Final Program and Abstracts

SIAM Conference on
UNCERTAINTY QUANTIFICATION
April 5-8, 2016
SwissTech Convention Center
EPFL Campus
Lausanne, Switzerland

SWISSTECH CONVENTION CENTER

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

This conference is sponsored by the SIAM Activity Group on Uncertainty Quantification (SIAG/UQ) and is co-sponsored by EPFL and MATHICSE.

This conference is being held in cooperation with the American Statistical Association (ASA) and GAMM Activity Group on Uncertainty Quantification (GAMM AG UQ).

The SIAM Activity Group on Uncertainty Quantification (SIAG/UQ) fosters activity and collaboration on all aspects of the effects of uncertainty and error on mathematical descriptions of real phenomena. It seeks to promote the development of theory and methods to describe quantitatively the origin, propagation, and interplay of different sources of error and uncertainty in analysis and predictions of the behavior of complex systems, including biological, chemical, engineering, financial, geophysical, physical and social/political systems. The SIAG/UQ serves to support interactions among mathematicians, statisticians, engineers, and scientists working in the interface of computation, analysis, statistics, and probability.

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Registration Desk

The registration desk is located in the "Campus" Area, 1st Floor of the Swiss Tech Convention Center. Registration is open during the following hours:

Monday, April 4
3:00 PM – 6:00 PM

Tuesday, April 5
7:00 AM – 6:40 PM

Wednesday, April 6
7:30 AM – 6:40 PM

Thursday, April 7
7:30 AM – 6:40 PM

Friday, April 8
7:30 AM – 6:40 PM

Conference Location

All sessions and on-site registration will take place at the SwissTech Convention Center, EPFL Campus.

SwissTech Convention Center
Quartier Nord de l'EPFL
Rte Louis-Favre 2
CH-1024 Ecublens
Lausanne, Switzerland
http://www.tstcc.ch/home/

In the event of any emergency, the general phone number for the SwissTech Convention Center is +41 21 693 42 42. The emergency number in Switzerland is 112.

Hotel Address

Local hotel information is available at http://www.siam.org/meetings/uq16/hotel.php.

Child Care

Requests for child care information should be directed to Nicole Giacomini (nicole.giacomini@meeting-com.ch).

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Funding Agencies

SIAM and the Conference Organizing Committee wish to extend their thanks and appreciation to the U.S. National Science Foundation for its support of this conference.

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The Plenary Session Room is fully equipped with screen and projectors. Presenters requiring special adaptors (other than VGA connection) must provide their own.

All other breakout rooms are equipped with a screen and a data projector. Presenters requiring special adaptors (other than VGA connection) must provide their own.

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Complimentary wireless Internet will be available onsite. Connections will be provided via Wifi Free_STCC1 (or 2 or 3). Passwords will be sent through Mobile by SMS. For international mobile that does not receive SMS in Switzerland, attendees may obtain a voucher at the STCC welcome desk.

Registration Fee Includes

- Attendance at the Scientific Sessions and Poster area
- Business Meeting (open to SIAG/UQ members)
- Certificate of participation
- Coffee breaks according to programme
- Congress Material (with personalized name badge)
- Poster session cocktail

Job Postings

Please check with the registration desk regarding the availability of job postings or visit *http://jobs.siam.org.*

Poster Session and Poster Blitz Information

The poster session is scheduled for Tuesday, April 5 from 6:40 PM – 8:00 PM. Poster presenters are requested to set up their poster material on the provided 95cm wide by 180cm high poster boards in the "Campus" Area, 1st Floor, on Monday, April 4 between 3:00 PM and 6:00 PM, or on Tuesday, April 5 between 7:00 AM and 4:30 PM. Push pins will be provided on site.

All materials must be posted by Tuesday, April 5 at 6:40 PM, the official start time of the session. Posters will remain on display through Friday, April 8. Poster displays must be removed by 6:40 PM. Posters remaining after this time will be discarded

There will be a Poster Blitz on Tuesday afternoon at 5:55 PM – 6:40 PM in Auditorium A.

SIAM Books and Journals

SIAM books are available at a discounted price during the conference. Complimentary copies of journals are also available on site. If a SIAM books representative is not available, orders may be placed according to the instructions on the Titles on Display form.

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SIAM

Comments?

Comments about SIAM meetings are encouraged! Please send to:

Cynthia Phillips, SIAM Vice President for Programs (*vpp@siam.org*).

Get-togethers

Poster Session and Welcome Reception

Tuesday, April 5

6:40 PM – 8:00 PM

Business Meeting
(open to SIAG/UQ members)

Wednesday, April 6

7:15 PM – 8:00 PM

Statement on Inclusiveness

As a professional society, SIAM is committed to providing an inclusive climate that encourages the open expression and exchange of ideas, that is free from all forms of discrimination, harassment, and retaliation, and that is welcoming and comfortable to all members and to those who participate in its activities. In pursuit of that commitment, SIAM is dedicated to the philosophy of equality of opportunity and treatment for all participants regardless of gender, gender identity or expression, sexual orientation, race, color, national or ethnic origin, religion or religious belief, age, marital status, disabilities, veteran status, field of expertise, or any other reason not related to scientific merit. This philosophy extends from SIAM conferences, to its publications, and to its governing structures and bodies. We expect all members of SIAM and participants in SIAM activities to work towards this commitment.

Please Note

The local organizers are not responsible for the safety and security of attendees' computers. Do not leave your laptop computers unattended. Please remember to turn off your cell phones, pagers, etc. during sessions.

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Audio and video recording of presentations at SIAM meetings is prohibited without the written permission of the presenter and SIAM.

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Minitutorials

All minitutorials will take place in Auditorium A.

Tuesday, April 5

10:40 AM - 12:40 PM

MT1 Computer Model Emulators and Rare Event Simulations

Organizer: **Elaine Spiller,** *Marquette University, USA*

2:10 PM - 4:10 PM

MT2 The Worst Case Approach to Uncertainty Quantification

Organizer: **Houman Owhadi,** *California Institute of Technology, USA*

Wednesday, April 6

8:35 AM - 10:35 AM

MT3 High Dimensional Approximation of Parametric PDE's

Organizer: **Albert Cohen**, *Université Pierre et Marie Curie, France*

2:10 PM - 4:10 PM

MT4 Particle and Ensemble Kalman Filters for Data Assimilation and Time Series Analysis

Organizer: **Hans Rudolf Künsch**, *ETH Zürich, Switzerland*

Minitutorials

Thursday, April 7

8:35 AM - 10:35 AM

MT5 Introduction to Quasi-Monte Carlo Methods --
with Application to PDEs with Random Coefficients
Organizer: **Frances Y. Kuo**, *University of New South Wales, Australia*

2:10 PM - 4:10 PM

MT6 High-Dimensional Statistics
Organizer: **Peter Buehlmann,** *ETH Zürich, Switzerland*

Friday, April 8

8:35 AM - 10:35 AM

MT7 Sobol' Indices: An Introduction and Some Recent Results
Organizer: **Art Owen,** *Stanford University, USA*

2:10 PM - 4:10 PM

MT8 Guidelines for Compressive Sensing in UQ
Organizer: **Rachel Ward**, *University of Texas at Austin, USA*

Invited Plenary Speakers

All Invited Plenary Presentations will take place in Auditorium A.

Tuesday, April 5

8:35 AM - 9:20 AM

IP1 Prediction, State Estimation, and
Uncertainty Quantification for Complex Turbulent Systems
Andrew Majda, *Courant Institute of Mathematical Sciences, New York University, USA*

9:25 AM - 10:10 AM

IP2 Sparse Grid Methods in Uncertainty Quantification
Michael Griebel, *Institut für Numerische Simulation, Universität Bonn and Fraunhofer-Institut für Algorithmen und Wissenschaftlich, Germany*

Wednesday, April 6

11:05 AM - 11:50 AM

IP3 Covariance Functions for Space-time Processes and Computer Experiments:
Some Commonalities and Some Differences
Michael Stein, *University of Chicago, USA*

11:55 AM - 12:40 PM

IP4 Reduction of Epistemic Uncertainty in Multifidelity
Simulation-Based Multidisciplinary Design
Wei Chen, *Northwestern University, USA*

Invited Plenary Speakers

All Invited Plenary Presentations will take place in Auditorium A.

Thursday, April 7

11:05 AM - 11:50 AM

IP5 Multi-fidelity Approaches to UQ for PDEs

Max Gunzburger, *Florida State University, USA*

11:55 AM - 12:40 PM

IP6 Uncertainty Quantification in Weather Forecasting

Tilmann Gneiting, *Heidelberg Institute for Theoretical Studies and Karlsruhe Institute of Technology, Germany*

Friday, April 8

11:05 AM - 11:50 AM

IP7 Uncertainty Quantification and Numerical Analysis: Interactions and Synergies

Daniela Calvetti, *Case Western Reserve University, USA*

11:55 AM - 12:40 PM

IP8 Multilevel Monte Carlo Methods

Mike Giles, *University of Oxford, United Kingdom*

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September 20

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October 4

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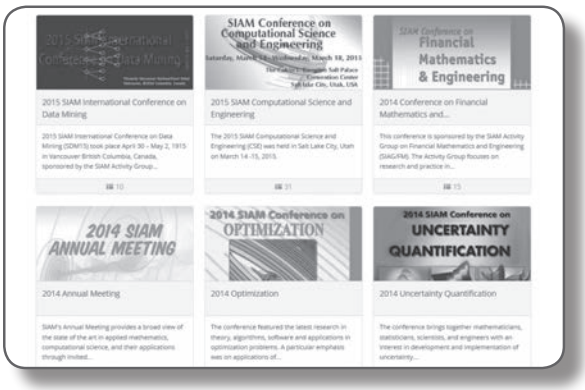

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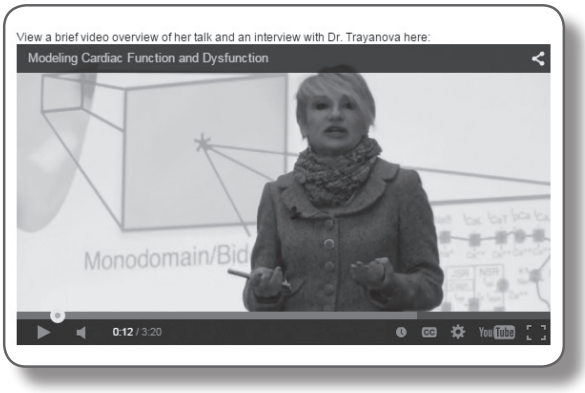

The collection, *Featured Lectures from our Archives,* includes audio and slides from 30 conferences since 2008, including talks by invited and prize speakers, select minisymposia, and minitutorials from the 2014 Annual Meeting, four 2014 SIAG meetings, and six 2015 meetings.

In addition, you can view brief video clips of speaker interviews and topic overviews from sessions at Annual Meetings starting in 2010, as well as the 2013 and 2015 SIAM Conference on Computational Science and Engineering and the 2014 SIAM Conference on the Life Sciences.

Plans for adding more content abound, including presentations from meetings in the geosciences and applied linear algebra.

New presentations are posted every few months as the program expands with sessions from additional SIAM meetings. Users can search for presentations by category, speaker name, and/or key words.

The audio, slide, and video presentations are part of SIAM's outreach activities to increase the public's awareness of mathematics and computational science in the real world, and to bring attention to exciting and valuable work being done in the field. Funding from SIAM, the National Science Foundation, and the Department of Energy was used to partially support this project.

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UQ16 Program

Monday, April 4

Registration

3:00 PM-6:00 PM

Room: "Campus" Area, 1st Floor

Tuesday, April 5

Registration

7:00 AM-6:40 PM

Room: "Campus" Area, 1st Floor

Opening Remarks and Welcome Address by Andreas Mortensen, EPFL Vice Provost for Research

8:20 AM-8:35 AM

Room:Auditorium A

Tuesday, April 5

IP1

Prediction, State Estimation, and Uncertainty Quantification for Complex Turbulent Systems

8:35 AM-9:20 AM

Room:Auditorium A

Chair: Andrew Stuart, University of Warwick, United Kingdom

Complex Turbulent Systems such as those in climate science and engineering turbulence are a grand challenge for prediction, state estimation, and uncertainty quantification (UQ). Such turbulent dynamical systems have an erroneous phase space with a large dimension of instability and crucial extreme events with major societal impact. Monte Carlo statistical predictions for complex turbulent dynamical systems are hampered by severe model error due to the curse of small ensemble size with the overwhelming expense of the forecast model and also due to lack of physical understanding. This lecture surveys recent strategies for prediction, state estimation, and UQ for such complex systems and illustrates them on prototype examples. The novel methods include physics contrained nonlinear regression strategies for low order models, calibration strategies for imperfect models combining information theory and statistical response theory, and novel state estimation algorithms.

Andrew Majda
Courant Institute of Mathematical Sciences, New York University, USA

Tuesday, April 5

IP2

Sparse Grid Methods in Uncertainty Quantification

9:25 AM-10:10 AM

Room:Auditorium A

Chair: Clayton G. Webster, Oak Ridge National Laboratory, USA

In this presentation, we give an overview on generalized sparse grid methods for stochastic and parametric partial differential equations as they arise in various forms in uncertainty quantification. We focus on the efficient approximation and treatment of the stochastic/parametric variables and discuss both, the case of finite and infinite/parametric stochastic dimension. Moreover, we deal with optimal numerical schemes based on sparse grids where also the product between the spatial and temporal variables and the stochastic/parametric variables is collectively taken into account. Overall, we obtain approximation schemes which involve cost complexities that resemble just the cost of the numerical solution of a constant number of plain partial differential equations in space (and time), i.e. without any stochastic/parametric variable. Here, this constant number depends only on the covariance decay of the stochastic fields of the input data of the overall problem.

Michael Griebel
Institut für Numerische Simulation, Universität Bonn and Fraunhofer-Institut für Algorithmen und Wissenschaftlich, Germany

Coffee Break

10:10 AM-10:40 AM

Room: "Campus" Area, 1st Floor

Tuesday, April 5

MT1

Computer Model Emulators and Rare Event Simulations

10:40 AM-12:40 PM

Room:Auditorium A

Chair: Elaine Spiller, Marquette University, USA

"If an unlikely event occurs, it is very likely to occur in the most likely way" (widely attributed to Michael Harrison, but unclaimed). In the case of complex computer models, emulators are an essential tool for an efficient search of state space to identify those "most likely ways" and to enable otherwise intractable rare event simulations. An introduction to this process and several cutting-edge examples will be explored in this tutorial.

Elaine Spiller, Marquette University, USA

Tuesday, April 5

MS1

Matrix Approximation Methods for Large-scale Problems in Data Analysis

10:40 AM-12:40 PM

Room:Garden 1A

Data analysis problems must scale with very large problem size — meaning both millions or billions of points and thousands of features for each point. A key computational bottleneck is the manipulation of large matrices arising in such data analysis problems, especially since these matrices are typically dense. Examples include kernel, covariance, and Hessian matrices. This minisymposium explores algorithmic and theoretical approaches for efficient matrix approximation in a variety of data analysis problems.

Organizer: William March
University of Texas at Austin, USA

Organizer: George Biros
University of Texas at Austin, USA

10:40-11:05 Askit: An Efficient Algorithm for Approximating Large Kernel Matrices
William March, University of Texas at Austin, USA

11:10-11:35 Fast Algorithms for Generating Realisations from High Dimensional Distributions
Sivaram Ambikasaran, International Centre for Theoretical Sciences (TIFR), India; *Krithika Narayanaswamy*, Indian Institute of Technology Madras, India

11:40-12:05 Kernel Methods for Large Scale Data Analysis
Christian Rieger, Universität Bonn, Germany

12:10-12:35 A Robust Parallel Direct Inverse Approximation for Kernel Machine with Applications
Chenhan Yu, University of Texas at Austin, USA

Tuesday, April 5

MS2

Uncertainty Quantification for Climate Modeling - Part I of III

10:40 AM-12:40 PM

Room:Garden 1B

For Part 2 see MS17

In recent years, the quantification of uncertainty in climate model predictions has become of great interest to scientists and policy-makers alike. Uncertainties in climate models result from a variety of sources, e.g., initial or boundary conditions, parameters, forcings, missing physics, observations, and/or numerical approximations. Speakers in this minisymposium will present their work towards developing algorithms for forward (uncertainty propagation) as well as inverse (optimization/Bayesian calibration/inference) uncertainty quantification in climate models. A variety of components of the climate system will be considered, including atmosphere, ocean, land, and ice, in addition to the coupling of one or more of these components.

Organizer: Irina K. Tezaur
Sandia National Laboratories, USA

Organizer: Mauro Perego
Sandia National Laboratories, USA

Organizer: William F. Spotz
Sandia National Laboratories, USA

Organizer: Charles Jackson
University of Texas at Austin, USA

10:40-11:05 Towards Uncertainty Quantification in 21st Century Sea-Level Rise Predictions: PDE Constrained Optimization as a First Step for Accelerating Forward Propagation

Mauro Perego, Sandia National Laboratories, USA; Stephen Price, Los Alamos National Laboratory, USA; Andrew Salinger, Irina K. Tezaur, John D. Jakeman, and Michael S. Eldred, Sandia National Laboratories, USA

continued in next column

11:10-11:35 Towards Uncertainty Quantification in 21st Century Sea-Level Rise Predictions: Efficient Methods for Forward Propagation of Uncertainty Through Land-Ice Models

Irina K. Tezaur, John D. Jakeman, Michael S. Eldred, Mauro Perego, and Andrew Salinger, Sandia National Laboratories, USA; Stephen Price, Los Alamos National Laboratory, USA

11:40-12:05 Accelerating the Calibration of High-Resolution Climate Models

Donald Lucas, Vera Bulaevskaya, and Gemma J. Anderson, Lawrence Livermore National Laboratory, USA

12:10-12:35 Quantifying the Impacts of Parametric Uncertainty on Biogeochemistry in the ACME Land Model

Daniel Ricciuto, Oak Ridge National Laboratory, USA; Khachik Sargsyan, Sandia National Laboratories, USA; Peter Thornton, Oak Ridge National Laboratory, USA

Tuesday, April 5

MS3

Uncertainty Quantification for Hyperbolic and Kinetic Equations - Part I of II

10:40 AM-12:40 PM

Room:Garden 1C

For Part 2 see MS18

Hyperbolic and kinetic equations often contain uncertain parameters due to inaccurate modeling, measurements, or empirical constitutive relations. A proper quantification of these uncertainties is therefore of practical importance to obtain reliable predictions to solutions of such equations. Moreover, the nonlinear nature of these problems poses great challenges in designing and analyzing efficient numerical/computational methods. We will report recent progress of uncertainty quantification for hyperbolic, kinetic, and related problems.

Organizer: Jingwei Hu
Purdue University, USA

Organizer: Shi Jin
Shanghai Jiao Tong University, China, and the University of Wisconsin-Madison, USA

10:40-11:05 Hyperbolic Stochastic Galerkin Methods for Nonlinear Systems of Hyperbolic Conservation Laws

Shi Jin, Shanghai Jiao Tong University, China, and the University of Wisconsin-Madison, USA

11:10-11:35 Robust Boundary Conditions for Stochastic Incompletely Parabolic and Hyperbolic Systems of Equations

Markus K. Wahlsten and Jan Nordström, Linköping University, Sweden

11:40-12:05 MLMC Methods for Computing Measure Valued and Statistical Solutions of Systems of Conservation Laws

Kjetil O. Lye, ETH Zürich, Switzerland

12:10-12:35 A Dynamically Bi-Orthogonal Method for Time-Dependent Stochastic Partial Differential Equation

Zhiwen Zhang, University of Hong Kong, Hong Kong

Tuesday, April 5

MS4

Some Recent Advances for Designs Of Experiments

10:40 AM-12:40 PM

Room:Garden 2A

Extensive use of numerical simulations opens the ways for new types of experimentations: more intensive explorations become possible, better understanding and optimized responses can be achieved. At the same time, complex simulations require long computations, which sets a limitation on what can be learnt in reasonable time. Designs of Experiments aims at defining what should be chosen for the inputs of a numerical model to achieve a prescribed objective. Different types of designs may be relevant according to objectives: regular designs, space-filling strategies, sparse quadrature grids, etc. This session aims at presenting recent advances on the topic.

Organizer: Clémentine Prieur
Université Joseph Fourier and Inria, France

10:40-11:05 Some New Space-Filling Designs for Computer Experiments
Boxin Tang, Simon Fraser University, Canada

11:10-11:35 Recursive Estimation Procedure of Sobol' Indices based on Replicated Designs
Laurent Gilquin, Inria Grenoble, France; Elise Arnaud, Universite Joseph Fourier, France; Hervé Monod, INRA, France; Clémentine Prieur, Université Joseph Fourier and Inria, France

11:40-12:05 Experimental Design Principles in Quadrature for Uncertainty Quantification
Henry P. Wynn, London School of Economics, United Kingdom

12:10-12:35 Generation of Tailor-Made Regular Factorial Designs
Hervé Monod, INRA, France

Tuesday, April 5

MS5

Large-Scale PDE-constrained Bayesian Inverse Problems - Part I of III

10:40 AM-12:40 PM

Room:Garden 2B

For Part 2 see MS20

Large-scale inverse problems are often characterised by a large number of input parameters, and a forward model that is computationally expensive to solve. The focus of this minisymposium is on recent advances in the theory and application of the Bayesian approach to large-scale PDE constrained inverse problems, including well-posedness of the posterior distribution, optimal experimental design, sampling methods such as MCMC, particle methods such as EnKF, and applications in areas such as geophysics, climate modelling, nano optics and electrical impedance tomography.

Organizer: Matthew M. Dunlop
University of Warwick, United Kingdom

Organizer: Marco Iglesias
University of Nottingham, United Kingdom

Organizer: Claudia Schillings
University of Warwick, United Kingdom

Organizer: Aretha L. Teckentrup
University of Warwick, United Kingdom

10:40-11:05 Approximations of Bayesian Inverse Problems Using Gaussian Process Emulators
Aretha L. Teckentrup and Andrew Stuart, University of Warwick, United Kingdom

11:10-11:35 Map Estimators and Their Consistency in Bayesian Inverse Problems for Functions
Masoumeh Dashti, University of Sussex, United Kingdom

11:40-12:05 The Bayesian Formulation of EIT: Analysis and Algorithms
Matthew M. Dunlop and Andrew Stuart, University of Warwick, United Kingdom

12:10-12:35 Maximum a Posteriori Estimates in Bayesian Inverse Problems
Tapio Helin, University of Helsinki, Finland; Martin Burger, University of Muenster, Germany

continued in next column

Tuesday, April 5

MS6

Uncertainty Quantification for Direct and Inverse Problems in Biomedical Applications - Part I of III

10:40 AM-12:40 PM

Room:Garden 2C

For Part 2 see MS21

The ability to perform numerical simulations of complex computational models arising from biomedical and bioengineering applications makes nowadays possible the solution of several identification, data assimilation and inverse problems of practical and clinical interests, also thanks to the large availability of reliable reduced order models. Being able to quantify and potentially reduce uncertainties along the whole simulation pipeline is of crucial importance since variability and uncertainty can arise from multiple sources; some instances are geometric uncertainty, intra- and inter-subject variability, as well as model uncertainty and experimental measurements. The minisymposium addresses such aspects in the context of biomedical applications.

