMPLEMENTATION, AND APPLICATIONS

SIAM The field of uncertainty quantification is evolving rapidly because of increasing emphasis on models that require quantified uncertainties for large-scale applications, novel algorithm development, and new computational architectures that facilitate implementation of these algorithms. Uncertainty Quantification: Theory, Implementation, and Applications provides readers with the basic concepts, theory, and algorithms necessary to quantify input and response uncertainties for simulation models arising in a broad range of disciplines. The book begins with a detailed discussion of applications where uncertainty quantification is critical for both scientific understanding and policy. It then covers concepts from probability and statistics, parameter selection techniques, frequentist and Bayesian model calibration, propagation of uncertainties, quantification of model discrepancy, surrogate model construction, and local and global sensitivity analysis. The author maintains a complementary web page where readers can find data used in the exercises and other supplementary material.

VERIFICATION, VALIDATION AND UNCERTAINTY QUANTIFICATION OF MULTI-PHYSICS MODELING OF NUCLEAR REACTORS

Woodhead Publishing Series in Verification, Validation and Uncertainty Quantification in Multi-Physics Modeling of Nuclear Reactors is a key reference for those tasked with ensuring the credibility and reliability of engineering models and simulations for the nuclear industry and nuclear energy research. Sections discuss simulation challenges and revise key definitions, concepts and terminology. Chapters cover solution verification, the frontier discipline of multi-physics coupling verification, model validation and its applications to single and multi-scale models, and uncertainty quantification. This essential guide will greatly assist engineers, scientists, regulators and students in applying rigorous verification, validation and uncertainty quantification methodologies to the M&S tools used in the industry. The book contains a strong focus on the verification and validation procedures required for the emerging multi-physics M&S tools that have great potential for use in the licensing of new reactors, as well as for power uprating and life extensions of operating reactors. Uniquely--and crucially for nuclear engineers--demonstrates the application of verification, validation and uncertainty methodologies to the modeling and simulation (M&S) of nuclear reactors Equips the reader to develop a rigorously defensible validation process irrespective of the particular M&S tool used Brings the audience up-to-speed on validation methods for traditional M&S tools Extends the discussion to the emerging area of validation of multi-physics and multi-scale nuclear reactor simulations

INDEX TO IEEE PUBLICATIONS

Issues for 1973- cover the entire IEEE technical literature.

EXPERIMENTATION, VALIDATION, AND UNCERTAINTY ANALYSIS FOR ENGINEERS

John Wiley & Sons Helps engineers and scientists assess and manage uncertainty at all stages of experimentation and validation of simulations Fully updated from its previous edition, Experimentation, Validation, and Uncertainty Analysis for Engineers, Fourth Edition includes expanded coverage and new examples of applying the Monte Carlo Method (MCM) in performing uncertainty analyses. Presenting the current, internationally accepted methodology from ISO, ANSI, and ASME standards for propagating uncertainties using both the MCM and the Taylor Series Method (TSM), it provides a logical approach to experimentation and validation through the application of uncertainty analysis in the planning, design, construction, debugging, execution, data analysis, and reporting phases of experimental and validation programs. It also illustrates how to use a spreadsheet approach to apply the MCM and the TSM, based on the authors' experience in applying uncertainty analysis in complex, large-scale testing of real engineering systems. Experimentation, Validation, and Uncertainty Analysis for Engineers, Fourth Edition includes examples throughout, contains end of chapter problems, and is accompanied by the authors' website www.uncertainty-analysis.com. Guides readers through all aspects of experimentation, validation, and uncertainty analysis Emphasizes the use of the Monte Carlo Method in performing uncertainty analysis Includes complete new examples throughout Features workable problems at the end of chapters Experimentation, Validation, and Uncertainty Analysis for Engineers, Fourth Edition is an ideal text and guide for researchers, engineers, and graduate and senior undergraduate students in engineering and science disciplines. Knowledge of the material in this Fourth Edition is a must for those involved in executing or managing experimental programs or validating models and simulations.