Organizer: Andrea Manzoni
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Luca Dede'
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Toni Lassila
University of Sheffield, United Kingdom

Organizer: Alfio Quarteroni
École Polytechnique Fédérale de Lausanne, Switzerland

10:40-11:05 Impact of Material Parameter Uncertainty on Stress in Patient Specific Models of the Heart
Joakim Sundnes, Simula Research Laboratory, Norway

11:10-11:35 Statistical Inverse Problems with Application to Neurosciences
Laura M. Sangalli, Politecnico di Milano, Italy

11:40-12:05 Stability of and Preconditioners for the Pressure and Velocity Reconstruction Based on Coarse and Noisy Velocity Measurement Such As 4D Phase-Contrast Magnetic Resonance Imaging
Kent-Andre Mardal, University of Oslo, Norway; Magne Nordaas and Simon W. Funke, Simula Research Laboratory, Norway

12:10-12:35 Understanding the Effects of Internal Carotid Artery Flow Uncertainty on Intracranial Aneurysm Haemodynamics: an "In Silico" Study on a Virtual Population
Ali Sarrami-Foroushani, Toni Lassila, and Luigi Y. Di Marco, University of Sheffield, United Kingdom; Arjan J. Geers, University of Edinburgh, United Kingdom; Ali Gooya and Alejandro F. Frangi, University of Sheffield, United Kingdom

continued in next column

Tuesday, April 5

MS7

Inverse Problems and Uncertainty Quantification - Part I of II

10:40 AM-12:40 PM

Room:Garden 3A

For Part 2 see MS22

This minisymposium deals with stochastic inverse problems and their connections to uncertainty quantification. The presentations review classical inverse problems from the standpoint of uncertainty quantification, develop computational tools for tackling Bayesian inverse problems, and introduce new stochastic concepts suitable for the study of inverse problems. Both computational and theoretical aspects of inverse problems and uncertainty quantification are considered.

Organizer: Nuutti Hyvonen
Aalto University, Finland

Organizer: Tapio Helin
University of Helsinki, Finland

10:40-11:05 Statistical Stopping Rules for Iterative Inverse Solvers
Daniela Calvetti, Case Western Reserve University, USA

11:10-11:35 Stochastic Boundary Maps in Eit
Jari Kaipio, University of Auckland, New Zealand

11:40-12:05 Statistical Methods for Pricing and Risk Management of CoCo-bonds
Martin Simon and Tobias Schoden, Deka Investment GmbH, Germany

12:10-12:35 Inverse Boundary Value Problem of Thermal Tomography
Lauri Mustonen, Aalto University, Finland

Tuesday, April 5

MS8

UQ in Turbulence Modelling - Part I of III

10:40 AM-12:40 PM

Room:Garden 3B

For Part 2 see MS23

Simulating turbulence has long been the primary difficultly in predicting the flow of fluids at high Reynolds numbers. Long considered from numerical and physical standpoints, UQ offers an alternative perspective on the problem. This has resulted in recent novel methods such as: Bayesian model error estimates for RaNS; model inadequacy detection with machine learning; stochastic sub grid models for LES; amongst others. This minisymposium will highlight computational and statistical challenges and methods. The goal is to contribute significantly towards improving the predictive capability of CFD.

Organizer: Richard P. Dwight
Delft University of Technology, Netherlands

Organizer: Paola Cinnella
ENSAM, ParisTech, France

10:40-11:05 Review of Uq in Turbulence Modelling to Date
Paola Cinnella, ENSAM, ParisTech, France; Richard P. Dwight and Wouter Edeling, Delft University of Technology, Netherlands

11:10-11:35 A Stochastic Model Inadequacy Representation for a Reynolds-Averaged Burgers' Equation K-Epsilon Model
Bryan W. Reuter, Todd Oliver, and Robert D. Moser, University of Texas at Austin, USA

11:40-12:05 A Practical Method for Estimating Uncertainty Due to Rans Modeling
Wouter Edeling and Richard P. Dwight, Delft University of Technology, Netherlands; Paola Cinnella, ENSAM, ParisTech, France

12:10-12:35 Quantifying Model-Form Uncertainties Using Field Inversion and Machine Learning
Karthik Duraisamy, Stanford University, USA

Tuesday, April 5

MS9

Data Assimilation and Uncertainty Quantification - Part I of II

10:40 AM-12:40 PM

Room:Garden 3C

For Part 2 see MS24

The information used by modern data assimilation techniques is marred with uncertainty due to missing physics in the models, errors in observations, and lack of a complete description of the priors. These uncertainties must be accurately estimated. The aim of the minisymposium is to document the recent strategies for uncertainty analysis. Topics include, but are not limited to, deterministic and statistical data assimilation approaches, uncertainty analysis, and adaptive sensor locations.

Organizer: Razvan Stefanescu
North Carolina State University, USA

Organizer: Adrian Sandu
Virginia Tech, USA

Organizer: Ionel M. Navon
Florida State University, USA

Organizer: Ralph C. Smith
North Carolina State University, USA

Organizer: Dacian N. Daescu
Portland State University, USA

10:40-11:05 Non-smooth Optimization Techniques for Solving a Radiation Data Assimilation Problem
Razvan Stefanescu and Ralph C. Smith, North Carolina State University, USA

11:10-11:35 Space-TimeAdaptive Approach to Variational Data Assimilation Using Wavelets
M. Yousuff Hussaini, Florida State University, USA; Innocent Souopgui, University of Southern Mississippi, USA; Scott Wieland and Oleg V. Vasilyev, University of Colorado Boulder, USA

continued in next column

11:40-12:05 Non Intrusive Polynomial Chaos Using Model Reduction
Ionel M. Navon, Florida State University, USA; Razvan Stefanescu, North Carolina State University, USA

12:10-12:35 Data Assimilation, Parameter Estimation and Rom for Cardiovascular Flows
Gianluigi Rozza, SISSA, International School for Advanced Studies, Trieste, Italy; *Francesco Ballarin*, SISSA-ISAS International School for Advanced Studies, Italy

Tuesday, April 5

MS10

Inverse Problems and Uncertainty Quantification in Subsurface Applications - Part I of II

10:40 AM-12:40 PM

Room:Garden 4A

For Part 2 see MS25

A typical inverse problem in the subsurface involves inferring parameter values from observations that are often sparse and scale-dependent. These intrinsic complications compound the problem of quantifying uncertainty, both predictive and in the inversion. This minisymposium focuses on methods related to recent advancements in the solution of inverse problems within the context of subsurface applications. Focus is placed on: new computational algorithms, both variational and ensemble based; sensitivity analysis; parametric and model uncertainties; and uncertainty quantification through reduced order models.

Organizer: Gowri Srinivasan
Los Alamos National Laboratory, USA

Organizer: Jeffrey Hyman
Los Alamos National Laboratory, USA

Organizer: Larrabee Winter
University of Arizona, USA

10:40-11:05 Using Level-Set Methods to Generate Random Conductivity Fields Conditioned on Data and Desired Statistical and Geometric Characteristics
Larrabee Winter, University of Arizona, USA

11:10-11:35 Fracture Length and Aperture Correlations: Implications for Transport Simulations in Discrete Fracture Networks
Jeffrey Hyman, Los Alamos National Laboratory, USA

11:40-12:05 Decision-Oriented Optimal Experimental Design
Dan O'Malley, Los Alamos National Laboratory, USA

12:10-12:35 Inversion by Conditioning
J. Jaime Gómez-Hernández and *Teng Xu*, Universitat Politècnica de València, Spain

Tuesday, April 5

MS11

Advances in Statistical Design and Scalable Polynomial Approximation of Stochastic Systems - Part I of II

10:40 AM-12:40 PM

Room:Garden 4B

For Part 2 see MS26

This minisymposium focuses on the fundamental problem of how to accurately approximate solutions of both forward and inverse stochastic systems. Modern treatment of predicting the behavior of physical and engineering problems relies on approximating solutions in terms of high dimensional spaces, particularly in the case when the input data are affected by large amounts of uncertainty. In addition, the development of scalable algorithms and solvers are also highly desired for significantly improving the capabilities of solving large-scale UQ problems. This minisymposium aims at exploring breakthroughs in sparse polynomial approximation and interpolation, multilevel methods, design of experiments, and scalable UQ solvers.

Organizer: Guannan Zhang
Oak Ridge National Laboratory, USA

Organizer: Eric Phipps
Sandia National Laboratories, USA

10:40-11:05 A Multilevel Stochastic Collocation Method for Pdes with Random Inputs
Max Gunzburger, Florida State University, USA

11:10-11:35 Embedded Ensemble Propagation for Improving Performance, Portability and Scalability of Uncertainty Quantification on Emerging Computational Architectures
Eric Phipps, Marta D'Elia, H. Carter Edwards, Mark Hoemmen, Jonathan J. Hu, and Siva Rajamanickam, Sandia National Laboratories, USA

continued in next column

11:40-12:05 Ensemble Grouping Strategies for Embedded Stochastic Collocation Methods Applied to Anisotropic Diffusion Problems
Marta D'Elia, H. Carter Edwards, Jonathan J. Hu, Eric Phipps, and Siva Rajamanickam, Sandia National Laboratories, USA

12:10-12:35 A Reduced-Basis Multilevel Method for High-Dimensional Stochastic Systems
Miroslav Stoyanov, Guannan Zhang, and Clayton G. Webster, Oak Ridge National Laboratory, USA

Tuesday, April 5

MS12

Theoretical and Computational Advances in Collocation Approximations for High-Dimensional Problems - Part I of II

10:40 AM-12:40 PM

Room:Garden 4C

For Part 2 see MS27

Many problems in uncertainty quantification rely on robust and efficient collocation approximations to cope with simulations dependent on high-dimensional parameters. Collocation methods are attractive because they are simple, non-intrusive, and are flexible enough to exploit sparsity and smoothness. The current challenges that this minisymposium aims to address involve quasi-optimal distributions, gradient enhancement, robust quadrature, and dimensional scaling. We bring together researchers from across the applied and computational mathematics community to discuss and collaborate on novel theoretical and computational advances in collocation strategies, and to discuss future directions for research.

Organizer: Akil Narayan
University of Utah, USA

Organizer: John D. Jakeman
Sandia National Laboratories, USA

Organizer: Tao Zhou
Chinese Academy of Sciences, China

10:40-11:05 Stochastic Collocation with Multi-Fidelity Models

Xueyu Zhu, Dongbin Xiu, and Akil Narayan, University of Utah, USA

11:10-11:35 Gradient-enhanced ℓ_1-minimization for Stochastic Collocation Approximations

Ling Guo, Shanghai Normal University, China; Tao Zhou, Chinese Academy of Sciences, China; Akil Narayan and Dongbin Xiu, University of Utah, USA

11:40-12:05 Infinite-Dimensional Compressed Sensing and Function Interpolation

Ben Adcock, Simon Fraser University, Canada

12:10-12:35 Stability and Accuracy of the Discrete Least-squares Approximation on Multivariate Polynomial Spaces

Giovanni Migliorati, Université Pierre et Marie Curie, France

continued in next column

Tuesday, April 5

MS13

Reduced Order Modelling for UQ PDEs Problems: Optimization, Control, Data Assimilation - Part I of II

10:40 AM-12:40 PM

Room:Garden 5A

For Part 2 see MS28

We provide a state of the art of reduced order modelling for PDEs with application in forward and inverse UQ problems, such as optimization, control, data assimilation and parameter estimation. Examples of applications are provided in several fields, such as heat and mass transfer, linear elasticity, viscous flows.

Organizer: Gianluigi Rozza
SISSA, International School for Advanced Studies, Trieste, Italy

Organizer: Irina K. Tezaur
Sandia National Laboratories, USA

Organizer: Peng Chen
University of Texas at Austin, USA

10:40-11:05 Nonlinear Reduced-Order Models for Unsteady Compressible Flows

Jeffrey Fike, Irina K. Tezaur, Matthew Barone, Kevin T. Carlberg, Micah Howard, and Srinivasan Arunajatesan, Sandia National Laboratories, USA

11:10-11:35 Sparse Grid, Reduced Basis Bayesian Inversion

Peng Chen, University of Texas at Austin, USA; Christoph Schwab, ETH Zürich, Switzerland

11:40-12:05 Control for Systems with Uncertain Parameters

Boris Kramer, Virginia Tech, USA; Karen E. Willcox and Benjamin Peherstorfer, Massachusetts Institute of Technology, USA

12:10-12:35 Goal-Oriented Nonlinear Model Reduction for Fast Bayesian Inference

Xiao Chen, Charles Tong, Christina Morency, and Joshua White, Lawrence Livermore National Laboratory, USA

Tuesday, April 5

MS14

Fast Solvers and Efficient Linear Algebra for Parameter-dependent PDEs - Part I of II

10:40 AM-12:40 PM

Room:Garden 5B

For Part 2 see MS29

Today, a wide range of approximation schemes is available for solving forward problems associated with PDE models with random inputs (or parameter-dependent PDEs). We mention stochastic collocation, stochastic Galerkin, multi-level and quasi Monte Carlo methods, as well as reduced basis methods. Although there have been recent advances in the analysis of such approximation schemes, the fast solution of the linear systems of equations associated with the discrete problems is still a significant challenge in many applications. This minisymposium is dedicated to recent advances in linear algebra for solving PDEs with random inputs, including iterative methods, preconditioning, low-rank, reduced basis and tensor-based methods.

Organizer: Catherine Powell
University of Manchester, United Kingdom

10:40-11:05 Fast Solvers for Parameter-Dependent Pdes
Catherine Powell, University of Manchester, United Kingdom

11:10-11:35 Low-Rank Tensor Approximations in Reduced Basis Methods and Uncertainty Quantification
Jonas Ballani, EPFL, Switzerland; *Daniel Kressner*, École Polytechnique Fédérale de Lausanne, Switzerland

11:40-12:05 Block-Diagonal Preconditioning for Optimal Control Problems Constrained by PDEs with Uncertain Inputs
Akwum Onwunta, Max Planck Institute, Magdeburg, Germany

12:10-12:35 An Efficient Reduced Basis Solver for Stochastic Galerkin Matrix Equations
David Silvester and Catherine Powell, University of Manchester, United Kingdom; *Valeria Simoncini*, Universita' di Bologna, Italy

Tuesday, April 5

MS15

PDE Constrained Optimization with Uncertain Data - Part I of II

10:40 AM-12:40 PM

Room:Garden 5C

For Part 2 see MS30

The modeling and computational treatment of uncertainty in the data of PDEs has made considerable progress in past 20 years, and more recently uncertainty quantification for more challenging tasks such as the solution of inverse and optimal control problems has received increased attention. This minisymposium will focus on numerical methods for uncertain data in PDE constrained optimization including optimal experimental design.

Organizer: Oliver G. Ernst
Technische Universitat Chemnitz, Germany

Organizer: Roland Herzog
Chemnitz University of Technology, Germany

10:40-11:05 Adaptive Methods for Pde Constrained Optimization with Uncertain Data
Matthias Heinkenschloss, Rice University, USA

11:10-11:35 Stochastic Collocation for Optimal Control with Stochastic Pde Constraints
Robert Kirby, University of Utah, USA; Hanne Tiesler, Fraunhofer MEVIS, Germany; Dongbin Xiu, University of Utah, USA; Tobias Preusser, Fraunhofer MEVIS, Germany

11:40-12:05 Mean-variance Risk-averse Optimal Control of Systems Governed by PDEs with Random Parameter Fields using Quadratic Approximations
Alen Alexanderian, North Carolina State University, USA; Noemi Petra, University of California, Merced, USA; *Georg Stadler*, Courant Institute of Mathematical Sciences, New York University, USA; Omar Ghattas, University of Texas at Austin, USA

continued in next column

12:10-12:35 Low-Rank Solvers for An Unsteady Stokes-Brinkman Optimal Control Problem with Random Data
Martin Stoll, Max Planck Institute, Magdeburg, Germany; Sergey Dolgov, University of Bath, United Kingdom; Peter Benner, Max-Planck-Institute for Dynamics of Complex Technical Systems, Germany; Akwum Onwunta, Max Planck Institute, Magdeburg, Germany

Lunch Break

12:40 PM-2:10 PM

Attendees on their own

Tuesday, April 5

MT2

The Worst Case Approach to Uncertainty Quantification

2:10 PM-4:10 PM

Room:Auditorium A

Chair: Houman Owhadi, California Institute of Technology, USA

"When in doubt, assume the worst!'' says the popular adage. But how do you compute the worst when calculus on a computer is necessarily discrete and finite and the space of admissible scenarios tend to be infinite dimensional? What is the worst, when information comes in the form of data sampled from an unknown distribution? Is there a relation between the worst case approach and the process of computing with partial information and limited resources?

Houman Owhadi, California Institute of Technology, USA

Tuesday, April 5

MS16

Computational Challenges for Gaussian Processes

2:10 PM-4:10 PM

Room:Garden 1A

Gaussian processes are widely used computational models for uncertainties described by random fields, such as space-time indexed random processes. For many applications of interest the resulting covariance matrices are dense and thus take n^2 operations to multiply with vectors and n^3 operations to compute likelihoods associated with them. These trends are untenable for the increasingly large data sets that are modeled with such processes. This minisymposium presents recent work in the area of fast algorithms that aim to alleviate or circumvent some of these challenges on the way of improving the scalability of data analysis and uncertainty quantification computations involving Gaussian processes.

Organizer: Mihai Anitescu
Argonne National Laboratory, USA

Organizer: Michael Stein
University of Chicago, USA

Organizer: Jie Chen
IBM T.J. Watson Research Center, USA

2:10-2:35 Hierarchically Compositional Kernels for Scalable Nonparametric Learning
Jie Chen, IBM T.J. Watson Research Center, USA

2:40-3:05 Generalized Rybicki Press Algorithm in Higher Dimensions
Sivaram Ambikasaran, International Centre for Theoretical Sciences (TIFR), India

3:10-3:35 Fast Spatial Gaussian Process Maximum Likelihood Estimation Via Skeletonization Factorizations
Victor Minden and Anil Damle, Stanford University, USA; Ken Ho, TSMC Technology Inc., Taiwan; Lexing Ying, Stanford University, USA

3:40-4:05 Fitting Gaussian Processes in Ensemble Kalman Filters
Jo Eidsvik, Norwegian University of Science and Technology, Norway

Tuesday, April 5

MS17

Uncertainty Quantification for Climate Modeling - Part II of III

2:10 PM-3:40 PM

Room:Garden 1B

For Part 1 see MS2
For Part 3 see MS32

In recent years, the quantification of uncertainty in climate model predictions has become of great interest to scientists and policy-makers alike. Uncertainties in climate models result from a variety of sources, e.g., initial or boundary conditions, parameters, forcings, missing physics, observations, and/or numerical approximations. Speakers in this minisymposium will present their work towards developing algorithms for forward (uncertainty propagation) as well as inverse (optimization/Bayesian calibration/inference) uncertainty quantification in climate models. A variety of components of the climate system will be considered, including atmosphere, ocean, land, and ice, in addition to the coupling of one or more of these components.

Organizer: Irina K. Tezaur
Sandia National Laboratories, USA

Organizer: Mauro Perego
Sandia National Laboratories, USA

Organizer: William F. Spotz
Sandia National Laboratories, USA

Organizer: Charles Jackson
University of Texas at Austin, USA

2:10-2:35 UQ for the Global Atmosphere Using Concurrent Samples
Bill Spotz, Jeffrey Fike, Irina K. Tezaur, Andrew Salinger, and Eric Phipps, Sandia National Laboratories, USA

2:40-3:05 Dealing with Uncertainties in Global Decadal Ocean State Estimation
Patrick Heimbach, University of Texas at Austin, USA

3:10-3:35 The Importance of Being Uncertain: The Influence of Initial Conditions in Ocean Models
Robin Tokmakian, Naval Postgraduate School, USA; Peter Challenor, University of Exeter, United Kingdom

Tuesday, April 5

MS18

Uncertainty Quantification for Hyperbolic and Kinetic Equations - Part II of II

2:10 PM-4:10 PM

Room:Garden 1C

For Part 1 see MS3

Hyperbolic and kinetic equations often contain uncertain parameters due to inaccurate modeling, measurements, or empirical constitutive relations. A proper quantification of these uncertainties is therefore of practical importance to obtain reliable predictions to solutions of such equations. Moreover, the nonlinear nature of these problems poses great challenges in designing and analyzing efficient numerical/computational methods. We will report recent progress of uncertainty quantification for hyperbolic, kinetic, and related problems.

Organizer: Jingwei Hu
Purdue University, USA

Organizer: Shi Jin
Shanghai Jiao Tong University, China, and the University of Wisconsin-Madison, USA

2:10-2:35 Asymptotic-Preserving Stochastic Galerkin Schemes for the Boltzmann Equation with Uncertainty
Jingwei Hu, Purdue University, USA

2:40-3:05 An Adaptive Hybrid Stochastic Galerkin Method for Uncertainty Quantification for Hyperbolic Problems with Several Random Variables
Ilja Kroeker, University of Stuttgart, Germany

3:10-3:35 Control Problems in Socio-Economic Models with Random Inputs
Lorenzo Pareschi, University of Ferrara, Italy

3:40-4:05 Stochastic Regularity of Observables for High Frequency Waves
Olof Runborg, KTH Stockholm, Sweden

Tuesday, April 5

MS19

Sequential Design of Computer Experiments

2:10 PM-4:10 PM

Room:Garden 2A

Computer simulators can be computationally intensive to run over a large number of input values, as required for optimization and various uncertainty quantification tasks. In design of experiments it is customary to use space-filling designs, e.g. Latin hypercube designs (LHD). Space-filling designs treat all regions of the design space as equally important, but are 'one shot' designs that may waste computations over some unnecessary regions of the input space. This minisymposium is devoted to the presentation of adaptive designs that can efficiently take advantage of information collected during the experimental design process.

Organizer: Serge Guillas
University College London, United Kingdom

Organizer: Joakim Beck
University College London, United Kingdom

2:10-2:35 Combination of Sequential Design and Variable Screening. Application to Uncertainties in the Source of Tsunami Simulations
Joakim Beck, *Serge Guillas*, and Simon Day, University College London, United Kingdom

2:40-3:05 Design for Calibration and History Matching for Complex Simulators
Richard D. Wilkinson, University of Sheffield, United Kingdom

3:10-3:35 Optimal Design for Correlated Processes with Input-Dependent Noise
Alexis Boukouvalas, The University of Manchester, UK

3:40-4:05 Inference for Multi-Model Ensembles: An Application in Glaciology
Derek Bingham, Gwenn Flowers, and Ofir Harari, Simon Fraser University, Canada

Tuesday, April 5

MS20

Large-Scale PDE-constrained Bayesian Inverse Problems - Part II of III

2:10 PM-4:10 PM

Room:Garden 2B

For Part 1 see MS5
For Part 3 see MS35

Large-scale inverse problems are often characterised by a large number of input parameters, and a forward model that is computationally expensive to solve. The focus of this minisymposium is on recent advances in the theory and application of the Bayesian approach to large-scale PDE constrained inverse problems, including well-posedness of the posterior distribution, optimal experimental design, sampling methods such as MCMC, particle methods such as EnKF, and applications in areas such as geophysics, climate modelling, nano optics and electrical impedance tomography.

Organizer: Matthew M. Dunlop
University of Warwick, United Kingdom

Organizer: Marco Iglesias
University of Nottingham, United Kingdom

Organizer: Claudia Schillings
University of Warwick, United Kingdom

Organizer: Aretha L. Teckentrup
University of Warwick, United Kingdom

2:10-2:35 Advances in Dimension-independent Markov Chain Monte Carlo Methods
Kody Law, Oak Ridge National Laboratory, USA; Youssef M. Marzouk and Tiangang Cui, Massachusetts Institute of Technology, USA; David E. Keyes, Hatem Ltaief, and Yuxin Chen, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

continued on next page

2:40-3:05 Metropolis-Hastings Algorithms in Function Space for Bayesian Inference of Groundwater Flow

Björn Sprungk, Technical University of Chemnitz, Germany; Daniel Rudolf, University of Jena, Germany; Oliver G. Ernst, Technische Universitat Chemnitz, Germany

3:10-3:35 Multilevel Sampling Techniques for Bayesian Inference

Robert Scheichl, University of Bath, United Kingdom; Aretha L. Teckentrup, University of Warwick, United Kingdom; Tim Dodwell, University of Bath, United Kingdom; Andrew Stuart, University of Warwick, United Kingdom

3:40-4:05 Optimal Experimental Design for Large-Scale PDE-Constrained Nonlinear Bayesian Inverse Problems

Alen Alexanderian, North Carolina State University, USA; *Omar Ghattas*, University of Texas at Austin, USA; Noemi Petra, University of California, Merced, USA; Georg Stadler, Courant Institute of Mathematical Sciences, New York University, USA

Tuesday, April 5

MS21

Uncertainty Quantification for Direct and Inverse Problems in Biomedical Applications - Part II of III

2:10 PM-4:10 PM

Room:Garden 2C

For Part 1 see MS6
For Part 3 see MS36

The ability to perform numerical simulations of complex computational models arising from biomedical and bioengineering applications makes nowadays possible the solution of several identification, data assimilation and inverse problems of practical and clinical interests, also thanks to the large availability of reliable reduced order models. Being able to quantify and potentially reduce uncertainties along the whole simulation pipeline is of crucial importance since variability and uncertainty can arise from multiple sources; some instances are geometric uncertainty, intra- and inter-subject variability, as well as model uncertainty and experimental measurements.
The minisymposium addresses such aspects in the context of biomedical applications.

Organizer: Andrea Manzoni
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Luca Dede'
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Toni Lassila
University of Sheffield, United Kingdom

Organizer: Alfio Quarteroni
École Polytechnique Fédérale de Lausanne, Switzerland

2:10-2:35 Bayesian Multi-Fidelity Monte Carlo for Uq with Large-Scale Models

Wolfgang A. Wall and Jonas Biehler, Technische Universität München, Germany

2:40-3:05 Data Assimilation and Uncertainty Quantification for Surgery Planning of Single-Ventricle Pathophysiology

Irene Vignon-Clementel, Inria de Paris, France

3:10-3:35 A Reduced-Order Strategy for Efficient State/parameter Identification in Cardiac Electrophysiology

Stefano Pagani, Politecnico di Milano, Italy; Andrea Manzoni and Alfio Quarteroni, École Polytechnique Fédérale de Lausanne, Switzerland

3:40-4:05 A Moment-Matching Method to Study the Variability of Phenomena Described by Complex Models

Eliott Tixier, Jean-Frédéric Gerbeau, and Damiano Lombardi, Inria Paris-Rocquencourt, France

continued in next column

Tuesday, April 5

MS22

Inverse Problems and Uncertainty Quantification - Part II of II

2:10 PM-4:10 PM

Room:Garden 3A

For Part 1 see MS7

This minisymposium deals with stochastic inverse problems and their connections to uncertainty quantification. The presentations review classical inverse problems from the standpoint of uncertainty quantification, develop computational tools for tackling Bayesian inverse problems, and introduce new stochastic concepts suitable for the study of inverse problems. Both computational and theoretical aspects of inverse problems and uncertainty quantification are considered.

Organizer: Nuutti Hyvonen
Aalto University, Finland

Organizer: Tapio Helin
University of Helsinki, Finland

2:10-2:35 Novel Uncertainty Measures for Inverse Problems

Martin Burger, University of Muenster, Germany

2:40-3:05 Convergence Rates for Bayesian Inversion

Hanne Kekkonen, University of Helsinki, Finland

3:10-3:35 Stochastic Inverse Problems with Impulsive Noise

Christian Clason, University of Duisburg-Essen, Germany

3:40-4:05 Stochastic Modulus of a Quadrilateral As a Benchmark Problem for Uncertain Domains

Vesa Kaarnioja, Aalto University, Finland; Harri H. Hakula, Helsinki University of Technology, Finland

Tuesday, April 5

MS23

UQ in Turbulence Modelling - Part II of III

2:10 PM-4:10 PM

Room:Garden 3B

For Part 1 see MS8
For Part 3 see MS38

Simulating turbulence has long been the primary difficultly in predicting the flow of fluids at high Reynolds numbers. Long considered from numerical and physical standpoints, UQ offers an alternative perspective on the problem. This has resulted in recent novel methods such as: Bayesian model error estimates for RaNS; model inadequacy detection with machine learning; stochastic sub grid models for LES; amongst others. This minisymposium will highlight computational and statistical challenges and methods. The goal is to contribute significantly towards improving the predictive capability of CFD.

Organizer: Richard P. Dwight
Delft University of Technology, Netherlands

Organizer: Paola Cinnella
ENSAM, ParisTech, France

2:10-2:35 Machine Learning for Uncertainty Quantification in Turbulent Flow Simulations

Julia Ling and Jeremy Templeton, Sandia National Laboratories, USA

2:40-3:05 Combining Approximate and Exact Bayesian Algorithms to Quantify Model-Form Uncertainties in RANS Simulations

Jianxun Wang, Virginia Tech, USA; Yang Xiu, Pacific Northwest National Laboratory, USA; Jinlong Wu and Heng Xiao, Virginia Tech, USA

3:10-3:35 Quantifying Turbulence Model Form Uncertainty in Rans Simulations of Complex Flow and Scalar Transport

Catherine Gorlé and Z. Hou, Columbia University, USA; Stéphanie Zéoli and Laurent Bricteux, Universite de Mons, Belgium

3:40-4:05 Uncertainty Quantification and Sensitivity Analysis in Large-Eddy Simulations

Lorenzo Siconolfi, Alessandro Mariotti, and *Maria Vittoria Salvetti*, University of Pisa, Italy

continued in next column

Tuesday, April 5

MS24

Data Assimilation and Uncertainty Quantification - Part II of II

2:10 PM-4:10 PM

Room:Garden 3C

For Part 1 see MS9

The information used by modern data assimilation techniques is marred with uncertainty due to missing physics in the models, errors in observations, and lack of a complete description of the priors. These uncertainties must be accurately estimated. The aim of the minisymposium is to document the recent strategies for uncertainty analysis. Topics include, but are not limited to, deterministic and statistical data assimilation approaches, uncertainty analysis, and adaptive sensor locations.

Organizer: Razvan Stefanescu
North Carolina State University, USA

Organizer: Adrian Sandu
Virginia Tech, USA

Organizer: Ionel M. Navon
Florida State University, USA

Organizer: Ralph C. Smith
North Carolina State University, USA

Organizer: Dacian N. Daescu
Portland State University, USA

2:10-2:35 Estimation of Covariance Matrices in Ensemble Kalman Filtering

Adrian Sandu, Elias Nino, and Xinwei Deng, Virginia Tech, USA

2:40-3:05 Use of Difference-Based Methods to Determine Statistical Models in Inverse Problems

H. T. Banks, North Carolina State University, USA

continued in next column

3:10-3:35 A Limited Memory Multiple Shooting Approach for Weakly Constrained Data Assimilation

Wanting Xu, University of Chicago, USA; Mihai Anitescu, Argonne National Laboratory, USA

3:40-4:05 The Intrinsic Dimension of Importance Sampling

Daniel Sanz-Alonso and Sergios Agapiou, University of Warwick, United Kingdom; Omiros Papaspiliopoulos, Universitat Pompeu Fabra, Spain; Andrew Stuart, University of Warwick, United Kingdom

Tuesday, April 5

MS25

Inverse Problems and Uncertainty Quantification in Subsurface Applications - Part II of II

2:10 PM-4:10 PM

Room:Garden 4A

For Part 1 see MS10

A typical inverse problem in the subsurface involves inferring parameter values from observations that are often sparse and scale-dependent. These intrinsic complications compound the problem of quantifying uncertainty, both predictive and in the inversion. This minisymposium focuses on methods related to recent advancements in the solution of inverse problems within the context of subsurface applications. Focus is placed on: new computational algorithms, both variational and ensemble based; sensitivity analysis; parametric and model uncertainties; and uncertainty quantification through reduced order models.

Organizer: Gowri Srinivasan
Los Alamos National Laboratory, USA

Organizer: Jeffrey Hyman
Los Alamos National Laboratory, USA

Organizer: Larrabee Winter
University of Arizona, USA

2:10-2:35 Data Dimension Reduction for Seismic Inversion

Gowri Srinivasan, Los Alamos National Laboratory, USA

2:40-3:05 Determining the Mechanisms That Result in Hydraulic Fracturing Production Decline Using Inverse Methods and Uncertainty Quantification

Hari Viswanathan, Los Alamos National Laboratory, USA

3:10-3:35 Preliminary Analysis of Sampling Methods with Geological Prior Models for Solving Inverse Problems

Christoph Jaeggli, Julien Straubhaar, and Philippe Renard, Universite de Neuchatel, Switzerland

3:40-4:05 Prediction Uncertainty for Solute Transport in Fractured Rock: From Theory to Experiments

Vladimir Cvetkovic, Royal Institute of Technology, Sweden

Tuesday, April 5

MS26

Advances in Statistical Design and Scalable Polynomial Approximation of Stochastic Systems - Part II of II

2:10 PM-4:10 PM

Room:Garden 4B

For Part 1 see MS11

This minisymposium focuses on the fundamental problem of how to accurately approximate solutions of both forward and inverse stochastic systems. Modern treatment of predicting the behavior of physical and engineering problems relies on approximating solutions in terms of high dimensional spaces, particularly in the case when the input data are affected by large amounts of uncertainty. In addition, the development of scalable algorithms and solvers are also highly desired for significantly improving the capabilities of solving large-scale UQ problems. This minisymposium aims at exploring breakthroughs in sparse polynomial approximation and interpolation, multilevel methods, design of experiments, and scalable UQ solvers.

Organizer: Guannan Zhang
Oak Ridge National Laboratory, USA

Organizer: Eric Phipps
Sandia National Laboratories, USA

2:10-2:35 Kennedy-O'Hagan Model with Calibration Parameters: Parameter Identifiability, Estimation Consistency and Efficiency

C. F. Jeff Wu, Georgia Institute of Technology, USA; Rui Tuo, Oak Ridge National Laboratory, USA

2:40-3:05 Experimental Design-based Methods for Simulating Probability Distributions

Roshan Vengazhiyil, Georgia Institute of Technology, USA

continued in next column

3:10-3:35 An Empirical Interpolation Method for a Class of Quasilinear PDEs with Random Input Data

Guannan Zhang, Oak Ridge National Laboratory, USA; Weidong Zhao, Shandong University, China

3:40-4:05 Impact of Spectral Sampling Techniques on Surrogate Modeling

Bhavya Kailkhura, Syracuse University, USA; *Jayaraman J. Thiagarajan* and Peer-Timo Bremer, Lawrence Livermore National Laboratory, USA; Pramod Varshney, Syracuse University, USA

Tuesday, April 5

MS27

Theoretical and Computational Advances in Collocation Approximations for High-Dimensional Problems - Part II of II

2:10 PM-4:10 PM

Room:Garden 4C

For Part 1 see MS12

Many problems in uncertainty quantification rely on robust and efficient collocation approximations to cope with simulations dependent on high-dimensional parameters. Collocation methods are attractive because they are simple, non-intrusive, and are flexible enough to exploit sparsity and smoothness. The current challenges that this minisymposium aims to address involve quasi-optimal distributions, gradient enhancement, robust quadrature, and dimensional scaling. We bring together researchers from across the applied and computational mathematics community to discuss and collaborate on novel theoretical and computational advances in collocation strategies, and to discuss future directions for research.

Organizer: Akil Narayan
University of Utah, USA

Organizer: John D. Jakeman
Sandia National Laboratories, USA

Organizer: Tao Zhou
Chinese Academy of Sciences, China

2:10-2:35 Sparse Polynomial Chaos Expansions Via Weighted L1-Minimization

Alireza Doostan, Ji Peng, and *Jerrad Hampton*, University of Colorado Boulder, USA

continued on next page

2:40-3:05 Quasi-Optimal Points Selection for Radial Basis Function Interpolation and Its Application to UQ

Liang Yan, Southeast University, China; Akil Narayan, University of Utah, USA; Tao Zhou, Chinese Academy of Sciences, China

3:10-3:35 Error Bounds for Regularized Least-squares Regression on Finite-dimensional Function Spaces

Bastian Bohn, Universitaet Bonn, Germany; Michael Griebel, Institut für Numerische Simulation, Universität Bonn and Fraunhofer-Institut für Algorithmen und Wissenschaftlich, Germany

3:40-4:05 Estimate of the Lebesgue Constant of Weighted Leja Sequence on Unbounded Domain

Peter Jantsch, University of Tennessee, USA

Tuesday, April 5

MS28

Reduced Order Modelling for UQ PDEs Problems: Optimization, Control, Data Assimilation - Part II of II

2:10 PM-4:10 PM

Room:Garden 5A

For Part 1 see MS13

We provide a state of the art of reduced order modelling for PDEs with application in forward and inverse UQ problems, such as optimization, control, data assimilation and parameter estimation. Examples of applications are provided in several fields, such as heat and mass transfer, linear elasticity, viscous flows.

Organizer: Gianluigi Rozza
SISSA, International School for Advanced Studies, Trieste, Italy

Organizer: Irina K. Tezaur
Sandia National Laboratories, USA

Organizer: Peng Chen
University of Texas at Austin, USA

2:10-2:35 Rom for Uq Control Problems

Gianluigi Rozza, SISSA, International School for Advanced Studies, Trieste, Italy; Peng Chen, University of Texas at Austin, USA

2:40-3:05 Joint Model and Parameter Dimension Reduction for Bayesian Inversion Applied to An Ice Sheet Problem

Noemi Petra, University of California, Merced, USA; Tiangang Cui, Massachusetts Institute of Technology, USA; Omar Ghattas, University of Texas at Austin, USA; Youssef M. Marzouk, Benjamin Peherstorfer, and Karen E. Willcox, Massachusetts Institute of Technology, USA

3:10-3:35 Weakly Intrusive Low-rank Methods for Model Order Reduction

Loic Giraldi, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Anthony Nouy, Ecole Centrale de Nantes, France

3:40-4:05 Projection Based Model Order Reduction for the Estimation of Vector-valued Variable of Interest

Olivier Zahm, Marie Billaud-Friess, and Anthony Nouy, Ecole Centrale de Nantes, France

Tuesday, April 5

MS29

Fast Solvers and Efficient Linear Algebra for Parameter-dependent PDEs - Part II of II

2:10 PM-4:10 PM

Room:Garden 5B

For Part 1 see MS14

Today, a wide range of approximation schemes is available for solving forward problems associated with PDE models with random inputs (or parameter-dependent PDEs). We mention stochastic collocation, stochastic Galerkin, multi-level and quasi Monte Carlo methods, as well as reduced basis methods. Although there have been recent advances in the analysis of such approximation schemes, the fast solution of the linear systems of equations associated with the discrete problems is still a significant challenge in many applications. This minisymposium is dedicated to recent advances in linear algebra for solving PDEs with random inputs, including iterative methods, preconditioning, low-rank, reduced basis and tensor-based methods.

Organizer: Catherine Powell
University of Manchester, United Kingdom

2:10-2:35 Balanced Iterative Solvers for Linear Systems Arising from Finite Element Approximation of PDEs

Pranjal Pranjal, University of Manchester, United Kingdom

2:40-3:05 Explicit Cost Bounds of Stochastic Galerkin Approximations for Parameterized Pdes with Random Coefficients

Nick Dexter, University of Tennessee, USA; Clayton G. Webster and Guannan Zhang, Oak Ridge National Laboratory, USA

continued on next page

Tuesday, April 5

MS29

Fast Solvers and Efficient Linear Algebra for Parameter-dependent PDEs - Part II of II

2:10 PM-4:10 PM

continued

3:10-3:35 Solving Log-Transformed Random Diffusion Problems by Stochastic Galerkin Mixed Finite Element Methods

Elisabeth Ullmann, Technische Universität München, Germany; Catherine Powell, University of Manchester, United Kingdom

3:40-4:05 Hydrodynamic Stability and UQ

David Silvester, University of Manchester, United Kingdom

Tuesday, April 5

MS30

PDE Constrained Optimization with Uncertain Data - Part II of II

2:10 PM-3:40 PM

Room:Garden 5C

For Part 1 see MS15

The modeling and computational treatment of uncertainty in the data of PDEs has made considerable progress in past 20 years, and more recently uncertainty quantification for more challenging tasks such as the solution of inverse and optimal control problems has received increased attention. This minisymposium will focus on numerical methods for uncertain data in PDE constrained optimization including optimal experimental design.

Organizer: Oliver G. Ernst
Technische Universitat Chemnitz, Germany

Organizer: Roland Herzog
Chemnitz University of Technology, Germany

2:10-2:35 Shape Optimization for Quadratic Functionals and States with Random Right-Hand Sides

Charles Dapogny, Université Joseph Fourier, France; Marc Dambrine, Universite de Pau et des Pays de l'Adour, France; *Helmut Harbrecht*, Universität Basel, Switzerland

2:40-3:05 Shape Optimization with Uncertain Data

Volker H. Schulz, University of Trier, Germany; Claudia Schillings, University of Warwick, United Kingdom

3:10-3:35 Non Parametric Calibration of Lévy Processes Via Kolmogorov's Forward and Backward Equation

Hanno Gottschalk, University of Wuppertal, Germany

Coffee Break

4:10 PM-4:30 PM

Room: "Campus" Area, 1st Floor

Tuesday, April 5

CP1

Solving Intrusive Polynomial Chaos Problems

4:30 PM-5:50 PM

Room:Garden 1A

Chair: Harri H. Hakula, Helsinki University of Technology, Finland

4:30-4:45 On Efficient Construction of Stochastic Moment Matrices

Harri H. Hakula, Helsinki University of Technology, Finland; Matti Leinonen, Aalto University, Finland

4:50-5:05 Iterative Solution of Random Eigenvalue Problem in An Ssfem Framework

Soumyadipta Sarkar and Debraj Ghosh, Indian Institute of Science, Bangalore, India

5:10-5:25 Uncertainty Quantification of High-Dimensional Stochastic Systems Using Two-Level Domain Decomposition Algorithms

Abhijit Sarkar, *Ajit Desai*, and Mohammad Khalil, Carleton University, Canada; Chris Pettit, United States Naval Academy, USA; Dominique Poirel, Royal Military College, Canada

5:30-5:45 An Adaptive Algorithm for Stochastic Optimal Control Problems based on Intrusive Polynomial Chaos

Lilli Bergner, Heidelberg University, Germany; Christian Kirches, University of Heidelberg, Germany

Tuesday, April 5

CP2

UQ in Life Science

4:30 PM-5:50 PM

Room:Garden 1B

Chair: Nicholas Tarabelloni, Politecnico di Milano, Italy

4:30-4:45 Selection and Validation of Models of Tumor Growth in the Presence of Uncertainty

Ernesto A B F Lima, Marissa N Rylander, Amir Shahmoradi, Danial Faghihi, and J Tinsley Oden, University of Texas at Austin, USA

4:50-5:05 Statistical Assessment and Calibration of Ecg Models

Nicholas Tarabelloni, Politecnico di Milano, Italy; Elisa Schenone, University of Luxembourg, Luxembourg; Annabelle Collin, Universite de Bordeaux I, France; Francesca Ieva, University of Milan, Italy; Anna Paganoni, Politecnico di Milano, Italy; Jean-Frédéric Gerbeau, Inria Paris-Rocquencourt, France

5:10-5:25 Modeling the Expected Time to Reach the Recognition Element in Nanopore Dna Sequencing

Benjamin Stadlbauer, Andreas Buttinger-Kreuzhuber, Gregor Mitscha-Eibl, and Clemens Heitzinger, Vienna University of Technology, Austria

5:30-5:45 Dna Pattern Recognition Using Canonical Correlation Analysis

Bimal K. Sarkar, Galgotias University, India

Tuesday, April 5

CP3

Surrogate Models

4:30 PM-5:30 PM

Room:Garden 1C

Chair: Nathan Owen, University of Exeter, United Kingdom

4:30-4:45 Comparison of Surrogate-Based Uncertainty Quantification Methods for Computationally Expensive Simulators

Nathan Owen, Peter Challenor, and Prathyush Menon, University of Exeter, United Kingdom

4:50-5:05 Simplification of Uncertain System to Their Approximate Model

Amit Kumar Choudhary and Shyam Krishna Nagar, Indian Institute of Technology (Banaras Hindu University), India

5:10-5:25 Randomized Cross Validation

Maria-Joao Rendas and Li You, CNRS, France

Tuesday, April 5

CP4

Cross Validation and Computer Experimental Design – SESSION CANCELLED

Tuesday, April 5

CP5

Sensitivity Analysis

4:30 PM-5:30 PM

Room:Garden 2B

Chair: Oleksiy V. Klymenko, Imperial College London, United Kingdom

4:30-4:45 Sensitivity Analysis with Dependence Measures for Spatio-Temporal Numerical Simulators
Amandine Marrel and Matthias De Lozzo, CEA, France; Fadji Hassane Mamadou, Université de Strasbourg, France; Olivier Bildstein, CEA, France; Philippe Ackerer, Université de Strasbourg, France