MASTERING UNCERTAINTY IN MECHANICAL ENGINEERING

Springer Nature This open access book reports on innovative methods, technologies and strategies for mastering uncertainty in technical systems. Despite the fact that current research on uncertainty is mainly focusing on uncertainty quantification and analysis, this book gives emphasis to innovative ways to master uncertainty in engineering design, production and product usage alike. It gathers authoritative contributions by more than 30 scientists reporting on years of research in the areas of engineering, applied mathematics and law, thus offering a timely, comprehensive and multidisciplinary account of theories and methods for quantifying data, model and structural uncertainty, and of fundamental strategies for mastering uncertainty. It covers key concepts such as robustness, flexibility and resilience in detail. All the described methods, technologies and strategies have been validated with the help of three technical systems, i.e. the Modular Active Spring-Damper System, the Active Air Spring and the 3D Servo Press, which have been in turn developed and tested during more than ten years of cooperative research. Overall, this book offers a timely, practice-oriented reference guide to graduate students, researchers and professionals dealing with uncertainty in the broad field of mechanical engineering.

TOWARDS BAYESIAN MODEL-BASED DEMOGRAPHY

AGENCY, COMPLEXITY AND UNCERTAINTY IN MIGRATION STUDIES

Springer Nature This open access book presents a ground-breaking approach to developing micro-foundations for demography and migration studies. It offers a unique and novel methodology for creating empirically grounded agent-based models of international migration - one of the most uncertain population processes and a top-priority policy area. The book discusses in detail the process of building a simulation model of migration, based on a population of intelligent, cognitive agents, their networks and institutions, all interacting with one another. The proposed model-based approach integrates behavioural and social theory with formal modelling, by embedding the interdisciplinary modelling process within a wider inductive framework based on the Bayesian statistical reasoning. Principles of uncertainty quantification are used to devise innovative computer-based simulations, and to learn

about modelling the simulated individuals and the way they make decisions. The identified knowledge gaps are subsequently filled with information from dedicated laboratory experiments on cognitive aspects of human decision-making under uncertainty. In this way, the models are built iteratively, from the bottom up, filling an important epistemological gap in migration studies, and social sciences more broadly.

MODELLING ASPECTS OF WATER FRAMEWORK DIRECTIVE IMPLEMENTATION

IWA Publishing This book is a concrete outcome from the Harmoni-C

AN INTRODUCTION TO DATA ANALYSIS AND UNCERTAINTY QUANTIFICATION FOR INVERSE PROBLEMS

SIAM Inverse problems are found in many applications, such as medical imaging, engineering, astronomy, and geophysics, among others. To solve an inverse problem is to recover an object from noisy, usually indirect observations. Solutions to inverse problems are subject to many potential sources of error introduced by approximate mathematical models, regularization methods, numerical approximations for efficient computations, noisy data, and limitations in the number of observations; thus it is important to include an assessment of the uncertainties as part of the solution. Such assessment is interdisciplinary by nature, as it requires, in addition to knowledge of the particular application, methods from applied mathematics, probability, and statistics. This book bridges applied mathematics and statistics by providing a basic introduction to probability and statistics for uncertainty quantification in the context of inverse problems, as well as an introduction to statistical regularization of inverse problems. The author covers basic statistical inference, introduces the framework of ill-posed inverse problems, and explains statistical questions that arise in their applications. An Introduction to Data Analysis and Uncertainty Quantification for Inverse Problems÷includes many examples that explain techniques which are useful to address general problems arising in uncertainty quantification, Bayesian and non-Bayesian statistical methods and discussions of their complementary roles, and analysis of a real data set to illustrate the methodology covered throughout the book.