4:50-5:05 Sobol' Indices for Problems Defined in Non-Rectangular Domains
Oleksiy V. Klymenko, Sergei Kucherenko, and Cleo Kontoravdi, Imperial College London, United Kingdom

5:10-5:25 Uncertainty Quantification and Sensitivity Analysis for Functional System Response, with An Application to Flyer Plate Experiments
Hua Chen, Haibing Zhou, and Shudao Zhang, Institute of Applied Physics and Computational Mathematics, China

Tuesday, April 5

CP6

Sampling and Bayesian Inference

4:30 PM-5:30 PM

Room:Garden 2C

Chair: Michael D. Shields, Johns Hopkins University, USA

4:30-4:45 A Bayesian Inference and Importance Sampling Approach to Propagation of Uncertain Probability Distributions
Michael D. Shields and Jiaxin Zhang, Johns Hopkins University, USA

4:50-5:05 Accuracy in Effect Size Estimation for Iid Observations
Francis Bilson Darku, University of Texas at Dallas, USA; Ken Kelly, University of Notre Dame, USA; Bhargab Chattopadhyay, University of Texas at Dallas, USA

5:10-5:25 Multidimensional Time Model for Probability Cumulative Function
Michael Fundator, National Academy of Sciences, USA

Tuesday, April 5

CP7

Generalized Polynomial Chaos

4:30 PM-5:50 PM

Room:Garden 3A

Chair: Bruno Despres, University of Paris VI, France

4:30-4:45 Propagation of Uncertainties for Hyperbolic Equations
Bruno Despres, University of Paris VI, France

4:50-5:05 Some a Priori Error Estimates of Stochastic Galerkin Approximations for Randomly Parameterized ODEs
Christophe Audouze and Prasanth B. Nair, University of Toronto, Canada

5:10-5:25 Level Set Methods for Polynomial Chaos Expansion of Stochastic PDEs Outputs
Pierre Sochala, BRGM, France; Olivier P. Le Maître, LIMSI-CNRS, France

5:30-5:45 Generalised Anova for the Solution of Stochastic Partial Differential Equations
Souvik Chakraborty and Rajib Chowdhury, Indian Institute of Technology Roorkee, India

Tuesday, April 5

CP8

Inverse Problems and Confidence Bounds

4:30 PM-5:50 PM

Room:Garden 3B

Chair: Mikael Kuusela, École Polytechnique Fédérale de Lausanne, Switzerland

4:30-4:45 Empirical Evolution Equations

Susan Wei, University of Minnesota, USA; Victor M. Panaretos, EPFL, Switzerland

4:50-5:05 Shape-Constrained Uncertainty Quantification in Unfolding Elementary Particle Spectra at the Large Hadron Collider

Mikael Kuusela, École Polytechnique Fédérale de Lausanne, Switzerland; Philip B. Stark, University of California, Berkeley, USA

5:10-5:25 Bayesian Parameter Inference with Stochastic Differential Equation Models

Carlo Albert, Eawag, Switzerland; Simone Ulzega, Swiss Federal Institute of Aquatic Science and Technology, Switzerland

5:30-5:45 Residuals in Inverse Problems and Model Form Uncertainty Quantification

Ben G. Fitzpatrick, Tempest Technologies LLC, USA

Tuesday, April 5

CP9

Inverse Problems and UQ in Electromagnetics

4:30 PM-5:50 PM

Room:Garden 3C

Chair: Pierre Minvielle-Larrousse, CEA/CESTA, France

4:30-4:45 Quantifying the Degradation in Thermally Treated Ceramic Matrix Composites

Jared Catenacci and H. T. Banks, North Carolina State University, USA

4:50-5:05 Characterizing Uncertainties in Photoacoustic Tomography

Sarah Vallelian, North Carolina State University, USA; Kui Ren, University of Texas at Austin, USA

5:10-5:25 A Bayesian Inversion Approach to Controlled-Source Electromagnetic Imaging

Dimitris Kamilis and Nick Polydorides, University of Edinburgh, United Kingdom

5:30-5:45 Spatial Prediction for Quantification of Radar Cross Section Measurement Uncertainty

Pierre Minvielle-Larrousse, CEA/CESTA, France; Jean DeKat, CEA, France; Bruno Stupfel, CEA/CESTA, France

Tuesday, April 5

CP10

UQ in Applications

4:30 PM-5:50 PM

Room:Garden 4A

Chair: Demet Cilden, Istanbul Technical University, Turkey

4:30-4:45 Quantifying Sources of Variability in Planing Hull Experiments

Margaret C. Nikolov and Carolyn Judge, United States Naval Academy, USA

4:50-5:05 Study of Detonation Computer Model Calibration with Approximate Bayesian Computing

Yan-Jin Wang, Institute of Applied Physics and Computational Mathematics, China

5:10-5:25 Attitude Determination and Uncertainty Analysis in Eclipse of Small Leo Satellites

Demet Cilden and Chingiz Hajiyev, Istanbul Technical University, Turkey

5:30-5:45 Performance Tuning of Next-Generation Sequencing Assembly Via Gaussian Process Model with Branching and Nested Factors

Ray-Bing Chen, Xinjie Chen, and Shuen-Lin Jeng, National Cheng Kung University, Taiwan

Tuesday, April 5

CP11

UQ in Electronic Applications

4:30 PM-5:30 PM

Room:Garden 4B

Chair: Gudmund Pammer, Vienna University of Technology, Austria

4:30-4:45 Non-Intrusive Stochastic Galerkin Method for the Stochastic Nonlinear Poisson-Boltzmann Equation

Gudmund Pammer and Clemens Heitzinger, Vienna University of Technology, Austria

4:50-5:05 Optimal Method for Calculating Solutions of the Stochastic Drift-Diffusion-Poisson System

Leila Taghizadeh and Clemens Heitzinger, Vienna University of Technology, Austria

5:10-5:25 Stochastic Modeling of Dopant Atoms in Nanoscale Transistors Using Multi-Level Monte Carlo

Amirreza Khodadadian, Leila Taghizadeh, and Clemens Heitzinger, Vienna University of Technology, Austria

Tuesday, April 5

CP12

Kriging, Stochastic Methods and Data Analysis

4:30 PM-5:50 PM

Room:Garden 4C

Chair: Dana Sylvan, California State University, Dominguez Hills, USA

4:30-4:45 A Low Rank Kriging for Large Spatial Data Sets

Siddhartha Nandy, Michigan State University, USA

4:50-5:05 Using Stochastic Estimation for Selective Inversion of Sparse Matrices

Fabio Verbosio, Università della Svizzera italiana, Switzerland; Matthias Bollhöfer, TU Braunschweig, Germany; Olaf Schenk and Drosos Kourounis, Università della Svizzera italiana, Switzerland

5:10-5:25 The Utility of Quantile Regression in Large Scale Disaster Research

Katarzyna Wyka, City University of New York, USA; Dana Sylvan, California State University, Dominguez Hills, USA; JoAnn Difede, Weill Cornell Medical College, Cornell University, USA

5:30-5:45 The "Spatial Boxplot": a Comprehensive Exploratory Tool for Spatial Data

Dana Sylvan, California State University, Dominguez Hills, USA

Tuesday, April 5

CP13

UQ and Optimization Methods in Material Science

4:30 PM-5:30 PM

Room:Garden 5A

Chair: Manav Vohra, Duke University, USA

4:30-4:45 Surrogate Based Inference of Atomic Diffusivity in Metallic Multilayers

Manav Vohra and Omar M. Knio, Duke University, USA

4:50-5:05 Estimating Uncertainty in Computer Vision Algorithms

James Gattiker, Los Alamos National Laboratory, USA

5:10-5:25 Estimation of the Super-Quantile for Optimization - Application in Thermal Engineering

Jonathan Guerra, ONERA, France; Fabrice Gamboa, University of Toulouse, France; Patrick Cattiaux, Institut de Mathématiques de Toulouse, France; Patricia Klotz, ONERA, France; Nicolas Dolin, Epsilon Ingénierie, France

Tuesday, April 5

CP14

UQ in Fluid Applications

4:30 PM-5:50 PM

Room:Garden 5B

Chair: Saleh Rezaeiravesh, Uppsala University, Sweden

4:30-4:45 Calibration of a Set of Wall Functions for Turbulent Flows
Saleh Rezaeiravesh, Uppsala University, Sweden; Mattias Liefvendahl, Swedish Defense Research Agency, Sweden; Per Lötstedt, Uppsala University, Sweden

4:50-5:05 Drop Spreading with Random Viscosity
Oliver E. Jensen and Feng Xu, University of Manchester, United Kingdom

5:10-5:25 Probabilistic Model Identification for the Simulation of Turbulent Flow over Porous Media
Noemi Friedman and Elmar Zander, Technische Universität Braunschweig, Germany; Pradeep Kumar, Technical University Braunschweig, Germany; Hermann G. Matthies, Technische Universität Braunschweig, Germany

5:30-5:45 Uncertainty Quantification Approaches for River Hydraulics Modelling
Lea Boittin, Luca Bonaventura, and Alessio Radice, Politecnico di Milano, Italy

Tuesday, April 5

CP15

UQ in Environment, Smart Grids, Economics

4:30 PM-5:10 PM

Room:Garden 5C

Chair: Cornelius Steinbrink, University of Oldenburg, Germany

4:30-4:45 Total Error: Propagation and Partitioning in a Lidar Driven Forest Growth Simulator
George Z. Gertner, University of Illinois, Urbana-Champaign, USA

4:50-5:05 Uncertainty Propagation Through Multidisciplinary Black-Box Co-Simulation Systems
Cornelius Steinbrink, University of Oldenburg, Germany; Sebastian Lehnhoff, OFFIS, Germany

Poster Blitz

5:55 PM-6:40 PM

Room:Auditorium A

Tuesday, April 5

PP1

Poster Session and Welcome Reception

6:40 PM-8:00 PM

Room: "Campus" Area, 1st Floor

Ridge-Scad Quantile Regression Model for Big Data
Muhammad Amin, Lixin Song, Milton Abdul Thorlie, and Xiaoguang Wang, Dalian University of Technology, China

Padé Approximation for the Helmholtz Equation with Parametric Or Stochastic Wavenumber
Francesca Bonizzoni, University of Vienna, Austria; Fabio Nobile, École Polytechnique Fédérale de Lausanne, Switzerland; Ilaria Perugia, University of Vienna, Austria

Identification of Physical Parameters Using Gaussian Process Change-Point Kernels
Ankit Chiplunkar, Airbus, France; Emmanuel Rachelson, Institut Supérieur de l'Aéronautique et de l'Espace, France; Michele Colombo, Airbus, France; Joseph Morlier, Institut Supérieur de l'Aéronautique et de l'Espace, France

Quantifying the Effect of Parameter Uncertainty in the Output of a Microsimulation Model of Cancer: The Case of Overdiagnosis in Prostate Cancer
Tiago M. De Carvalho, Erasmus Universiteit, Netherlands

Uncertainty Quantification from a Hierarchy of Models
Pierre Dossantos-Uzarralde, Commissariat à l'Energie Atomique, France

Demonstration of Uncertainty Quantification Python Laboratory (UQ-PyL)
Chen Wang and *Qingyun Duan*, Beijing Normal University, China; Charles Tong, Lawrence Livermore National Laboratory, USA

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Tuesday, April 5

PP1

Poster Session and Welcome Reception

6:40 PM-8:00 PM

Room: "Campus" Area, 1st Floor

continued

Uncertainty Propagation in Flooding Using Non-Intrusive Polynomial Chaos
Chase Dwelle, Jongho Kim, and Valeriy Ivanov, University of Michigan, USA

High-Dimensional Uncertainty Quantification of Fluid-Structure Interaction
Ionut-Gabriel Farcas, Benjamin Uekermann, Tobias Neckel, and Hans-Joachim Bungartz, Technische Universität München, Germany

Algebraic Method for the Construction of a Series of Uniform Computer Designs
Zebida Gheribi-Aoulmi, University of Brothers Mentouri, Algeria; Mohamed Laib, University of Sciences and Technology Houari, Algeria; Imane Rezgui, University of Brothers Mentouri, Algeria

A Framework for Variational Data Assimilation with Superparameterization
Ian Grooms, New York University, USA

Identification of Aleatory Uncertainties in Material Properties
Eliska Janouchova, Czech Technical University, Prague, Czech Republic; Anna Kucerova and Jan Sykora, Czech Technical University, Czech Republic

Hybrid Reduced Basis Method and Generalized Polynomial Chaos for Stochastic Partial Differential Equations
Jiahua Jiang, University of Massachusetts, Dartmouth, USA

Using Training Realizations to Characterize, Identify, and Remove Model Errors in Bayesian Geophysical Inversion
Corinna Koepke and James Irving, University of Lausanne, Switzerland

Robust Experiment Design Based on Sobol Indices
Anna Kucerova and Jan Sykora, Czech Technical University, Czech Republic; Eliska Janouchova, Czech Technical University, Prague, Czech Republic

π4U: An Hpc Framework for Bayesian Uncertainty Quantification of Large Scale Computational Models
Lina Kulakova, Panagiotis Hadjidoukas, and Panagiotis Angelikopoulos, ETH Zürich, Switzerland; Costas Papadimitriou, University of Thessaly, Greece; Dmitry Alexeev, Diego Rossinelli, and Petros Koumoutsakos, ETH Zürich, Switzerland

Optimization of Expensive Black-Box Models Using Information Gain
Remi Lam and Karen E. Willcox, Massachusetts Institute of Technology, USA

Approximating Uncertain Dynamical Systems Using Time-Dependent Orthogonal Bases
Jinchun Lan, Sha Wei, and Zhike Peng, State Key Laboratory of Mechanical System and Vibration, Shanghai Jiao Tong University, China

On Low-Rank Entropy Maximization of Covariance Matrices
Fu Lin, Argonne National Laboratory, USA; Jie Chen, IBM T.J. Watson Research Center, USA

Sensitivity Analysis of the Uncertainty in Rapid Pressure Strain Correlation Models
Aashwin Mishra and Sharath Girimaji, Texas A&M University, USA

Parameter Estimation for a Porous Media Transport Problem
Thilo Moshagen and Elmar Zander, Technische Universität Braunschweig, Germany

Data Assimilation for Uncertainty Reduction in Forecasting Cholera Epidemics: An Application to the Haiti Outbreak
Damiano Pasetto, École Polytechnique Fédérale de Lausanne, Switzerland; Flavio Finger, Enrico Bertuzzo, and Andrea Rinaldo, EPFL, Switzerland

State Dependent Model Error Characterization for Data Assimilation
Sahani Pathiraja, Lucy Marshall, and Ashish Sharma, University of New South Wales, Australia; Hamid Moradkhani, Portland State University, USA

A Simple Alarm for Early Detection of Epidemics Over Networks
Razvan Romanescu, University of Guelph, Canada; Rob Deardon, University of Calgary, Canada

Adaptive Optimal Designs for Dose-Finding Studies with Time-to-Event Outcomes on Continuous Dose Space
Yevgen Ryeznik and Andrew Hooker, Uppsala University, Sweden; Oleksandr Sverdlov, EMD Serono, Inc., USA

A New Algorithm for Sensor-Location Problems in the Sense of Optimal Design of Experiments for Pdes
Daniel Walter, Technische Universität München, Germany

A Fast Computational Method for Tracking the Evolving Spatial-Temporal Gene Networks Based on Topological Information
Lin Wan, Chinese Academy of Sciences, China

Robust Optimization for Silicon Photonics Process Variations
Tsui-Wei Weng and Luca Daniel, Massachusetts Institute of Technology, USA

Parameterization-Induced Model Discrepancy
Jeremy White, U.S. Geological Survey, USA

Efficient Gpce-Based Rock Characterization for the Analysis of a Hydrocarbon Reservoir
Claudia Zoccarato, University of Padova, Italy; Noemi Friedman and Elmar Zander, Technische Universität Braunschweig, Germany

Effective Emulators for Flood Forecasting and Realtime Water Management
Juan Pablo Carbajal, David Machac, Jörg Rieckermann, and Carlo Albert Eawag, Swiss Federal Institute of Aquatic Science and Technology, Switzerland

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Uncertainty Classification for Strategic Energy Planning
Stefano Moret, Michel Bierlaire, and François Maréchal, EPFL, Switzerland

Uncertainty Quantification in Large Civil Infrastructure
Sai Ganesh S. Pai and Ian Smith, EPFL, Switzerland

Estimation of Smooth Functions with An Application to Climate Extremes
Yousra El Bachir, EPFL, Switzerland

Comparing Networks and Graphical Models at Different Scales
Djalel-Eddine Meskaldji and Stephan Morgenthaler, EPFL, Switzerland

A Bayesian View of Doubly Robust Causal Inference

Saarela Olli, University of Toronto, Canada; *Léo Belzile*, EPFL, Switzerland; Stephens David A., McGill University, Canada

Tuesday, April 5

PP101

Minisymposterium: Active Subspaces

6:40 PM-8:00 PM

Room: "Campus" Area, 1st Floor

Paul Constantine, Colorado School of Mines, USA

Active Subspaces: Theory and Practice
Paul Constantine, Colorado School of Mines, USA

Active Subspaces: Deriving Metrics for Sensitivity Analysis
Paul M. Diaz and Paul Constantine, Colorado School of Mines, USA

Active Subspaces: Quantifying Errors in Surrogate Models of Failure Probability
Andrew Glaws, Colorado School of Mines, USA

Active Subspaces: Application to Gas Turbine Design and Optimization
Zach Grey and Paul Constantine, Colorado School of Mines, USA

Active Subspaces: Hypercube Domains and Zonotopes
Kerrek Stinson and Paul Constantine, Colorado School of Mines, USA

Tuesday, April 5

PP102

Minisymposterium: UQ Software for Science and Engineering Practitioners

6:40 PM-8:00 PM

Room: "Campus" Area, 1st Floor

Brian M. Adams, Sandia National Laboratories, USA

Matthew Parno, Massachusetts Institute of Technology, USA

Cossan-X: General Purpose Software for Uncertainty Quantification and Risk Management
Edoardo Patelli, *Marco de Angelis*, Raneesha Manoharan, and Matteo Broggi, University of Liverpool, United Kingdom

UQ with the Spatially Adaptive Sparse Grid Toolkit SG++

Dirk Pflüger, *Fabian Franzelin*, and Julian Valentin, University of Stuttgart, Germany

MUQ (MIT Uncertainty Quantification): Algorithms and Interfaces for Solving Forward and Inverse Uncertainty Quantification Problems

Matthew Parno, *Andrew D. Davis*, and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

Practical Use of Chaospy for Pedestrian Traffic Simulations
Florian Künzner, Technical University of Munich, Germany; Tobias Neckel, Technische Universität München, Germany; Isabella von Sivers, Munich University of Applied Science, Germany

Implementation of UQ Workflows with the C++/Python UQTk Toolkit
Cosmin Safta, Khachik Sargsyan, Kenny Chowdhary, and Bert J. Debusschere, Sandia National Laboratories, USA

Dakota: Algorithms for Design Exploration and Simulation Credibility

Patricia D. Hough and *Adam Stephens*, Sandia National Laboratories, USA

Uqlab: a General-Purpose Matlab-Based Platform for Uncertainty Quantification

Stefano Marelli and *Bruno Sudret*, ETH Zürich, Switzerland

Wednesday, April 6

Registration

7:30 AM-6:40 PM

Room: "Campus" Area, 1st Floor

MT3

High Dimensional Approximation of Parametric PDE's

8:35 AM-10:35 AM

Room:Auditorium A

Chair: Albert Cohen, Université Pierre et Marie Curie, France

High dimensional problems arise naturally in modeling with PDEs depending on parametric or stochastic variables. They typically result in numerical difficulties due to the so-called 'curse of dimensionality''. This tutorial will present several recent approximation results that show that these difficulties can be circumvented in relevant instances by polynomial methods, based on the concept of sparse approximation. These results may be viewed as benchmarks for numerical algorithms aiming to treat these high dimensional problems.

Albert Cohen, Université Pierre et Marie Curie, France

Wednesday, April 6

MS31

Low Rank and Sparse Structure in Large-scale Bayesian Computation - Part I of III

8:35 AM-10:35 AM

Room:Garden 1A

For Part 2 see MS46

Bayesian computation for many science and engineering applications must contend with expensive or intractable numerical models, typically embedded in likelihood functions that involve high-dimensional parameters and/or high-dimensional data sets. Markov chain Monte Carlo, sequential Monte Carlo, and other posterior exploration schemes require repeated evaluations of such models, in principle over high-dimensional spaces. In this setting, standard algorithms quickly become intractable. Methods for identifying and exploiting low-rank structure and sparsity in the representation of the posterior distribution are becoming essential for solving these otherwise intractable Bayesian inference problems. This minisymposium will bring together researchers to present recent advances in structure-exploiting methods intended to accelerate large-scale Bayesian computation.

Organizer: Alessio Spantini
Massachusetts Institute of Technology, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Tiangang Cui
Massachusetts Institute of Technology, USA

Organizer: Kody Law
Oak Ridge National Laboratory, USA

8:35-9:00 On the Low Dimensional Structure of Bayesian Inference via Measure Transport

Alessio Spantini and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

9:05-9:30 Uncertainty Quantification for Multiscale Systems Using Deep Gaussian Processes

Alireza Daneshkhah and Nicholas Zabaras, University of Warwick, United Kingdom

9:35-10:00 Model Error Quantification for High-Dimensional Bayesian Inverse Problems

Isabell Franck and Phaedon S. Koutsourelakis, Technische Universität München, Germany

10:05-10:30 Sequential Monte Carlo in Truly High-dimensional Models

Patrick Rebeschini, Yale University, USA; Ramon Van Handel, Princeton University, USA

continued in next column

Wednesday, April 6

MS32

Uncertainty Quantification for Climate Modeling - Part III of III

8:35 AM-10:35 AM

Room:Garden 1B

For Part 2 see MS17

In recent years, the quantification of uncertainty in climate model predictions has become of great interest to scientists and policy-makers alike. Uncertainties in climate models result from a variety of sources, e.g., initial or boundary conditions, parameters, forcings, missing physics, observations, and/or numerical approximations. Speakers in this minisymposium will present their work towards developing algorithms for forward (uncertainty propagation) as well as inverse (optimization/Bayesian calibration/inference) uncertainty quantification in climate models. A variety of components of the climate system will be considered, including atmosphere, ocean, land, and ice, in addition to the coupling of one or more of these components.

Organizer: Irina K. Tezaur
Sandia National Laboratories, USA

Organizer: Mauro Perego
Sandia National Laboratories, USA

Organizer: William F. Spotz
Sandia National Laboratories, USA

Organizer: Charles Jackson
University of Texas at Austin, USA

8:35-9:00 Uncertainty Quantification for NASA's Orbiting Carbon Observatory 2 (OCO-2) Mission

Jonathan Hobbs and Amy Braverman, Jet Propulsion Laboratory, California Institute of Technology

9:05-9:30 Quantifying the Effect of Parameter Uncertainties on the Simulation of Drought in the Community Atmosphere Model

Gemma J. Anderson, Don Lucas, Celine Bonfils, and Ben Santer, Lawrence Livermore National Laboratory, USA

9:35-10:00 Estimation of the Coefficients in a Coulomb Friction Boundary Condition for Ice Sheet Sliding on Bedrocks

Luca Bertagna and Max Gunzburger, Florida State University, USA; Mauro Perego, Sandia National Laboratories, USA

10:05-10:30 Emulation of Future Climate Uncertainties Arising from Uncertain Parametrizations

Kai-Lan Chang and Serge Guillas, University College London, United Kingdom; Hanli Liu, National Center for Atmospheric Research, USA

continued in next column

Wednesday, April 6

MS33

Computational Uncertainty Quantification of Hyperbolic Problems - Part I of II

8:35 AM-10:35 AM

Room:Garden 1C

For Part 2 see MS48

We propose a minisymposium on the computational uncertainty quantification of hyperbolic problems by bringing together the leading experts. We hold two sessions consisting of eight presentations addressing most recent developments in the field. Our main focus will be on the forward propagation of uncertainty for different types of hyperbolic problems, including linear waves, high frequency waves, and non- linear conservation laws. Beside scarcity of measurements and high-dimensionality of parameters, we will address the major challenge for efficient and accurate uncertainty propagation typical to hyperbolic problems, which is the lack of regularity of quantities of interest with respect to input parameters.

Organizer: Mohammed Motamed
University of New Mexico, USA

Organizer: Olof Runborg
KTH Stockholm, Sweden

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

8:35-9:00 A Sparse Stochastic Collocation Technique for High Frequency Wave Propagation with Uncertainty

Gabriela Malenova, KTH Royal Institute of Technology, Sweden; Mohammad Motamed, University of New Mexico, USA; Olof Runborg, KTH Stockholm, Sweden; Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

continued on next page

Wednesday, April 6

MS33

Computational Uncertainty Quantification of Hyperbolic Problems - Part I of II

8:35 AM-10:35 AM

Room:Garden 1C

continued

9:05-9:30 Multilevel Monte Carlo Approximation of Statistical Solutions of Incompressible Flow
Christoph Schwab, Siddhartha Mishra, and *Fillippo Leonardi*, ETH Zürich, Switzerland

9:35-10:00 A Multi-Order Monte Carlo Discontinuous Galerkin Method for Wave Equations with Uncertainty
Daniel Appelo and Mohammed Motamed, University of New Mexico, USA

10:05-10:30 Numerical Methods for Stochastic Conservation Laws
Håkon Hoel, KTH Stockholm, Sweden; Kenneth Karlsen, Nils Henrik Risebro, and Erlend Storrøsten, University of Oslo, Norway

Wednesday, April 6

MS34

Advances in Computationally Intensive Inference - Part I of III

8:35 AM-10:35 AM

Room:Garden 2A

For Part 2 see MS49

Computationally intensive inference refers to statistical inference using simulation- based techniques requiring a significant amount of computing resources. These methods have been applied with great success to complicated, non-linear and possibly high-dimensional inference problems. They methods are supported by many strong theoretical results, and their analysis has recently been receiving increased attention in applied probability. In the last decades, the topic has attracted interest from researchers in Statistics and Applied Probability, Applied Mathematics and Engineering. This minisymposium aims to bring together experts from these different communities to present recent advances in theory, methodology and applications related to computationally intensive intensive inference.

Organizer: Kody Law
Oak Ridge National Laboratory, USA

Organizer: Alexandre Thiery
National University of Singapore, Singapore

Organizer: Nikolas Kantas
Imperial College London, United Kingdom

8:35-9:00 Title Not Available
Lawrence Murray, Oxford University, United Kingdom

9:05-9:30 Reversible Proposal Mcmc in High Dimension
Kengo Kamatani, Osaka University, Japan

9:35-10:00 A Bayesian Level-Set Approach for Geometric Inverse Problems
Marco Iglesias, University of Nottingham, United Kingdom

10:05-10:30 Adaptive Random Scan Gibbs Samplers
Krys Latuszynski, Gareth O. Roberts, and Cyril Chimisov, Warwick University, United Kingdom

Wednesday, April 6

MS35

Large-Scale PDE-constrained Bayesian Inverse Problems - Part III of III

8:35 AM-10:35 AM

Room:Garden 2B

For Part 2 see MS20

Large-scale inverse problems are often characterised by a large number of input parameters, and a forward model that is computationally expensive to solve. The focus of this minisymposium is on recent advances in the theory and application of the Bayesian approach to large-scale PDE constrained inverse problems, including well-posedness of the posterior distribution, optimal experimental design, sampling methods such as MCMC, particle methods such as EnKF, and applications in areas such as geophysics, climate modelling, nano optics and electrical impedance tomography.

Organizer: Matthew M. Dunlop
University of Warwick, United Kingdom

Organizer: Marco Iglesias
University of Nottingham, United Kingdom

Organizer: Claudia Schillings
University of Warwick, United Kingdom

Organizer: Aretha L. Teckentrup
University of Warwick, United Kingdom

8:35-9:00 Iterative Ensemble Smoothers for Calibration and Uncertainty Quantification of Large Petroleum Reservoir Models
Dean S. Oliver, Uni Research, United Kingdom

9:05-9:30 Shape Uncertainty Quantification for Scattering Transmission Problems
Laura Scarabosio and Ralf Hiptmair, ETH Zürich, Switzerland; Claudia Schillings, University of Warwick, United Kingdom; Christoph Schwab, ETH Zürich, Switzerland

continued on next page

9:35-10:00 Polynomial Chaos Based Bayesian Identification Procedures
Bojana V. Rosic, Technische Universität Braunschweig, Germany

10:05-10:30 Artificial Boundary Conditions and Domain Truncation in Electrical Impedance Tomography
Janne M. Huttunen, Nokia Technologies, Finland; Jari Kaipio, University of Auckland, New Zealand; Erkki Somersalo and Daniela Calvetti, Case Western Reserve University, USA; Paul Hadwin, University of Auckland, New Zealand

Wednesday, April 6

MS36

Uncertainty Quantification for Direct and Inverse Problems in Biomedical Applications - Part III of III

8:35 AM-10:35 AM

Room:Garden 2C

For Part 2 see MS21

The ability to perform numerical simulations of complex computational models arising from biomedical and bioengineering applications makes nowadays possible the solution of several identification, data assimilation and inverse problems of practical and clinical interests, also thanks to the large availability of reliable reduced order models. Being able to quantify and potentially reduce uncertainties along the whole simulation pipeline is of crucial importance since variability and uncertainty can arise from multiple sources; some instances are geometric uncertainty, intra- and inter-subject variability, as well as model uncertainty and experimental measurements.
The minisymposium addresses such aspects in the context of biomedical applications.

Organizer: Andrea Manzoni
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Luca Dede'
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Toni Lassila
University of Sheffield, United Kingdom

Organizer: Alfio Quarteroni
École Polytechnique Fédérale de Lausanne, Switzerland

8:35-9:00 Integrating Clinical Data Uncertainty in Cardiac Model Personalisation
Maxime Sermesant, Inria, France

9:05-9:30 Sensitivity Analysis of Pulse Wave Propagation in Human Arterial Network
Laurent Dumas, Universite de Versailles, France; Antoine Brault, Unaffiliated; Didier Lucor, Université Paris VI, France

9:35-10:00 Assimilation and Propagation of Clinical Data Uncertainty in Cardiovascular Modeling
Daniele E. Schiavazzi and Alison Marsden, Stanford University, USA

10:05-10:30 Posterior Adaptation of Polynomial Surrogate for Bayesian Inference in Arterial Flow Networks
Didier Lucor, Université Paris VI, France; Lionel Mathelin, CNRS, France; Olivier P. Le Maître, LIMSI-CNRS, France

continued in next column

Wednesday, April 6

MS37

Analysis and Uncertainty Quantification of Spatio-temporal Data - Part I of III

8:35 AM-10:35 AM

Room:Garden 3A

For Part 2 see MS52

Current technological developments allow the collection of huge amounts of spatio-temporal data that are usually stored and afterwards analyzed to support the decision-making process. There are many challenges in representing, processing, analysis and mining of such datasets due to complex structure of spatiotemporal objects and the relationships among them in both spatial and temporal dimensions. This minisymposium will address the analytical methodologies, strategies or techniques that allow the analysis of complex spatio-temporal data, and the suitable prediction and uncertainty quantification mechanisms that ensure an effective integration of this type of data in the decision-making process.

Organizer: Bani Mallick
Texas A&M University, USA

8:35-9:00 Modelling Extremes on River Networks

Anthony Davison, École Polytechnique Fédérale de Lausanne, Switzerland

9:05-9:30 Investigating Nested Geographic Structure in Consumer Purchases: A Bayesian Dynamic Multi-Scale Spatiotemporal Modeling Approach

Dipak Dey, University of Connecticut, USA

9:35-10:00 On Dynamic Nearest-Neighbor Gaussian Process Models for High-Dimensional Spatiotemporal Datasets

Abhirup Datta, University of Minnesota, Twin Cities, USA; *Sudipto Banerjee*, University of California, Los Angeles, USA; Andrew Finley, Michigan State University, USA

10:05-10:30 Predictive Model Assessment in Spatio-temporal Models for Infectious Disease Spread

Leonhard Held and Sebastian Meyer, University of Zurich, Switzerland

Wednesday, April 6

MS38

UQ in Turbulence Modelling - Part III of III

8:35 AM-10:35 AM

Room:Garden 3B

For Part 2 see MS23

Simulating turbulence has long been the primary difficultly in predicting the flow of fluids at high Reynolds numbers. Long considered from numerical and physical standpoints, UQ offers an alternative perspective on the problem. This has resulted in recent novel methods such as: Bayesian model error estimates for RaNS; model inadequacy detection with machine learning; stochastic sub grid models for LES; amongst others. This minisymposium will highlight computational and statistical challenges and methods. The goal is to contribute significantly towards improving the predictive capability of CFD.

Organizer: Richard P. Dwight
Delft University of Technology, Netherlands

Organizer: Paola Cinnella
ENSAM, ParisTech, France

8:35-9:00 Bayesian Optimal Experimental Design for Estimating Parameters of Turbulence Models

Dimitrios Papadimitriou, Costas Argyris, and *Costas Papadimitriou*, University of Thessaly, Greece

9:05-9:30 Preliminary Study of a Stochastic Rans Model Exploiting Local Model Inadequacy Indicators

Martin Schmelzer and Richard P. Dwight, Delft University of Technology, Netherlands; Paola Cinnella, ENSAM, ParisTech, France

9:35-10:00 Quantifying Uncertainty in the Prediction of Pollutant Dispersion

Clara García-Sánchez and Catherine Gorlé, Columbia University, USA

10:05-10:30 Physics-Derived Model Form Uncertainty in Turbulent Combustion

Michael E. Mueller, Princeton University, USA; Venkat Raman, University of Michigan, USA

Wednesday, April 6

MS39

Variability and Reliability in Electronic Engineering Applications

8:35 AM-10:35 AM

Room:Garden 3C

In electronic engineering, miniaturization causes undesired variations within industrial manufacturing procedures. Consequently, an uncertainty quantification is required to achieve a robust design of electronic devices and to guarantee a reliable performance of elements in circuits. Typically, the variability of design parameters, material parameters or geometries is modeled by random variables or random processes. In this minisymposium, recent progress is addressed in modeling and numerical simulation of problems from electronics. For example, multiphysics or coupled problems from nanoelectronics are considered. The state-of-the-art often consists in Monte-Carlo simulation for engineering problems. Alternatively, sophisticated methods are demonstrated in this field of application.

Organizer: Roland Pulch
University of Greifswald, Germany

8:35-9:00 Methods for Electronics Problems with Uncertain Parameters: An Overview

Roland Pulch, University of Greifswald, Germany

9:05-9:30 Efficient Evaluation of Bond Wire Fusing Probabilities

Thorben Casper, *Ulrich Römer*, and Sebastian Schöps, Technische Universität Darmstadt, Germany

9:35-10:00 Parametric Model Order Reduction for Efficient Uncertainty Quantification of Nanoelectronic Devices

Yao Yue and Lihong Feng, Max Planck Institute for Dynamics of Complex Technical Systems, Germany; Wim Schoenmaker and Peter Meuris, MAGWEL, Belgium; Peter Benner, Max-Planck-Institute for Dynamics of Complex Technical Systems, Germany

continued on next page

10:05-10:30 Stochastic Inverse Problem of Material Parameter Reconstruction in a Passive Semiconductor Structure

Piotr A. Putek, Bergische Universität Wuppertal, Germany; Wim Schoenmaker, MAGWEL, Belgium; E. Jan W. ter Maten and Michael Guenther, Bergische Universität Wuppertal, Germany; Pascal Reynier, ACCO Semiconductor, Inc., France; Tomas Gotthans, Brno University of Technology, Czech Republic

Wednesday, April 6

MS40

Uncertainty Quantification in Subsurface Environments - Part I of III

8:35 AM-10:35 AM

Room:Garden 4A

For Part 2 see MS55

Our knowledge of the structure and properties of porous media is typically incomplete. Therefore, outputs of subsurface flow and transport models are plagued by uncertainty. Designing effective numerical methods dealing with uncertainties requires both mathematical and hydrogeological expertise and is crucial in every phase of the workflow, from the solution of inverse problems for the identification of the flow and transport properties to the forward propagation of the uncertainties, the sensitivity analysis and the design of management policies. This minisimposium gathers researchers with different backgrounds active in the area, presenting both advances in dedicated UQ techniques and realistic test-cases.

Organizer: Lorenzo Tamellini
Università di Pavia, Italy

Organizer: Giovanni Porta
Politecnico di Milano, Italy

Organizer: Monica Riva
Politecnico di Milano, Italy

Organizer: Alberto Guadagnini
Politecnico di Milano, Italy

8:35-9:00 Inverse Modeling of Geochemical and Mechanical Compaction in Sedimentary Basins Through Polynomial Chaos Expansion

Ivo Colombo and Giovanni Porta, Politecnico di Milano, Italy; Lorenzo Tamellini, Università di Pavia, Italy; Monica Riva, Alberto Guadagnini, and Anna Scotti, Politecnico di Milano, Italy

9:05-9:30 Stochastic Identification of Contaminant Sources

J. Jaime Gómez-Hernández and Teng Xu, Universitat Politècnica de València, Spain

9:35-10:00 Accounting for Known Sources of Model Error During Bayesian Posterior Sampling of Geophysical Inverse Problems

James Irving, Corinna Koepke, and Delphine Roubinet, University of Lausanne, Switzerland

10:05-10:30 Towards Geological Realism in Predicting Uncertainty in Reservoir Inverse Modelling: Geostatistics and Machine Learning

Vasily Demyanov, Daniel Arnold, Alexandra Kuznetsova, Temistocles S. Rojas, and Mike Christie, Heriot-Watt University, United Kingdom

continued in next column

Wednesday, April 6

MS41

Software for UQ - Part I of III

8:35 AM-10:35 AM

Room:Garden 4B

For Part 2 see MS56

With the growing importance of UQ in various disciplines and fields, software solutions and libraries for UQ problems get more and more important. This raises interesting questions from the application scientist such as: What are the current properties of available tools? For which classes of problems have they been developed? What are challenges for UQ software and which resources are required? What are the next steps and the long-term goals of development? This minisymposium brings together experts for different software in the context of UQ, ranging from tools that ease up individual tasks of UQ up to whole frameworks for solving UQ problems.

Organizer: Tobias Neckel
Technische Universität München, Germany

Organizer: Dirk Pflüger
University of Stuttgart, Germany

8:35-9:00 Adaptive Sparse Grids for UQ with SG++
Dirk Pflüger and Fabian Franzelin, University of Stuttgart, Germany

9:05-9:30 UQTk: a C++/Python Toolkit for Uncertainty Quantification
Bert J. Debusschere, Khachik Sargsyan, Cosmin Safta, and Kenny Chowdhary, Sandia National Laboratories, USA

9:35-10:00 Opencossan: A Open Matlab Tool for Dealing with Randomness, Imprecision and Vagueness
Edoardo Patelli, Matteo Broggi, and Marco de Angelis, University of Liverpool, United Kingdom

10:05-10:30 MUQ (MIT Uncertainty Quantification): A Flexible Software Framework for Algorithms and Applications
Matthew Parno, *Andrew D. Davis*, and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

Wednesday, April 6

MS42

Sparse Techniques for High-dimensional UQ Problems and Applications - Part I of III

8:35 AM-10:35 AM

Room:Garden 4C

For Part 2 see MS57

Uncertainty quantification in computational models is strongly challenged by the high-dimensionality of the input parameter space. Relatedly, classical techniques such as polynomial chaos expansions typically lead to under-determined problems. This curse of dimensionality has recently been tackled by sparse learning techniques, such as sparse grids interpolation, l1-regularized regression (e.g. compressive sensing and least angle regression). These methods successfully address the high-dimensionality challenge at an affordable cost, if the latter has an underlying sparse structure. This minisymposium will focus on the latest developments of these techniques for the sake of uncertainty propagation and sensitivity analysis.

Organizer: Bruno Sudret
ETH Zürich, Switzerland

Organizer: Alireza Doostan
University of Colorado Boulder, USA

Organizer: Khachik Sargsyan
Sandia National Laboratories, USA

8:35-9:00 Sample-Efficient, Basis-Adaptive Polynomial Chaos Approximation
Jerrad Hampton and Alireza Doostan, University of Colorado Boulder, USA

continued in next column

9:05-9:30 Sparse Approximation Using L1-L2 Minimization
Yeonjong Shin, University of Utah, USA; Liang Yan, Southeast University, China; Dongbin Xiu, University of Utah, USA

9:35-10:00 A Dictionary Learning Strategy for Bayesian Inference
Lionel Mathelin, CNRS, France; Alessio Spantini and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

10:05-10:30 Interpolation Via Weighted L1 Minimization
Rachel Ward, University of Texas at Austin, USA; Holger Rauhut, RWTH Aachen, Germany; *Giang Tran*, University of California, Los Angeles, USA

Wednesday, April 6

MS43

PDF Methods for Uncertainty Quantification

8:35 AM-10:35 AM

Room:Garden 5A

Methods based on probability density functions (PDF) offer a number of advantages in quantifying parametric uncertainty, including detection of rare events, computation of all high-order moments and an immunity to sampling errors. Although recent formulations based on the joint response-excitation PDF or the cumulative PDF allow process with (colored) noise of arbitrary correlation length, strength and function, grand challenge remains the solution of high-dimensional equations, both in the excitation and response space. In this MS, various new formulations will be presented to tackle high-dimensionality, using sparse grids, separated series representations, ANOVA, etc., along with numerical methods for diverse UQ problems.

Organizer: Peng Wang
BeiHang University, China

Organizer: George E. Karniadakis
Brown University, USA

8:35-9:00 The Probability Density Evolution Method for Multi-Dimensional Nonlinear Stochastic Dynamical Systems
Jianbin Chen, Junyi Yang, and Jie Li, Tongji University, China

9:05-9:30 Method of Distributions for Uncertainty Quantification
Pierre Gremaud, North Carolina State University, USA; Daniel M. Tartakovsky, University of California, San Diego, USA

9:35-10:00 Uncertainty Propagation Across Distinct Pdf Systems and Stochastic Spectral Methods
Heyrim Cho, University of Maryland, USA

10:05-10:30 Probabilistic Solutions to Random Differential Equations under Colored Excitation Using the Response-Excitation Approach
Ivi C. Tsantili, National Technical University of Athens, Greece and Beijing Computational Science Research Center, China; Gerassimos A. Athanassoulis, National Technical University of Athens, Greece and ITMO University, Russia; Zacharias G. Kapelonis, National Technical University of Athens, Greece

continued in next column

Wednesday, April 6

MS44

The Interplay of Dynamical Systems, Control Theory, and Uncertainty Quantification

8:35 AM-10:35 AM

Room:Garden 5B

The areas of dynamical systems theory, control theory, and uncertainty quantification are intimately tied together. In this session, we will explore the interconnections between the areas of dynamical systems theory and control theory with uncertainty analysis. In particular, we will explore both the use of dynamical systems and control theory in the construction of novel approaches for uncertainty quantification, as well as the development of new methods for propagating uncertainty through dynamical systems that display complicated temporal dynamics. The session will focus on computational efficiency, long term dynamics, stochastic optimization, and operator theoretic methods.

Organizer: Tuhin Sahai
United Technologies Research Center, USA

8:35-9:00 Set Oriented Numerical Methods for Uncertainty Analysis
Michael Dellnitz and Karin Mora, University of Paderborn, Germany; Tuhin Sahai, United Technologies Research Center, USA

9:05-9:30 A Chaotic Dynamical System That Samples
Tuhin Sahai, United Technologies Research Center, USA; George Mathew, iRhythm Technologies, USA; Amit Surana, United Technologies Research Center, USA

9:35-10:00 Koopman Operator Based Nonlinear Estimation
Amit Surana and Andrzej Banaszuk, United Technologies Research Center, USA

10:05-10:30 Admm for 2-Stage Stochastic Quadratic Programs
Arvind Raghunathan, Mitsubishi Electric Research Laboratories, USA

Wednesday, April 6

MS45

UQ and Numerical Methods for Stochastic (P)DEs

8:35 AM-10:35 AM

Room:Garden 5C

This minisymposium will present four talks on numerical methods for stochastic PDEs or stochastic integral equations- that is time dependent equations with space-time noise as forcing. These type of equations arise, for example, in ferromagentism, neuroscience, climate circulation models, porous media etc. Such methods are essential in order to quantify uncertainty in computed quantities, for example using a MC/MLMC type approach. Key questions arise about the convergence of the schemes, accuracy and efficiency.