ELICITATION

THE SCIENCE AND ART OF STRUCTURING JUDGEMENT

Springer This book is about elicitation: the facilitation of the quantitative expression of subjective judgement about matters of fact, interacting with subject experts, or about matters of value, interacting with decision makers or stakeholders. It offers an integrated presentation of procedures and processes that allow analysts and experts to think clearly about numbers, particularly the inputs for decision support systems and models. This presentation encompasses research originating in the communities of structured probability elicitation/calibration and multi-criteria decision analysis, often unaware of each other’s developments. Chapters 2 through 9 focus on processes to elicit uncertainty from experts, including the Classical Method for aggregating judgements from multiple experts concerning probability distributions; the issue of validation in the Classical Method; the Sheffield elicitation framework; the IDEA protocol; approaches following the Bayesian perspective; the main elements of structured expert processes for dependence elicitation; and how mathematical methods can incorporate correlations between experts. Chapters 10 through 14 focus on processes to elicit preferences from stakeholders or decision makers, including two chapters on problems under uncertainty (utility functions), and three chapters that address elicitation of preferences independently of, or in absence of, any uncertainty elicitation (value functions and ELECTRE). Two chapters then focus on cross-cutting issues for elicitation of uncertainties and elicitation of preferences: biases and selection of experts. Finally, the last group of chapters illustrates how some of the presented approaches are applied in practice, including a food security case in the UK; expert elicitation in health care decision making; an expert judgement based method to elicit nuclear threat risks in US ports; risk assessment in a pulp and paper manufacturer in the Nordic countries; and elicitation of preferences for crop planning in a Greek region.

UNDERSTANDING RISKS AND UNCERTAINTIES IN ENERGY AND CLIMATE POLICY

MULTIDISCIPLINARY METHODS AND TOOLS FOR A LOW CARBON SOCIETY

Springer This open access book analyzes and seeks to consolidate the use of robust quantitative tools and qualitative methods for the design and assessment of energy and climate policies. In particular, it examines energy and climate policy performance and associated risks, as well as public acceptance and portfolio analysis in climate policy, and presents methods for evaluating the costs and benefits of flexible policy implementation as well as new framings for business and market actors. In turn, it discusses the development of alternative policy pathways and the identification of optimal switching points, drawing on concrete examples to do so. Lastly, it discusses climate change mitigation policies’ implications for the agricultural, food, building, transportation, service and manufacturing sectors.

COMPUTER SIMULATION VALIDATION

FUNDAMENTAL CONCEPTS, METHODOLOGICAL FRAMEWORKS, AND PHILOSOPHICAL PERSPECTIVES

Springer This unique volume introduces and discusses the methods of validating computer simulations in scientific research. The core concepts, strategies, and techniques of validation are explained by an international team of pre-eminent authorities, drawing on expertise from various fields ranging from engineering and the physical sciences to the social sciences and history. The work also offers new and original philosophical perspectives on the validation of simulations. Topics and features: introduces the fundamental concepts and principles related to the validation of computer simulations, and examines philosophical frameworks for thinking about validation; provides an overview of the various strategies and techniques available for validating simulations, as well as the preparatory steps that have to be taken prior to validation; describes commonly used reference points and mathematical frameworks applicable to simulation validation; reviews the legal prescriptions, and the administrative and procedural activities related to simulation validation; presents examples of best practice that demonstrate how methods of validation are applied in various disciplines and with different types of simulation models; covers important practical challenges faced by simulation scientists when applying validation methods and techniques; offers a selection of general philosophical reflections that explore the significance of validation from a broader perspective. This truly interdisciplinary handbook will appeal to a broad audience, from professional scientists spanning all natural and social sciences, to young scholars new to research with computer simulations. Philosophers of science, and methodologists seeking to increase their understanding of simulation validation, will also find much to benefit from in the text.