Organizer: Gabriel J. Lord
Heriot-Watt University, United Kingdom

Organizer: Raphael Kruse
Technische Universität Berlin, Germany

8:35-9:00 Numerical Approximation of Stochastic Differential Equations
Adam Andersson and *Raphael Kruse*, Technische Universität Berlin, Germany

9:05-9:30 Computations of Waves in a Neural Model
Gabriel J. Lord, Heriot-Watt University, United Kingdom

9:35-10:00 SPDEs with Lévy Noise and Weak Convergence
Felix Lindner, Technische Universität Kaiserslautern, Germany

10:05-10:30 Mild Stochastic Calculus in Infinite Dimensions
Arnulf Jentzen, ETH Zürich, Switzerland

Coffee Break

10:35 AM-11:05 AM

Room: "Campus" Area, 1st Floor

Wednesday, April 6

IP3

Covariance Functions for Space-time Processes and Computer Experiments: Some Commonalities and Some Differences

11:05 AM-11:50 AM

Room:Auditorium A

Chair: James Berger, Duke University, USA

Gaussian processes are commonly used to model both natural processes, for which the indices are space and/or time, and computer experiments, for which the indices are often parameters of the computer model. In both settings, the modeling of the covariance function of the process is critical. I will review various approaches to modeling covariance functions for natural processes, with a focus on the space-time setting. I will then consider what lessons, if any, can be drawn from this work for modeling covariance functions for computer experiments.

Michael Stein
University of Chicago, USA

Wednesday, April 6

IP4

Reduction of Epistemic Uncertainty in Multifidelity Simulation-Based Multidisciplinary Design

11:55 AM-12:40 PM

Room:Auditorium A

Chair: Ralph C. Smith, North Carolina State University, USA

Epistemic model uncertainty is a significant source of uncertainty that affects the prediction of a multidisciplinary system using multifidelity analyses. Uncertainty reduction can be achieved by gathering additional experiments and simulations data; however resource allocation for multidisciplinary design optimization (MDO) and analysis remains a challenging task due to the complex structure of a multidisciplinary system and the dynamic nature of decision making. We will present a novel approach that integrates multidisciplinary uncertainty analysis (MUA) and multidisciplinary statistical sensitivity analysis (MSSA) to answer the questions about where (sampling locations), what (disciplinary responses), and which (simulations versus experiments) for allocating more resources. The proposed approach strategically breaks resource allocation into a sequential process, the decision making is hence much more tractable. Meanwhile the method is efficient for complex multidisciplinary analysis by employing inexpensive Spatial Random Process (SRP) emulators and analytical formulas of MUA and MSSA.

Wei Chen
Northwestern University, USA

Lunch Break

12:40 PM-2:10 PM

Attendees on their own

Wednesday, April 6

MT4

Particle and Ensemble Kalman Filters for Data Assimilation and Time Series Analysis

2:10 PM-4:10 PM

Room:Auditorium A

Chair: Hans Rudolf Künsch, ETH Zürich, Switzerland

This tutorial presents (1) A review of particle and ensemble Kalman filter methods for estimating the state of a Markovian system based on partial and noisy observations, (2) Combinations of the two methods that can handle non-Gaussian features of the prediction distribution while avoiding sample depletion, (3) The use of unbiased estimates of the likelihood in an MCMC algorithm to estimate unknown static parameters of the underlying model.

Hans Rudolf Künsch, ETH Zürich, Switzerland

Wednesday, April 6

MS46

Low Rank and Sparse Structure in Large-scale Bayesian Computation - Part II of III

2:10 PM-4:10 PM

Room:Garden 1A

For Part 1 see MS31
For Part 3 see MS62

Bayesian computation for many science and engineering applications must contend with expensive or intractable numerical models, typically embedded in likelihood functions that involve high-dimensional parameters and/or high-dimensional data sets. Markov chain Monte Carlo, sequential Monte Carlo, and other posterior exploration schemes require repeated evaluations of such models, in principle over high-dimensional spaces. In this setting, standard algorithms quickly become intractable. Methods for identifying and exploiting low-rank structure and sparsity in the representation of the posterior distribution are becoming essential for solving these otherwise intractable Bayesian inference problems. This minisymposium will bring together researchers to present recent advances in structure-exploiting methods intended to accelerate large-scale Bayesian computation.

Organizer: Alessio Spantini
Massachusetts Institute of Technology, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Tiangang Cui
Massachusetts Institute of Technology, USA

Organizer: Kody Law
Oak Ridge National Laboratory, USA

2:10-2:35 Subspace Acceleration Strategies for Sampling on Function Space

Tiangang Cui, Massachusetts Institute of Technology, USA; K Law, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Youssef M. Marzouk, Massachusetts Institute of Technology, USA

2:40-3:05 Efficient Computations for Large-Scale Inverse Problems with Bayesian Sampling

Eric Machorro, National Security Technologies, LLC, USA; Jesse Adams, University of Arizona, USA; Kevin Joyce, University of Montana, USA

3:10-3:35 Scalable Parameterized Surrogates Based on Low Rank Tensor Approximations for Large-Scale Bayesian Inverse Problems

Nick Alger, Tan Bui-Thanh, and Omar Ghattas, University of Texas at Austin, USA

3:40-4:05 Accelerating MCMC with Active Subspaces

Paul Constantine, Colorado School of Mines, USA; Tan Bui-Thanh, University of Texas at Austin, USA; Carson Kent, Colorado School of Mines, USA

continued in next column

Wednesday, April 6

MS47

Bayesian Inverse Problems Beyond the 'Conventional' Setting - Part I of II

2:10 PM-4:10 PM

Room:Garden 1B

For Part 2 see MS63

Bayesian treatments of inverse problems which employ Gaussian priors and error models have been studied extensively. In practice, however, many Bayesian inverse problems involve alternative choices: the priors and/or error models may not be Gaussian; priors and likelihood functions may contain unknown hyperparameters, leading to hierarchical formulations; and the forward models themselves may be stochastic. Such problems are often more challenging to solve than the conventional Gaussian inverse problems, and many methods developed for the Gaussian setting may not apply. The purpose of the minisymposium is to present recent advances in this broader array of Bayesian inverse problem formulations, as well as new computational methods for addressing these challenges.

Organizer: Jinglai Li
Shanghai Jiao Tong University, China

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

2:10-2:35 Bayesian Parameter Inference Across Scales
Margaret Callahan and Daniela Calvetti, Case Western Reserve University, USA

2:40-3:05 Expectation Propagation for Electrical Impedance Tomography
Bangti Jin, University College London, United Kingdom

3:10-3:35 Bayesian Sampling Using a Wishart Prior in Radiography Image Reconstruction
Marylesa Howard, National Security Technologies, LLC, USA

3:40-4:05 Prior and Posterior Convergence for Some Finite Element Approximations
Sari Lasanen, University of Oulu, Finland

Wednesday, April 6

MS48

Computational Uncertainty Quantification of Hyperbolic Problems - Part II of II

2:10 PM-4:10 PM

Room:Garden 1C

For Part 1 see MS33

We propose a minisymposium on the computational uncertainty quantification of hyperbolic problems by bringing together the leading experts. We hold two sessions consisting of eight presentations addressing most recent developments in the field. Our main focus will be on the forward propagation of uncertainty for different types of hyperbolic problems, including linear waves, high frequency waves, and non- linear conservation laws. Beside scarcity of measurements and high-dimensionality of parameters, we will address the major challenge for efficient and accurate uncertainty propagation typical to hyperbolic problems, which is the lack of regularity of quantities of interest with respect to input parameters.

Organizer: Mohammed Motamed
University of New Mexico, USA

Organizer: Olof Runborg
KTH Stockholm, Sweden

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

2:10-2:35 Multilevel Monte Carlo for Convective Transport in Inhomogeneous Media
Gianluca Iaccarino, Stanford University, USA; Alireza Doostan, University of Colorado Boulder, USA; *Gianluca Geraci*, Stanford University, USA

continued in next column

2:40-3:05 Computing Measure Valued and Statistical Solutions of Hyperbolic Systems of Conservation Laws
Siddhartha Mishra, ETH Zürich, Switzerland

3:10-3:35 Fast Bayesian Optimal Experimental Design for Seismic Source Inversion
Quan Long, United Technologies Research Center, USA; Mohammad Motamed, University of New Mexico, USA; Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

3:40-4:05 Continuation Multi Level Monte Carlo for Uncertainty Quantification in Compressible Aerodynamics
Michele Pisaroni, Fabio Nobile, and Penelope Leyland, École Polytechnique Fédérale de Lausanne, Switzerland

Wednesday, April 6

MS49

Advances in Computationally Intensive Inference - Part II of III

2:10 PM-4:10 PM

Room:Garden 2A

For Part 1 see MS34
For Part 3 see MS65

Computationally intensive inference refers to statistical inference using simulation- based techniques requiring a significant amount of computing resources. These methods have been applied with great success to complicated, non-linear and possibly high-dimensional inference problems. They methods are supported by many strong theoretical results, and their analysis has recently been receiving increased attention in applied probability. In the last decades, the topic has attracted interest from researchers in Statistics and Applied Probability, Applied Mathematics and Engineering. This minisymposium aims to bring together experts from these different communities to present recent advances in theory, methodology and applications related to computationally intensive intensive inference.

Organizer: Kody Law
Oak Ridge National Laboratory, USA

Organizer: Alexandre Thiery
National University of Singapore, Singapore

Organizer: Nikolas Kantas
Imperial College London, United Kingdom

2:10-2:35 Gibbs-Langevin Samplers
Omiros Papaspiliopoulos, Universitat Pompeu Fabra, Spain

2:40-3:05 The Backward Sde Filter
Vasileios Maroulas, University of Tennessee, Knoxville, USA; Bao Feng, Oak Ridge National Laboratory, USA

3:10-3:35 Improving the Performance of Overdamped Langevin Samplers by Breaking Detailed Balance
Andrew Duncan, Oxford University, United Kingdom; Greg Pavliotis, Imperial College London, United Kingdom; Tony Lelievre, CERMICS ENPC, France

3:40-4:05 A Piecewise Deterministic Markov Process for Efficient Sampling in R^n
Joris Bierkens and Gareth O. Roberts, Warwick University, United Kingdom

continued in next column

Wednesday, April 6

MS50

Quantifying and Accounting for Uncertainties in Large Scale (Atmospheric and Oceanic) Models - Part I of II

2:10 PM-4:10 PM

Room:Garden 2B

For Part 2 see MS66

Uncertainty quantification (UQ) of climate system forecasts and projections presents fundamental challenges that is intertwined with limitations in observations and scientific understanding. The goal of this session is to provide a forum to discuss ideas for advancing the science of UQ in climate modeling and its components. This includes: How can the various uncertainties in such models be appropriately quantified and represented? How best to reduce uncertainty using approaches such as data assimilation or inverse modeling? How can stochastic features in models be addressed and included? How reliable are uncertainties quantified by ensembles? What information do they carry?

Organizer: Ibrahim Hoteit
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Organizer: Aneesh Subramanian
University of Oxford, United Kingdom

Organizer: Omar M. Knio
Duke University, USA

Organizer: Mohamed Iskandarani
University of Miami, USA

continued on next page

Wednesday, April 6

MS50

Quantifying and Accounting for Uncertainties in Large Scale (Atmospheric and Oceanic) Models - Part I of II

2:10 PM-4:10 PM

Room:Garden 2B

continued

2:10-2:35 Greater Accuracy with Reduced Precision: A Stochastic Paradigm for Weather and Climate Prediction
Tim Palmer, University of Oxford, United Kingdom

2:40-3:05 Probabilistic Regional Ocean Predictions
Deepak Subramani and Pierre Lermusiaux, Massachusetts Institute of Technology, USA

3:10-3:35 Empirical Bayes Approach to Climate Model Calibration
Charles Jackson, University of Texas at Austin, USA; Gabriel Huerta, University of New Mexico, USA

3:40-4:05 A Parametrization of Ocean Mesoscale Eddies: Stochasticity and Non-viscous Stresses
Laure Zanna, University of Oxford, United Kingdom

Wednesday, April 6

MS51

Bayesian Inversion and Low-rank Approximation - Part I of II

2:10 PM-4:10 PM

Room:Garden 2C

For Part 2 see MS67

Sparse approximations, especially in the form of low-rank methods, have become essential in the solution and representation of high-dimensional stochastic problems. Identification in the form of Bayesian inverse problems - in particular when performed repeatedly or sequentially for dynamical systems - requires the efficient solution and representation of high-dimensional stochastic forward problems. Additionally it seems advantageous if the Bayesian update can take advantage of such sparse representations, and produce the update also in sparse form. The minisymposium will focus on sparse techniques for the representation and solution of high-dimensional problems, and their interplay with Bayesian inverse problems and Bayesian inversion.

Organizer: Hermann G. Matthies
Technische Universität Braunschweig, Germany

Organizer: Alireza Doostan
University of Colorado Boulder, USA

Organizer: Martin Eigel
WIAS, Berlin, Germany

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

Organizer: Reinhold Schneider
Technische Universität Berlin, Germany

2:10-2:35 Solution of Stochastic PDEs Via Low-Rank Separated Representation: A Randomized Alternating Least Squares Approach
Matt Reynolds and Alireza Doostan, University of Colorado Boulder, USA; Gregory Beylkin, University of Colorado, USA

2:40-3:05 Tensor Train Approximation of the First Moment Equation for Elliptic Problems with Lognormal Coefficients
Francesca Bonizzoni, University of Vienna, Austria; Fabio Nobile and Daniel Kressner, École Polytechnique Fédérale de Lausanne, Switzerland

3:10-3:35 Blending Finite Dimensional Manifold Samplers with Dimension-Independent MCMC
Shiwei Lan, University of Warwick, United Kingdom

3:40-4:05 Dynamical Low Rank Approximation of Incompressible Navier Stokes Equations with Random Parameters
Eleonora Musharbash and Fabio Nobile, École Polytechnique Fédérale de Lausanne, Switzerland

continued in next column

Wednesday, April 6

MS52

Analysis and Uncertainty Quantification of Spatio-temporal Data - Part II of III

2:10 PM-4:10 PM

Room:Garden 3A

For Part 1 see MS37
For Part 3 see MS68

Current technological developments allow the collection of huge amounts of spatio-temporal data that are usually stored and afterwards analyzed to support the decision-making process. There are many challenges in representing, processing, analysis and mining of such datasets due to complex structure of spatiotemporal objects and the relationships among them in both spatial and temporal dimensions. This minisymposium will address the analytical methodologies, strategies or techniques that allow the analysis of complex spatio-temporal data, and the suitable prediction and uncertainty quantification mechanisms that ensure an effective integration of this type of data in the decision-making process.

Organizer: Bani Mallick
Texas A&M University, USA

2:10-2:35 Tukey g-and-h Random Fields
Marc Genton, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

2:40-3:05 Functional Car Models for Large Spatially Correlated Functional Datasets
Veera Baladandayuthapani, University of Texas MD Anderson Cancer Center, USA

3:10-3:35 Fusing Multiple Existing Space-Time Land Cover Products
Amanda Hering, Colorado School of Mines, USA

3:40-4:05 Testing for Spatial and Spatio-Temporal Stationarity
Suhasini Subba Rao, Texas A&M University, USA

Wednesday, April 6

MS53

Uncertainty Management for Robust Industrial Design in Aeronautics - Part I of II

2:10 PM-4:10 PM

Room:Garden 3B

For Part 2 see MS69

This minisymposium aims at showcasing recent advances in the areas of Uncertainty Management and Quantification (QM and QU) and Robust Design methods (RDM) in Aeronautics and aircraft industry to treat large numbers of simultaneous uncertainties in analysis and design, including uncertainties on operational conditions, uncertainties on geometries resulting from manufacturing tolerances, numerical error sources and uncertain physical model parameters. It is organized in collaboration with the UMRIDA EU-project.

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Dirk Wunsch
NUMECA International, Belgium

2:10-2:35 Robust Design Optimization of a Supersonic Natural Laminar Flow Wing-Body
Domenico Quagliarella and Emiliano Iuliano, Centro Italiano Ricerche Aerospaziali, Italy

2:40-3:05 Surrogate-Based Robust Airfoil Optimization Considering Geometrical Uncertainties
Daigo Maruyama, DLR Braunschweig, Germany; Dishi Liu and Stefan Görtz, German Aerospace Center (DLR), Germany

3:10-3:35 Uncertainty in Massflow Measurements in Pipes Due to Bends
Zeno Belligoli and Richard P. Dwight, Delft University of Technology, Netherlands

3:40-4:05 An Investigation of Uncertainty Effects in Mixed Hyperbolic- Parabolic Problems Due to Stochastically Varying Geometry
Jan Nordström and Markus K. Wahlsten, Linköping University, Sweden

Wednesday, April 6

MS54

Uncertainty Quantification of Systems Exhibiting Intermittent Dynamics - Part I of II

2:10 PM-4:10 PM

Room:Garden 3C

For Part 2 see MS70

A wide range of dynamical systems encountered in nature and technology are characterized by the presence of intermittent episodes with strongly transient characteristics. These occurrences are typically associated with strongly nonlinear dynamical mechanisms, which is hard to capture using conventional UQ methods. This minisymposium is focusing on analytical and computational methods and their applications for the uncertainty quantification and prediction of dynamical systems that exhibit such strongly transient behavior.

Organizer: Themistoklis Sapsis
Massachusetts Institute of Technology, USA

Organizer: Andrew Majda
Courant Institute of Mathematical Sciences, New York University, USA

2:10-2:35 A Probabilistic Decomposition-Synthesis Method for the Quantification of Rare Events
Mustafa Mohamad and Themistoklis Sapsis, Massachusetts Institute of Technology, USA

2:40-3:05 Causality Or Correlation? Multiscale Inference and An Application to Geoscience
Illia Horenko, Free University of Berlin, Germany

3:10-3:35 Rigorous Intermittency in Turbulent Diffusion Models with a Mean Gradient
Xin T. Tong and *Andrew Majda*, Courant Institute of Mathematical Sciences, New York University, USA

3:40-4:05 Improving Prediction Skill of Imperfect Turbulent Models Through Statistical Response and Information Theory
Di Qi, New York University, USA

Wednesday, April 6

MS55

Uncertainty Quantification in Subsurface Environments - Part II of III

2:10 PM-4:10 PM

Room:Garden 4A

For Part 1 see MS40
For Part 3 see MS71

Our knowledge of the structure and properties of porous media is typically incomplete. Therefore, outputs of subsurface flow and transport models are plagued by uncertainty. Designing effective numerical methods dealing with uncertainties requires both mathematical and hydrogeological expertise and is crucial in every phase of the workflow, from the solution of inverse problems for the identification of the flow and transport properties to the forward propagation of the uncertainties, the sensitivity analysis and the design of management policies. This minisimposium gathers researchers with different backgrounds active in the area, presenting both advances in dedicated UQ techniques and realistic test-cases.

Organizer: Lorenzo Tamellini
Università di Pavia, Italy

Organizer: Giovanni Porta
Politecnico di Milano, Italy

Organizer: Monica Riva
Politecnico di Milano, Italy

Organizer: Alberto Guadagnini
Politecnico di Milano, Italy

2:10-2:35 Making Uncertainty Quantification of Multi-Component Reactive Transport Manageable

Olaf A. Cirpka and Matthias Loschko, University of Tübingen, Germany; Thomas Wöhling, Technische Universitaet Dresden, Germany

2:40-3:05 Concentration Statistics for Transport in Heterogeneous Media: Self-Averaging, Mixing Models and the Evolution of Uncertainty

Marco Dentz, IDAEA and Spanish National Research Council (CSIC), Spain; Tanguy Le Borgne, Université de Rennes 1, France

3:10-3:35 Subsurface Flow Simulations in Stochastic Discrete Fracture Networks

Stefano Berrone, Claudio Canuto, *Sandra Pieraccini*, and Stefano Scialo`, Politecnico di Torino, Italy

3:40-4:05 Sparse Grid and Monte Carlo Methods for Groundwater Transport Problems

Francesco Tesei, Fabio Nobile, and Sebastian Krumscheid, École Polytechnique Fédérale de Lausanne, Switzerland

continued in next column

Wednesday, April 6

MS56

Software for UQ - Part II of III

2:10 PM-4:10 PM

Room:Garden 4B

For Part 1 see MS41
For Part 3 see MS72

With the growing importance of UQ in various disciplines and fields, software solutions and libraries for UQ problems get more and more important. This raises interesting questions from the application scientist such as: What are the current properties of available tools? For which classes of problems have they been developed? What are challenges for UQ software and which resources are required? What are the next steps and the long-term goals of development? This minisymposium brings together experts for different software in the context of UQ, ranging from tools that ease up individual tasks of UQ up to whole frameworks for solving UQ problems.

Organizer: Tobias Neckel
Technische Universität München, Germany

Organizer: Dirk Pflüger
University of Stuttgart, Germany

2:10-2:35 The Parallel C++ Statistical Library Queso: Quantification of Uncertainty for Estimation, Simulation and Optimization

Damon McDougall, University of Texas at Austin, USA

2:40-3:05 Chaospy: A Modular Implementation of Polynomial Chaos Expansions and Monte Carlo Methods

Simen Tennoe, Simula Research Laboratory, Norway

3:10-3:35 Recent Advances in Dakota UQ

Brian M. Adams and Patricia D. Hough, Sandia National Laboratories, USA

3:40-4:05 Handling Large-Scale Uncertainty Quantification with SmartUQ

Peter Qian, University of Wisconsin, Madison and SmartUQ, USA

Wednesday, April 6

MS57

Sparse Techniques for High-dimensional UQ Problems and Applications - Part II of III

2:10 PM-4:10 PM

Room:Garden 4C

For Part 1 see MS42
For Part 3 see MS73

Uncertainty quantification in computational models is strongly challenged by the high-dimensionality of the input parameter space. Relatedly, classical techniques such as polynomial chaos expansions typically lead to under-determined problems. This curse of dimensionality has recently been tackled by sparse learning techniques, such as sparse grids interpolation, l1-regularized regression (e.g. compressive sensing and least angle regression). These methods successfully address the high-dimensionality challenge at an affordable cost, if the latter has an underlying sparse structure. This minisymposium will focus on the latest developments of these techniques for the sake of uncertainty propagation and sensitivity analysis.

Organizer: Bruno Sudret
ETH Zürich, Switzerland

Organizer: Alireza Doostan
University of Colorado Boulder, USA

Organizer: Khachik Sargsyan
Sandia National Laboratories, USA

2:10-2:35 Mixing Auto-Regressive Models and Sparse Polynomial Chaos Expansions for Time-Variant Problems
Bruno Sudret and Chu Mai, ETH Zürich, Switzerland

2:40-3:05 Iteration Method for Enhancing the Sparsity
Xiu Yang, Huan Lei, and Nathan Baker, Pacific Northwest National Laboratory, USA; Guang Lin, Purdue University, USA

3:10-3:35 Efficient Sampling Schemes for Recovering Sparse PCE
John D. Jakeman, Sandia National Laboratories, USA; Akil Narayan, University of Utah, USA

3:40-4:05 Germ-Transformed Polynomial Chaos Expansions
Guillaume Perrin, CEA, France; Christian Soize, Universite de Paris-Est, France

Wednesday, April 6

MS58

Scalable Multi-fidelity Methods in Uncertainty Quantification - Part I of II

2:10 PM-4:10 PM

Room:Garden 5A

For Part 2 see MS74

Uncertainty quantification (UQ) poses the need to numerically solve governing equations (i.e., the forward problem) multiple times, often thousands of times. The complexity in repeatedly solving forward problems is further amplified in the presence of non-linearity, high-dimensionality, and massive data-sets; all common features in realistic physical and biological systems. The goal of this minisymposium is to establish an interface between scientific computing and machine learning techniques, towards developing scalable workflows for UQ in high-dimensional stochastic dynamical systems. Relevant topics include, but are not limited to: multi-fidelity modeling, unsupervised learning from big data, surrogate-based modeling, and relevant applications to UQ problems.