UNCERTAINTY QUANTIFICATION OF CALCULATED TEMPERATURES FOR THE AGR 3/4 EXPERIMENT

A series of Advanced Gas Reactor (AGR) irradiation experiments are being conducted within the Advanced Reactor Technology (ART) Fuel Development and Qualification Program. The main objectives of the fuel experimental campaign are to provide the necessary data on fuel performance to support fuel process development, qualify a fuel design and fabrication process for normal operation and accident conditions, and support development and validation of fuel performance and fission product transport models and codes (PLN 3636, "Technical Program Plan for INL Advanced Reactor Technologies Technology Development Office/Advanced Gas Reactor Fuel Development and Qualification Program"). The AGR 3/4 test was inserted in the Northeast Flux Trap position in the Advanced Test Reactor (ATR) core at Idaho National Laboratory (INL) in December 2011 and successfully completed irradiation in mid-April 2014, resulting in irradiation of the tristructural isotropic (TRISO) fuel for 369.1 effective full-power days (EFPDs) during approximately 2.4 calendar years. The AGR 3/4 data, including the irradiation data and calculated results, were qualified and stored in the Nuclear Data Management and Analysis System (NDMAS) (Pham 2015). To support the U.S. TRISO fuel performance assessment and to provide data for validation of fuel performance and fission product transport models and codes, the daily as run thermal analysis has been performed separately on each of twelve AGR 3/4 capsules for the entire irradiation as discussed in (ECAR-2807, "AGR 3/4 Daily As Run Thermal Analyses"). The ABAQUS code's finite element based thermal model predicts the daily average volume average (VA) fuel temperature (FT), peak FT, and graphite matrix, sleeve, and sink temperature in each capsule. The JMOCUP simulation codes were also created to perform depletion calculations for the AGR 3/4 experiment (ECAR-2753, "JMOCUP As-Run Daily Physics Depletion Calculation for the AGR 3/4 TRISO Particle Experiment in ATR Northeast Flux Trap"). This depletion analysis provides fast fluence and fission heat rate data for all components (fuel compacts, graphite rings, stainless steel retainer, etc.), which are used as inputs for the thermal analysis codes. The graphite temperatures from thermocouples (TCs) in each capsule were used to calibrate these thermal analysis codes. However, given the high rate of TC failure under the harsh irradiation and thermal conditions in the AGR capsules, the thermal analysis results are very useful in aiding TC data qualification, increasing the confidence in delineating failures of the measuring instruments (TCs) from physical mechanisms that may have shifted the system thermal response (Pham and Einerson 2011).

UNCERTAINTY IN MECHANICAL ENGINEERING

PROCEEDINGS OF THE 4TH INTERNATIONAL CONFERENCE ON UNCERTAINTY IN MECHANICAL ENGINEERING (ICUME 2021), JUNE 7–8, 2021

Springer This open access book reports on methods and technologies to describe, evaluate and control uncertainty in mechanical engineering applications. It brings together contributions by engineers, mathematicians and legal experts, offering a multidisciplinary perspective on the main issues affecting uncertainty throughout the complete system lifetime, which includes process and product planning, development, production and usage. The book is based on the proceedings of the 4th International Conference on Uncertainty in Mechanical Engineering (ICUME 2021), organized by the Collaborative Research Center (CRC) 805 of the TU Darmstadt, and held online on June 7–8, 2021. All in all, it offers a timely resource for researchers, graduate students and practitioners in the field of mechanical engineering, production engineering and engineering optimization.

INFORMATION PROCESSING AND MANAGEMENT OF UNCERTAINTY IN KNOWLEDGE-BASED SYSTEMS

18TH INTERNATIONAL CONFERENCE, IPMU 2020, LISBON, PORTUGAL, JUNE 15–19, 2020, PROCEEDINGS, PART I

Springer Nature This three volume set (CCIS 1237-1239) constitutes the proceedings of the 18th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2020, in June 2020. The conference was scheduled to take place in Lisbon, Portugal, at University of Lisbon, but due to COVID-19 pandemic it was held virtually. The 173 papers were carefully reviewed and selected from 213 submissions. The papers are organized in topical sections: homage to Enrique Ruspini; invited talks; foundations and mathematics; decision making, preferences and votes; optimization and uncertainty; games; real world applications; knowledge processing and creation; machine learning I; machine learning II; XAI; image processing; temporal data processing; text analysis and processing; fuzzy interval analysis; theoretical and applied aspects of imprecise probabilities; similarities in artificial intelligence; belief function theory and its applications; aggregation: theory and practice; aggregation: pre-aggregation functions and other generalizations of monotonicity; aggregation: aggregation of different data structures; fuzzy methods in data mining and knowledge discovery; computational intelligence for logistics and transportation problems; fuzzy implication functions; soft methods in statistics and data analysis; image understanding and explainable AI; fuzzy and generalized quantifier theory; mathematical methods towards dealing with uncertainty in applied sciences; statistical image processing and analysis, with applications in neuroimaging; interval uncertainty; discrete models and computational intelligence; current techniques to model, process and describe time series; mathematical fuzzy logic and graded reasoning models; formal concept analysis, rough sets, general operators and related topics; computational intelligence methods in information modelling, representation and processing.