Organizer: Paris Perdikaris
Massachusetts Institute of Technology, USA

Organizer: Daniele Venturi
Brown University, USA

Organizer: George E. Karniadakis
Brown University, USA

continued in next column

2:10-2:35 Multi-Fidelity Information Fusion Algorithms for High Dimensional Systems and Massive Data-Sets
Paris Perdikaris, Massachusetts Institute of Technology, USA; Daniele Venturi, University of California, Santa Cruz, USA; George Em Karniadakis, Brown University, USA

2:40-3:05 Probabilistic Active Subspaces: Learning High-Dimensional Noisy Functions Without Gradients
Ilias Bilionis, Rohit Tripathy, and Marcial Gonzalez, Purdue University, USA

3:10-3:35 Optimization Under Uncertainty of High-Dimensional, Sloppy Models
Phaedon S. Koutsourelakis, Technische Universität München, Germany

3:40-4:05 Recursive Cokriging Models for Global Sensitivity Analysis of Multi-Fidelity Computer Codes
Loic Le Gratiet, EDF, France; Josselin Garnier, Université Paris VII, France

Wednesday, April 6

MS59

Theory and Simulation of Failure Probabilities and Rare Events - Part I of II

2:10 PM-4:10 PM

Room:Garden 5B

For Part 2 see MS75

The evaluation of failure probabilities is a fundamental problem in reliability analysis and risk management of systems with uncertain inputs. We consider systems described by PDEs with random coefficients together with efficient approximation schemes. This includes stochastic finite elements, collocation, reduced basis, and advanced Monte Carlo methods. Efficient evaluation and updating of small failure probabilities and rare events remains a significant computational challenge. This minisymposium brings together tools from applied probability, numerical analysis, and computational science and engineering. We showcase advances in analysis and computational treatment of rare events and failure probabilities, including variance reduction, advanced meta-models, and multilevel Monte Carlo.

Organizer: Elisabeth Ullmann
Technische Universität München, Germany

Organizer: Iason Papaioannou
Technische Universität München, Germany

2:10-2:35 Zero-variance Approaches in Static Reliability Problems
Gerardo Rubino, Inria Rennes, France

2:40-3:05 From Probability-Boxes to Imprecise Failure Probabilities Using Meta-Models
Roland Schöbi and Bruno Sudret, ETH Zürich, Switzerland

3:10-3:35 Optimal L2-Norm Empirical Importance Weights for the Change of Probability Measure
Sergio Amaral, Massachusetts Institute of Technology, USA; Douglas Allaire, Texas A&M University, USA; Karen E. Willcox, Massachusetts Institute of Technology, USA

3:40-4:05 Speeding Up Monte Carlo Simulations by Using An Emulator
Anuj Kumar Tyagi and Wil Schilders, Technische Universiteit Eindhoven, The Netherlands; Xavier Jonsson, Mentor Graphics, France; Theo Beelen, Technische Universiteit Eindhoven, The Netherlands

continued in next column

Wednesday, April 6

MS60

Analysis and Algorithms for High and Infinite Dimensional Problems - Part I of III

2:10 PM-4:10 PM

Room:Garden 5C

For Part 2 see MS76

Real world problems involving hundreds or thousands of variables are ubiquitous today, with examples in physics, biological modeling, climate modeling, finance, geomechanics, etc. This minisymposium will bring together researchers from a range of applied, computational, and theoretical fields with focus on tackling high and infinite dimensional problems. The key theoretical tools will be quasi-Monte Carlo methods and high-order polynomial-type approximations in conjunction with established Sparse Grid techniques.

Organizer: Michael Griebel
Institut für Numerische Simulation, Universität Bonn and Fraunhofer-Institut für Algorithmen und Wissenschaftlich, Germany

Organizer: Frances Y. Kuo
University of New South Wales, Australia

Organizer: Dirk Nuyens
KU Leuven, Belgium

Organizer: Stefan Vandewalle
KU Leuven, Belgium

2:10-2:35 $\mathcal{H}$-Matrix Accelerated Second Moment Analysis for Potentials with Rough Correlation
Juergen Doelz, Helmut Harbrecht, and Michael Peters, Universität Basel, Switzerland; Christoph Schwab, ETH Zürich, Switzerland

2:40-3:05 Lattice Test Systems for Qmc Integration
Karl Jansen, Deutsches Elektronen-Synchrotron, Germany

continued on next page

3:10-3:35 Very High Dimensional Integration Problems in Quantum Lattice Gauge Theory
Hernan Leovey, Humboldt University Berlin, Germany

3:40-4:05 A Practical Multilevel Higher Order Quasi-Monte Carlo Method for Simulating Elliptic Pdes with Random Coefficients
Dirk Nuyens, *Pieterjan Robbe*, and Stefan Vandewalle, KU Leuven, Belgium

Coffee Break

4:10 PM-4:40 PM

Room: "Campus" Area, 1st Floor

Wednesday, April 6

MS61

Visualization in Computer Experiments

4:40 PM-6:40 PM

Room:Auditorium A

While exploring a simulation computer code, one can be faced to the complexity of its input and/or output variables. If these variables represent a temporal or a spatial phenomenon, the difficulty is to provide tools adapted to their functional and uncertain nature in order to understand and synthesize their behavior. This minisymposium aims at presenting several practical and industrial issues, as well as new visualization methods, software and new research problems. This active research domain deals with information visualization, uncertainty representation, computer graphics, scientific computing, statistical learning theory, decision making, etc.

Organizer: Bertrand Iooss
EDF, France

4:40-5:05 Several Visualization Issues in Uncertainty and Sensitivity Analysis of Model Outputs
Bertrand Iooss and Anne-Laure Popelin, EDF, France

5:10-5:35 Analysis and Visualization of Ensembles of Shapes
Ross Whitaker, University of Utah, USA

5:40-6:05 Vizualizing the Uncertainty Represented by Vector-Valued Ensemble Fields
Rudiger Westermann, Technische Universität München, Germany

6:10-6:35 Functional Data Visualization: An Extension of the Highest Density Regions Boxplot
Simon Nanty, Commissariat à l'Energie Atomique, France; Celine Helbert, Institut Camille Jordan, France; Amandine Marrel, CEA, France; Nadia Pérot, Commissariat à l'Energie Atomique, France; *Clémentine Prieur*, Université Joseph Fourier and Inria, France

Wednesday, April 6

MS62

Low Rank and Sparse Structure in Large-scale Bayesian Computation - Part III of III

4:40 PM-6:40 PM

Room:Garden 1A

For Part 2 see MS46

Bayesian computation for many science and engineering applications must contend with expensive or intractable numerical models, typically embedded in likelihood functions that involve high-dimensional parameters and/or high-dimensional data sets. Markov chain Monte Carlo, sequential Monte Carlo, and other posterior exploration schemes require repeated evaluations of such models, in principle over high-dimensional spaces. In this setting, standard algorithms quickly become intractable. Methods for identifying and exploiting low-rank structure and sparsity in the representation of the posterior distribution are becoming essential for solving these otherwise intractable Bayesian inference problems. This minisymposium will bring together researchers to present recent advances in structure-exploiting methods intended to accelerate large-scale Bayesian computation.

Organizer: Alessio Spantini
Massachusetts Institute of Technology, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Tiangang Cui
Massachusetts Institute of Technology, USA

Organizer: Kody Law
Oak Ridge National Laboratory, USA

continued on next page

Wednesday, April 6

MS62

Low Rank and Sparse Structure in Large-scale Bayesian Computation - Part III of III

4:40 PM-6:40 PM

Room:Garden 1A

continued

4:40-5:05 Dynamic Mutual Information Fields and Adaptive Sampling
Tapovan Lolla and Pierre Lermusiaux, Massachusetts Institute of Technology, USA

5:10-5:35 Estimating Large-Scale Chaotic Dynamics
Heikki Haario, Lappeenranta University of Technology, Finland

5:40-6:05 Convolved Hidden Markov Models applied to Geophysical Inversion
Henning Omre and Torstein Fjeldstad, Norwegian University of Science and Technology, Norway

6:10-6:35 Efficiently Computing Covariance of Parameter Estimates in Inverse Problems
Paul Barbone, Boston University, USA

Wednesday, April 6

MS63

Bayesian Inverse Problems Beyond the 'Conventional' Setting - Part II of II

4:40 PM-6:40 PM

Room:Garden 1B

For Part 1 see MS47

Bayesian treatments of inverse problems which employ Gaussian priors and error models have been studied extensively. In practice, however, many Bayesian inverse problems involve alternative choices: the priors and/or error models may not be Gaussian; priors and likelihood functions may contain unknown hyperparameters, leading to hierarchical formulations; and the forward models themselves may be stochastic. Such problems are often more challenging to solve than the conventional Gaussian inverse problems, and many methods developed for the Gaussian setting may not apply. The purpose of the minisymposium is to present recent advances in this broader array of Bayesian inverse problem formulations, as well as new computational methods for addressing these challenges.

Organizer: Jinglai Li
Shanghai Jiao Tong University, China

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

4:40-5:05 Besov Space Priors and X-Ray Tomography
Samuli Siltanen, University of Helsinki, Finland

5:10-5:35 High-Dimensional Bayesian Inversion with Priors Far from Gaussians
Martin Burger, University of Muenster, Germany; *Felix Lucka*, University College London, United Kingdom

5:40-6:05 A Tv-Gaussian Prior for Infinite Dimensional Bayesian Inverse Problems
Jinglai Li, Shanghai Jiao Tong University, China

6:10-6:35 Efficient Bayesian Estimation Using Conditional Expectations
Elmar Zander and Hermann G. Matthies, Technische Universität Braunschweig, Germany

Wednesday, April 6

MS64

Data Driven Dynamical Systems - Part I of II

4:40 PM-6:40 PM

Room:Garden 1C

For Part 2 see MS79

Data-driven methods are transforming the engineering, physical, and biological sciences. In particular, techniques from machine learning, dimensionality reduction, and sparse sensing are being leveraged to significant advantage in engineering design for the modeling and control of complex systems. This minisymposium brings together experts who are integrating methods from data science with the goal of characterizing complex dynamical systems.

Organizer: Steven Brunton
University of Washington, USA

Organizer: J. Nathan Kutz
University of Washington, USA

4:40-5:05 Sparse Identification of Nonlinear Dynamics: Governing Equations from Data
Steven Brunton, University of Washington, USA

5:10-5:35 Structure and Resilience of Two-Dimensional Fluid Flow Networks
Kunihiko Taira, Florida State University, USA

5:40-6:05 Low-Dimensional Modeling and Control of Nonlinear Dynamics Using Cluster Analysis
Eurika Kaiser, CNRS, France

6:10-6:35 Bayesian Inference of Biogeochemical-Physical Dynamical Models
Pierre Lermusiaux, Massachusetts Institute of Technology, USA

Wednesday, April 6

MS65

Advances in Computationally Intensive Inference - Part III of III

4:40 PM-6:40 PM

Room:Garden 2A

For Part 2 see MS49

Computationally intensive inference refers to statistical inference using simulation- based techniques requiring a significant amount of computing resources. These methods have been applied with great success to complicated, non-linear and possibly high-dimensional inference problems. They methods are supported by many strong theoretical results, and their analysis has recently been receiving increased attention in applied probability. In the last decades, the topic has attracted interest from researchers in Statistics and Applied Probability, Applied Mathematics and Engineering. This minisymposium aims to bring together experts from these different communities to present recent advances in theory, methodology and applications related to computationally intensive intensive inference.

Organizer: Kody Law
Oak Ridge National Laboratory, USA

Organizer: Alexandre Thiery
National University of Singapore, Singapore

Organizer: Nikolas Kantas
Imperial College London, United Kingdom

4:40-5:05 Variance Estimation and Allocation in the Particle Filter

Anthony Lee, Warwick University, United Kingdom; Nick Whitely, University of Bristol, United Kingdom

5:10-5:35 Title Not Available

Ben Calderhead, Imperial College, London, United Kingdom

5:40-6:05 Incremental Local Approximations for Computationally Intensive Mcmc on Targeted Marginals

Andrew D. Davis and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

6:10-6:35 Parallel Adaptive Importance Sampling

Simon Cotter, University of Oxford, United Kingdom

continued in next column

Wednesday, April 6

MS66

Quantifying and Accounting for Uncertainties in Large Scale (Atmospheric and Oceanic) Models - Part II of II

4:40 PM-6:40 PM

Room:Garden 2B

For Part 1 see MS50

Uncertainty quantification (UQ) of climate system forecasts and projections presents fundamental challenges that is intertwined with limitations in observations and scientific understanding. The goal of this session is to provide a forum to discuss ideas for advancing the science of UQ in climate modeling and its components. This includes: How can the various uncertainties in such models be appropriately quantified and represented? How best to reduce uncertainty using approaches such as data assimilation or inverse modeling? How can stochastic features in models be addressed and included? How reliable are uncertainties quantified by ensembles? What information do they carry?

Organizer: Ibrahim Hoteit
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Organizer: Aneesh Subramanian
University of Oxford, United Kingdom

Organizer: Omar M. Knio
Duke University, USA

Organizer: Mohamed Iskandarani
University of Miami, USA

continued on next page

Wednesday, April 6

MS66

Quantifying and Accounting for Uncertainties in Large Scale (Atmospheric and Oceanic) Models - Part II of II

4:40 PM-6:40 PM

Room:Garden 2B

continued

4:40-5:05 Polynomial Chaos-Based Bayesian Inference of K-Profile Parametrization in a General Circulation Model of the Torpical Pacific

Ihab Sraj, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Sarah Zedler and Charles Jackson, University of Texas at Austin, USA; *Omar M. Knio*, Duke University, USA; Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

5:10-5:35 Ensemble Variational Assimilation

Olivier Talagrand and Mohamed Jardak, École Normale Supérieure Paris, France

5:40-6:05 Model Reduction for Climate Model Structural Uncertainty Quantification

Nathan Urban, Cristina Garcia-Cardona, Terry Haut, Alexandra Jonko, Balu Nadiga, and *Juan Saenz*, Los Alamos National Laboratory, USA

6:10-6:35 Field Sensitivity Analysis of the Circulation in the Gulf of Mexico Using a PC Representation

Guotu Li, Duke University, USA; Mohamed Iskandarani and Matthieu Le Henaff, University of Miami, USA; Justin Winokur, Duke University, USA; Olivier P. Le Maître, LIMSI-CNRS, France; Omar M. Knio, Duke University, USA

Wednesday, April 6

MS67

Bayesian Inversion and Low-rank Approximation - Part II of II

4:40 PM-7:10 PM

Room:Garden 2C

For Part 1 see MS51

Sparse approximations, especially in the form of low-rank methods, have become essential in the solution and representation of high-dimensional stochastic problems. Identification in the form of Bayesian inverse problems - in particular when performed repeatedly or sequentially for dynamical systems - requires the efficient solution and representation of high-dimensional stochastic forward problems. Additionally it seems advantageous if the Bayesian update can take advantage of such sparse representations, and produce the update also in sparse form. The minisymposium will focus on sparse techniques for the representation and solution of high-dimensional problems, and their interplay with Bayesian inverse problems and Bayesian inversion.

Organizer: Hermann G. Matthies
Technische Universität Braunschweig, Germany

Organizer: Alireza Doostan
University of Colorado Boulder, USA

Organizer: Martin Eigel
WIAS, Berlin, Germany

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

Organizer: Reinhold Schneider
Technische Universität Berlin, Germany

4:40-5:05 Spectral Likelihood Expansions and Nonparametric Posterior Surrogates

Joseph Nagel, ETH Zürich, Switzerland

5:10-5:35 Rapid Bayesian Inference on Bayesian Cyclic Networks

Robert K. Niven, University of New South Wales, Australia; Bernd R. Noack and Eurika Kaiser, CNRS, France; Louis N. Cattafesta, Florida State University, USA; Laurent Cordier, CNRS, France; Markus Abel, Universität Potsdam, Germany

5:40-6:05 Stochastic Collocation Methods for Nonlinear Probabilistic Problems in Solid Mechanics

Joachim Rang, Frederik Fahrendorf, Laura De Lorenzis, and Hermann G. Matthies, Technische Universität Braunschweig, Germany

6:10-6:35 Exploiting Tensor Structure in Bayesian Inverse Problems

Alex A. Gorodetsky and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

6:40-7:05 Bayesian Inversion Using Hierarchical Tensor Approximations

Manuel Marschall, Technische Universität Berlin, Germany; Martin Eigel, WIAS, Berlin, Germany; Reinhold Schneider, Technische Universität Berlin, Germany

continued in next column

Wednesday, April 6

MS68

Analysis and Uncertainty Quantification of Spatio-temporal Data - Part III of III

4:40 PM-6:40 PM

Room:Garden 3A

For Part 2 see MS52

Current technological developments allow the collection of huge amounts of spatio-temporal data that are usually stored and afterwards analyzed to support the decision-making process. There are many challenges in representing, processing, analysis and mining of such datasets due to complex structure of spatiotemporal objects and the relationships among them in both spatial and temporal dimensions. This minisymposium will address the analytical methodologies, strategies or techniques that allow the analysis of complex spatio-temporal data, and the suitable prediction and uncertainty quantification mechanisms that ensure an effective integration of this type of data in the decision-making process.

Organizer: Bani Mallick
Texas A&M University, USA

4:40-5:05 Bayesian Models for Uncertainty Quantification of Antarctic Ice Shelves
Reinhard Furrer and David Masson, University of Zurich, Switzerland

5:10-5:35 Fused Adaptive Lasso for Spatial and Temporal Quantile Function Estimation
Ying Sun, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Huixia Wang, George Washington University, USA; Montserrat Fuentes, North Carolina State University, USA

5:40-6:05 Full Scale Multi-Output Spatial Temporal Gaussian Process Emulator with Non-Seperable Auto-Covariance Function
Huiyan Sang, Texas A&M University, USA

6:10-6:35 An Adaptive Spatial Model for Precipitation Data from Multiple Satellite over Large Regions
Bani Mallick, Texas A&M University, USA

Wednesday, April 6

MS69

Uncertainty Management for Robust Industrial Design in Aeronautics - Part II of II

4:40 PM-6:40 PM

Room:Garden 3B

For Part 1 see MS53

This minisymposium aims at showcasing recent advances in the areas of Uncertainty Management and Quantification (QM and QU) and Robust Design methods (RDM) in Aeronautics and aircraft industry to treat large numbers of simultaneous uncertainties in analysis and design, including uncertainties on operational conditions, uncertainties on geometries resulting from manufacturing tolerances, numerical error sources and uncertain physical model parameters. It is organized in collaboration with the UMRIDA EU-project.

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Dirk Wunsch
NUMECA International, Belgium

4:40-5:05 Innovative Methodologies for Robust Design Optimization with Large Number of Uncertainties
Alberto Clarich and Rosario Russo, ESTECO, USA

5:10-5:35 Non-Adaptive Construction of Sparse Polynomial Surrogates in Computational Aerodynamics
Eric M. Savin, ONERA, France

5:40-6:05 Manufacturing Tolerances in Industrial Turbo-Machinery Design
Rémy Nigro, Universite de Mons, Belgium; Dirk Wunsch, NUMECA International, Belgium; Grégory Coussement, Universite de Mons, Belgium; Charles Hirsch, NUMECA International, Belgium

6:10-6:35 Efficient Usage of 2nd Order Sensitivity for Uncertainty Quantification
Lukas Laniewski-Wollk and *Marcin Wyrozebski*, Warsaw University of Technology, Poland

Wednesday, April 6

MS70

Uncertainty Quantification of Systems Exhibiting Intermittent Dynamics - Part II of II

4:40 PM-7:10 PM

Room:Garden 3C

For Part 1 see MS54

A wide range of dynamical systems encountered in nature and technology are characterized by the presence of intermittent episodes with strongly transient characteristics. These occurrences are typically associated with strongly nonlinear dynamical mechanisms, which is hard to capture using conventional UQ methods. This minisymposium is focusing on analytical and computational methods and their applications for the uncertainty quantification and prediction of dynamical systems that exhibit such strongly transient behavior.

Organizer: Themistoklis Sapsis
Massachusetts Institute of Technology, USA

Organizer: Andrew Majda
Courant Institute of Mathematical Sciences, New York University, USA

4:40-5:05 Multi-Resolution Dynamic Mode Decomposition and Koopman Theory
J. Nathan Kutz, University of Washington, USA

5:10-5:35 Multiscale Relations Measure for Categorical Data and Application to Genomics
Susanne Gerber, Università della Svizzera Italiana, Italy

5:40-6:05 A Transfer Operator Approach to the Prediction of Atmospheric Regime Transition
Alexis Tantet, University of Utrecht, Netherlands; Henk A. Dijkstra, Utrecht University, The Netherlands

6:10-6:35 Dynamic Patterns in the Brain
Bing W. Brunton, University of Washington, USA

6:40-7:05 Reduced Order Precursors of Rare Events in Unidirectional Nonlinear Water Waves
Themistoklis Sapsis and Will Cousins, Massachusetts Institute of Technology, USA

Wednesday, April 6

MS71

Uncertainty Quantification in Subsurface Environments - Part III of III

4:40 PM-6:10 PM

Room:Garden 4A

For Part 2 see MS55

Our knowledge of the structure and properties of porous media is typically incomplete. Therefore, outputs of subsurface flow and transport models are plagued by uncertainty. Designing effective numerical methods dealing with uncertainties requires both mathematical and hydrogeological expertise and is crucial in every phase of the workflow, from the solution of inverse problems for the identification of the flow and transport properties to the forward propagation of the uncertainties, the sensitivity analysis and the design of management policies. This minisimposium gathers researchers with different backgrounds active in the area, presenting both advances in dedicated UQ techniques and realistic test-cases.