INTRODUCTION TO ENVIRONMENTAL MODELING

Cambridge University Press This textbook presents the timeless basic physical and mathematical principles and philosophy of environmental modeling to students who need to be taught how to think in a different way than they would for more narrowly-defined engineering or physics problems. Examples come from a range of hydrologic, atmospheric, and geophysical problems.

UNCERTAINTY QUANTIFICATION AND MODEL CALIBRATION

BoD – Books on Demand Uncertainty quantification may appear daunting for practitioners due to its inherent complexity but can be intriguing and rewarding for anyone with mathematical ambitions and genuine concern for modeling quality. Uncertainty quantification is what remains to be done when too much credibility has been invested in deterministic analyses and unwarranted assumptions. Model calibration describes the inverse operation targeting optimal prediction and refers to inference of best uncertain model estimates from experimental calibration data. The limited applicability of most state-of-the-art approaches to many of the large and complex calculations made today makes uncertainty quantification and model calibration major topics open for debate, with rapidly growing interest from both science and technology, addressing subtle questions such as credible predictions of climate heating.

UNCERTAINTY QUANTIFICATION IN LAMINATED COMPOSITES

A META-MODEL BASED APPROACH

CRC Press Over the last few decades, uncertainty quantification in composite materials and structures has gained a lot of attention from the research community as a result of industrial requirements. This book presents computationally efficient uncertainty quantification schemes following meta-model-based approaches for stochasticity in material and geometric parameters of laminated composite structures. Several metamodels have been studied and comparative results have been presented for different static and dynamic responses. Results for sensitivity analyses are provided for a comprehensive coverage of the relative importance of different material and geometric parameters in the global structural responses.

PROCEEDINGS OF THE CONFERENCE ON GEOSTATISTICAL, SENSITIVITY, AND UNCERTAINTY METHODS FOR GROUND-WATER FLOW AND RADIONUCLIDE TRANSPORT MODELING

SAN FRANCISCO, CALIFORNIA, SEPTEMBER 15-17, 1987

Very Good,No Highlights or Markup,all pages are intact.

PRACTICAL BAYESIAN INFERENCE

Cambridge University Press This book introduces the major concepts of probability and statistics, along with the necessary computational tools, for undergraduates and graduate students.

ENERGY RESEARCH ABSTRACTS

UNCERTAINTY QUANTIFICATION OF CALCULATED TEMPERATURES FOR THE AGR-1 EXPERIMENT

This report documents an effort to quantify the uncertainty of the calculated temperature data for the first Advanced Gas Reactor (AGR-1) fuel irradiation experiment conducted in the INL's Advanced Test Reactor (ATR) in support of the Next Generation Nuclear Plant (NGNP) R & D program. Recognizing uncertainties inherent in physics and thermal simulations of the AGR-1 test, the results of the numerical simulations can be used in combination with the statistical analysis methods to improve qualification of measured data. Additionally, the temperature simulation data for AGR tests can be used for validation of the fuel transport and fuel performance simulation models. The crucial roles of the calculated fuel temperatures in ensuring achievement of the AGR experimental program objectives require accurate determination of the model temperature uncertainties. The report is organized into three chapters. Chapter 1 introduces the AGR Fuel Development and Qualification program and provides overviews of AGR-1 measured data, AGR-1 test configuration and test procedure, and thermal simulation. Chapters 2 describes the uncertainty quantification procedure for temperature simulation data of the AGR-1 experiment, namely, (i) identify and quantify uncertainty sources; (ii) perform sensitivity analysis for several thermal test conditions; (iii) use uncertainty propagation to quantify overall response temperature uncertainty. A set of issues associated with modeling uncertainties resulting from the expert assessments are identified. This also includes the experimental design to estimate the main effects and interactions of the important thermal model parameters. Chapter 3 presents the overall uncertainty results for the six AGR-1 capsules. This includes uncertainties for the daily volume-average and peak fuel temperatures, daily average temperatures at TC locations, and time-average volume-average and time-average peak fuel temperatures.

CARDIOVASCULAR MATHEMATICS

MODELING AND SIMULATION OF THE CIRCULATORY SYSTEM

Springer Science & Business Media Mathematical models and numerical simulations can aid the understanding of physiological and pathological processes. This book offers a mathematically sound and up-to-date foundation to the training of researchers and serves as a useful reference for the development of mathematical models and numerical simulation codes.