Organizer: Lorenzo Tamellini
Università di Pavia, Italy

Organizer: Giovanni Porta
Politecnico di Milano, Italy

Organizer: Monica Riva
Politecnico di Milano, Italy

Organizer: Alberto Guadagnini
Politecnico di Milano, Italy

4:40-5:05 An Adaptive Sparse Grid Algorithm for Darcy Problems with Log-normal Permeability

Lorenzo Tamellini, Università di Pavia, Italy; Fabio Nobile, École Polytechnique Fédérale de Lausanne, Switzerland; Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Francesco Tesei, École Polytechnique Fédérale de Lausanne, Switzerland

continued in next column

5:10-5:35 The Role of Global Sensitivity Analysis in Interpreting Subsurface Processes under Uncertainty

Valentina Ciriello, Università di Bologna, Italy

5:40-6:05 Estimating Flow Parameters for the Unsaturated Zone Using Data Assimilation

Insa Neuweiler, University of Hannover, Germany; Daniel Erdal, University of Tübingen, Germany; Natascha Lange, University of Hannover, Germany

Wednesday, April 6

MS72

Software for UQ - Part III of III

4:40 PM-6:10 PM

Room:Garden 4B

For Part 2 see MS56

With the growing importance of UQ in various disciplines and fields, software solutions and libraries for UQ problems get more and more important. This raises interesting questions from the application scientist such as: What are the current properties of available tools? For which classes of problems have they been developed? What are challenges for UQ software and which resources are required? What are the next steps and the long-term goals of development? This minisymposium brings together experts for different software in the context of UQ, ranging from tools that ease up individual tasks of UQ up to whole frameworks for solving UQ problems.

Organizer: Tobias Neckel
Technische Universität München, Germany

Organizer: Dirk Pflüger
University of Stuttgart, Germany

4:40-5:05 Advancements in the Uqlab Framework for Uncertainty Quantification

Stefano Marelli, Christos Lataniotis, and Bruno Sudret, ETH Zürich, Switzerland

5:10-5:35 PSUADE: A Software Toolkit for Uncertainty Quantification

Charles Tong, Lawrence Livermore National Laboratory, USA

5:40-6:05 Uncertainty Quantification Python Laboratory (UQ-PyL) – A GUI For Parametric Uncertainty Analysis of Large Complex Dynamical Models

Qingyun Duan and Chen Wang, Beijing Normal University, China; Charles Tong, Lawrence Livermore National Laboratory, USA

Wednesday, April 6

MS73

Sparse Techniques for High-dimensional UQ Problems and Applications - Part III of III

4:40 PM-6:40 PM

Room:Garden 4C

For Part 2 see MS57

Uncertainty quantification in computational models is strongly challenged by the high-dimensionality of the input parameter space. Relatedly, classical techniques such as polynomial chaos expansions typically lead to under-determined problems. This curse of dimensionality has recently been tackled by sparse learning techniques, such as sparse grids interpolation, l1-regularized regression (e.g. compressive sensing and least angle regression). These methods successfully address the high-dimensionality challenge at an affordable cost, if the latter has an underlying sparse structure. This minisymposium will focus on the latest developments of these techniques for the sake of uncertainty propagation and sensitivity analysis.

Organizer: Bruno Sudret
ETH Zürich, Switzerland

Organizer: Alireza Doostan
University of Colorado Boulder, USA

Organizer: Khachik Sargsyan
Sandia National Laboratories, USA

4:40-5:05 Posterior Concentration and High Order Quasi Monte Carlo for Bayesian Inverse Problems

Christoph Schwab, ETH Zürich, Switzerland; Josef Dick and Thong Le Gia, University of New South Wales, Australia; Robert N. Gantner, ETH Zürich, Switzerland

5:10-5:35 Multilevel Monte-Carlo Hybrids Exploiting Multifidelity Modeling and Sparse Polynomial Chaos

Michael S. Eldred, Sandia National Laboratories, USA; Gianluca Geraci, Stanford University, USA; John D. Jakeman, Sandia National Laboratories, USA

5:40-6:05 A Multi-Level Compressed Sensing Petrov Galerkin Method for the Approximation of Parametric PDEs

Jean-Luc Bouchot, Benjamin Bykowski, and Holger Rauhut, RWTH Aachen, Germany; Christoph Schwab, ETH Zürich, Switzerland

6:10-6:35 CORSING: Sparse Approximation of PDEs Based on Compressed Sensing

Simone Brugiapaglia and Stefano Micheletti, Politecnico di Milano, Italy; Fabio Nobile, École Polytechnique Fédérale de Lausanne, Switzerland; Simona Perotto, Politecnico di Milano, Italy

continued in next column

Wednesday, April 6

MS74

Scalable Multi-fidelity Methods in Uncertainty Quantification - Part II of II

4:40 PM-6:40 PM

Room:Garden 5A

For Part 1 see MS58

Uncertainty quantification (UQ) poses the need to numerically solve governing equations (i.e., the forward problem) multiple times, often thousands of times. The complexity in repeatedly solving forward problems is further amplified in the presence of non-linearity, high-dimensionality, and massive data-sets; all common features in realistic physical and biological systems. The goal of this minisymposium is to establish an interface between scientific computing and machine learning techniques, towards developing scalable workflows for UQ in high-dimensional stochastic dynamical systems. Relevant topics include, but are not limited to: multi-fidelity modeling, unsupervised learning from big data, surrogate-based modeling, and relevant applications to UQ problems.

Organizer: Paris Perdikaris
Massachusetts Institute of Technology, USA

Organizer: Daniele Venturi
Brown University, USA

Organizer: George E. Karniadakis
Brown University, USA

4:40-5:05 Tree-Structured Expectation Propagation for Stochastic Multiscale Differential Equations

Demetris Marnerides and Nicholas Zabaras, University of Warwick, United Kingdom

continued on next page

Wednesday, April 6

MS74

Scalable Multi-fidelity Methods in Uncertainty Quantification - Part II of II

4:40 PM-6:40 PM

Room:Garden 5A

continued

5:10-5:35 Model Adaptivity in Bayesian Inverse Problems

Jayanth Jagalur-Mohan and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

5:40-6:05 Multi-Fidelity Simulation of Random Fields by Multi-Variate Gaussian Process Regression

Lucia Parussini, Universita di Trieste, Italy; Daniele Venturi, University of California, Santa Cruz, USA

6:10-6:35 A Multifidelity Stochastic CFD Framework for Robust Simulation with Gappy Data

Seungjoon Lee, Brown University, USA; Ioannis Kevrekedis, Princeton University, USA; George Em Karniadakis, Brown University, USA

Wednesday, April 6

MS75

Theory and Simulation of Failure Probabilities and Rare Events - Part II of II

4:40 PM-6:40 PM

Room:Garden 5B

For Part 1 see MS59

The evaluation of failure probabilities is a fundamental problem in reliability analysis and risk management of systems with uncertain inputs. We consider systems described by PDEs with random coefficients together with efficient approximation schemes. This includes stochastic finite elements, collocation, reduced basis, and advanced Monte Carlo methods. Efficient evaluation and updating of small failure probabilities and rare events remains a significant computational challenge. This minisymposium brings together tools from applied probability, numerical analysis, and computational science and engineering. We showcase advances in analysis and computational treatment of rare events and failure probabilities, including variance reduction, advanced meta-models, and multilevel Monte Carlo.

Organizer: Elisabeth Ullmann
Technische Universität München, Germany

Organizer: Iason Papaioannou
Technische Universität München, Germany

4:40-5:05 Multilevel Monte Carlo Methods for Computing Failure Probability of Porous Media Flow Systems

Fritjof Fagerlund and *Fredrik Hellman*, Uppsala University, Sweden; Axel Målqvist, Chalmers University of Technology, Sweden; Auli Niemi, Uppsala University, Sweden

5:10-5:35 Subset Simulation: Strategies to Enhance the Performance of the Method

Wolfgang Betz, Iason Papaioannou, and Daniel Straub, Technische Universität München, Germany

5:40-6:05 Markov Chain Monte Carlo for Rare Event Reliability Analysis with Nonlinear Finite Elements

David K. Green, University of New South Wales, Australia

6:10-6:35 Bayesian Updating of Rare Events: The BUS Approach

Iason Papaioannou, Wolfgang Betz, and Daniel Straub, Technische Universität München, Germany

continued in next column

Wednesday, April 6

MS76

Analysis and Algorithms for High and Infinite Dimensional Problems - Part II of III

4:40 PM-6:40 PM

Room:Garden 5C

For Part 1 see MS60
For Part 3 see MS151

Real world problems involving hundreds or thousands of variables are ubiquitous today, with examples in physics, biological modeling, climate modeling, finance, geomechanics, etc. This minisymposium will bring together researchers from a range of applied, computational, and theoretical fields with focus on tackling high and infinite dimensional problems. The key theoretical tools will be quasi-Monte Carlo methods and high-order polynomial-type approximations in conjunction with established Sparse Grid techniques.

Organizer: Michael Griebel
Institut für Numerische Simulation, Universität Bonn and Fraunhofer-Institut für Algorithmen und Wissenschaftlich, Germany

Organizer: Frances Y. Kuo
University of New South Wales, Australia

Organizer: Dirk Nuyens
KU Leuven, Belgium

Organizer: Stefan Vandewalle
KU Leuven, Belgium

4:40-5:05 Numerical Integration of Piecewise Smooth Systems
Andreas Griewank, Humboldt University Berlin, Germany

5:10-5:35 Gpu Acceleration of the Stochastic Grid Bundling Method for Early-Exercise Options
Alvaro Leitao, Centrum voor Wiskunde en Informatica (CWI), Netherlands

5:40-6:05 On Tensor Product Approximation of Analytic Functions
Jens Oettershagen, University of Bonn, Germany

6:10-6:35 Numerical Solution of Elliptic Diffusion Problems on Random Domains
Michael Peters and Helmut Harbrecht, Universität Basel, Switzerland

Wednesday, April 6

SIAG/UQ Business Meeting

7:15 PM-8:00 PM

Room:Auditorium A

Thursday, April 7

Registration

7:30 AM-6:40 PM

Room: "Campus" Area, 1st Floor

MT5

Introduction to Quasi-Monte Carlo Methods -- with Application to PDEs with Random Coefficients

8:35 AM-10:35 AM

Room:Auditorium A

Chair: Frances Y. Kuo, University of New South Wales, Australia

This tutorial provides a contemporary review of quasi-Monte Carlo (QMC) methods for approximating high dimensional integrals. I will introduce the families of lattice rules and digital nets, and highlight some recent developments. One key element is the "fast component-by-component construction" which yields QMC methods with a prescribed rate of convergence for sufficiently smooth functions. A careful selection of parameters called "weights" is needed to ensure that the worst case errors in an appropriately weighted function space are bounded independently of the dimension. I will also summarize recent research efforts on the application of QMC methods to PDEs with random coefficients.

Frances Y. Kuo, University of New South Wales, Australia

Thursday, April 7

MS77

Characterizing the Effects of Data Variability and Uncertainty on Simulation Based Geophysical Hazards Analyses - Part I of III

8:35 AM-10:35 AM

Room:Garden 1A

For Part 2 see MS92

Large scale simulations and ensemble based methodologies for UQ are now widely used in analysis of geophysical flows like storm surges, tsunamis, lahars. Simulation based hazard assessments are critically dependent on proper identification and characterization of parameters ranging from basal resistance, topography/ bathymetry and other initiation conditions. Furthermore, one must carefully handle the rare nature of the most dangerous events to both exploit the limited geophysical data and use simulations efficiently. In this set of talks we will invite 12 speakers dealing with these issues for storm surges, tsunamis, landslides and volcanic plume transport using different methodologies.

Organizer: Elaine Spiller
Marquette University, USA

Organizer: Abani K. Patra
State University of New York at Buffalo, USA

Organizer: Serge Guillas
University College London, United Kingdom

8:35-9:00 An Overview of Uncertainty Quantification in Geophysical Hazard Analyses
Elaine Spiller, Marquette University, USA

continued in next column

9:05-9:30 A Measure-Theoretic Approach to Parameter Estimation
Clint Dawson, University of Texas at Austin, USA; Troy Butler, University of Colorado, Denver, USA; *Steven Mattis* and Lindley C. Graham, University of Texas at Austin, USA

9:35-10:00 Uncertainty Quantification of a Tsunami Model with Uncertain Bathymetry Using Statistical Emulation
Xiaoyu Liu and Serge Guillas, University College London, United Kingdom

10:05-10:30 Uncertainty Quantification About Dynamic Flow, Frequency, and Initiation of Pyroclastic Flows
Robert Wolpert, Duke University, USA

Thursday, April 7

MS78

Inverse Problems Meet Big Data

8:35 AM-10:35 AM

Room:Garden 1B

Inverse problems and uncertainty quantification are pervasive in engineering and science. The exponential increase in the quantity of measurements and data holds tremendous promise for data-driven scientific discoveries. Nonetheless, this promise cannot come to fruition without a systematic and scalable methodology for the estimation of the solution and its uncertainty in the presence of large data sets. This minisymposium collects recent advances in data-scalable algorithms for inverse problems such as randomization and compression and their effect on estimation problems. The aim is to engage researchers from inverse problems and big data problems in discussions about big data inverse problems.

Organizer: Tan Bui-Thanh
University of Texas at Austin, USA

Organizer: Matthias Chung
Virginia Tech, USA

Organizer: Eldad Haber
University of British Columbia, Canada

8:35-9:00 A Randomized Misfit Approach for Data Reduction in Large-Scale Inverse Problems
Tan Bui-Thanh, Ellen Le, and *Aaron Myers*, University of Texas at Austin, USA

9:05-9:30 Uncertainty Quantification in 4D Seismic
Alison Malcolm, Memorial University, Newfoundland, Canada; Di Yang, ExxonMobil, USA; Michael Fehler, Massachusetts Institute of Technology, USA; Maria Kotsi, Memorial University, Newfoundland, Canada

9:35-10:00 Sub-sampled Newton Methods and Modern Big Data Problems
Farbod Roosta-Khorasani and Michael Mahoney, University of California, Berkeley, USA

10:05-10:30 Title Not Available
Eldad Haber, University of British Columbia, Canada

Thursday, April 7

MS79

Data Driven Dynamical Systems - Part II of II

8:35 AM-10:35 AM

Room:Garden 1C

For Part 1 see MS64

Data-driven methods are transforming the engineering, physical, and biological sciences. In particular, techniques from machine learning, dimensionality reduction, and sparse sensing are being leveraged to significant advantage in engineering design for the modeling and control of complex systems. This minisymposium brings together experts who are integrating methods from data science with the goal of characterizing complex dynamical systems.

Organizer: Steven Brunton
University of Washington, USA

Organizer: J. Nathan Kutz
University of Washington, USA

8:35-9:00 Uncertainty Analysis - An Operator Theoretic Approach
Igor Mezic, University of California, Santa Barbara, USA

9:05-9:30 Discovering Dynamics from Measurements, Inputs, and Delays
Joshua L. Proctor, Institute for Disease Modeling, USA

9:35-10:00 Improved Dynamic Mode Decomposition Algorithms for Noisy Data
Scott Dawson, Princeton University, USA; Maziar Hemati, University of Minnesota, USA; Matthew Williams, United Technologies Research Center, USA; Clarence Rowley, Princeton University, USA

10:05-10:30 Temporal Compressive Sensing of Strain Histories of Compliant Wings for Classification of Aerodynamic Regimes
Krithika Manohar, University of Washington, USA

Thursday, April 7

MS80

Design of Computer Experiments and Sequential Strategies with Gaussian Process Models - Part I of III

8:35 AM-10:35 AM

Room:Garden 2A

For Part 2 see MS95

Design and analysis of computer experiments constitute an active research field at a crossroads between applied mathematics, statistics, and many application domains. Gaussian process models have become an essential tool for guiding sequential strategies dedicated to a number of goals including single- and multi-objective optimization, estimation of regions of interest, etc. In this session, we will gather junior and senior researchers from various communities, who will present novel contributions pertaining to one or the other aspect of static and sequential design of computer experiments, with a specific focus on the potentialities offered by stochastic models such as Gaussian process ones.

Organizer: Xu He
Chinese Academy of Sciences, China

Organizer: David Ginsbourger
Idiap Research Institute and University of Bern, Switzerland

Organizer: C. F. Jeff Wu
Georgia Institute of Technology, USA

8:35-9:00 An Iterative Procedure for Large-scale Computer Experiments
Shifeng Xiong, Chinese Academy of Sciences, China

9:05-9:30 A Constructive Method for Generating Near Minimax Distance Designs
Xu He, Chinese Academy of Sciences, China

9:35-10:00 Smoothed Brownian Kriging Models for Computer Simulations
Matthew Plumlee, University of Michigan, USA

10:05-10:30 A Submodular Criterion for Space-Filling Design
Luc Pronzato and Maria-Joao Rendas, CNRS, France

Thursday, April 7

MS81

Perspectives on Model-informed Data Assimilation - Part I of II

8:35 AM-10:35 AM

Room:Garden 2B

For Part 2 see MS96

In many applications noisy and incomplete information about a process of interest arrives online in a sequential manner and one aims to recover the relevant conditional state estimates. Often one is confronted with high dimensional problems based on imperfect forward models. The field of data assimilation has grown out of the necessity to obtain approximate, computationally feasible solutions to this problem. This minisymposium aims to bring together experts interested in nonlinear filtering and data assimilation, and in particular the incorporation of model-specific insight and constraints on model uncertainties, to share their latest ideas on systematic improvements of data assimilation algorithms.

Organizer: Kody Law
Oak Ridge National Laboratory, USA

Organizer: Michal Branicki
University of Edinburgh, United Kingdom

8:35-9:00 A Hybrid Ensemble Transform Filter for High Dimensional Dynamical Systems
Walter Acevedo, Sebastian Reich, and Maria Reinhardt, Universität Potsdam, Germany

9:05-9:30 Stability of Ensemble Kalman Filters
Xin T. Tong and Andrew Majda, Courant Institute of Mathematical Sciences, New York University, USA; David Kelly, University of Warwick, United Kingdom

9:35-10:00 Bayesian Smoothing and Learning for Multiscale Ocean Flows
Jing Lin, Tapovan Lolla, and Pierre Lermusiaux, Massachusetts Institute of Technology, USA

10:05-10:30 Uncertainty Propagation for Bilinear Pdes: the Minimax Approach
Sergiy Zhuk and Tigran Tchrakian, IBM Research, Ireland

Thursday, April 7

MS82

Low-rank and Sparse Tensor Methods for Uncertainty Quantification

8:35 AM-10:35 AM

Room:Garden 2C

Low-rank tensor methods allow us to speed up the solution of multi-parametric/stochastic PDEs and inverse problems. The main issues are to keep a low-rank approximation of the high-dimensional input data through the whole computing process and compute the solution in a low-rank tensor format with the (quasi-)linear cost. The coefficient inverse problem is connected with the problem of uncertainty quantification in the coefficients. In both cases one should identify unknown/uncertain coefficients of the problems, taking into account available measurements and expert knowledge. The purpose of this minisymposium is to bring together experts in UQ, stochastic/multi-parametric problems, experts in multi-linear algebra and experts in the Bayesian approach for inverse problems.

Organizer: Alexander Litvinenko
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Organizer: Mike Espig
RWTH Aachen, Germany

Organizer: Lars Grasedyck
RWTH Aachen, Germany

Organizer: Anthony Nouy
Ecole Centrale de Nantes, France

8:35-9:00 Low-rank Approximation Method for the Solution of Dynamical Systems with Uncertain Parameters
Marie Billaud-Friess and Anthony Nouy, Ecole Centrale de Nantes, France

continued in next column

9:05-9:30 Alternating Iteration for Low-Rank Solution of the Inverse Stochastic Stokes Equation
Sergey Dolgov, University of Bath, United Kingdom; Peter Benner, Max-Planck-Institute for Dynamics of Complex Technical Systems, Germany; Akwum Onwunta and Martin Stoll, Max Planck Institute, Magdeburg, Germany

9:35-10:00 On the Convergence of Alternating Least Squares Optimisation in Tensor Format Representations
Mike Espig, RWTH Aachen, Germany; W. Hackbusch, Unaffiliated; Aram Khachatryan, Max Planck Institute for Mathematics in the Sciences, Germany

10:05-10:30 Parallel Low Rank Tensor Arithmetics for Extreme Scale UQ
Christian Loebbert, RWTH Aachen University, Germany

Thursday, April 7

MS83

Advances in Sampling Methods for Bayesian Inverse Problems - Part I of III

8:35 AM-10:35 AM

Room:Garden 3A

For Part 2 see MS98

The numerical solution of inverse problems involving complex forward models has become essential to uncertainty quantification in many science and engineering applications. Here, the Bayesian approach provides rigorous characterizations of uncertainty. Yet computational characterisation of the posterior distribution---typically via sampling---remains a computationally challenging task. Challenges include adapting to correlated, concentrated, and non-Gaussian posterior structure; performing real-time estimation from large data streams; handling forward models in a non-intrusive setting; and developing mathematical analysis to illuminate and guide these approaches. This minisymposium presents recent developments in sampling methods, including MCMC, EnKF, and sparse quadratures in high or infinite-dimensional parameter spaces.

Organizer: Tan Bui-Thanh
University of Texas at Austin, USA

Organizer: Mark Girolami
University of Warwick, United Kingdom

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Christoph Schwab
ETH Zürich, Switzerland

continued on next page

8:35-9:00 Discrete Monge-Kantorovich Approach for Sampling Bayesian Posteriors
Aaron Myers, University of Texas at Austin, USA; *Kainan Wang*, Halliburton, USA; Alexandre Thiery, National University of Singapore, Singapore; Tan Bui-Thanh, University of Texas at Austin, USA

9:05-9:30 Hierarchical Bayesian Level Set Inversion
Matthew M. Dunlop, University of Warwick, United Kingdom; Marco Iglesias, University of Nottingham, United Kingdom; *Andrew Stuart*, University of Warwick, United Kingdom

9:35-10:00 A Partial Domain Inversion Approach for Large-scale Baysian Inverse Problems in High Dimensional Parameter Spaces
Vishwas Rao and *Tan Bui-Thanh*, University of Texas at Austin, USA

10:05-10:30 Higher-Order Quasi-Monte Carlo Integration in Bayesian Inversion
Robert N. Gantner and Christoph Schwab, ETH Zürich, Switzerland; Josef Dick and Thong Le Gia, University of New South Wales, Australia

Thursday, April 7

MS84

Uncertainty Quantification for Complex Physical Models - Part I of III

8:35 AM-10:35 AM

Room:Garden 3B

For Part 2 see MS99

Advances in modeling, algorithms, and computational resources are allowing simulations to play an increasingly important role in driving decisions regarding complex physical systems. However, computational models of such systems are commonly afflicted by many types of error and uncertainty. In this context, uncertainty quantification are crucial to making well- informed decisions. The aim of this minisymposium is to bring together researchers developing approaches for quantifying uncertainties, including those due to uncertain parameters, inadequate physical models, and uncertain or sparse experimental data, for models of complex physical systems such as turbulent flows, subsurface flow, oceanic flow, and materials applications.

Organizer: Heng Xiao
Virginia Tech, USA

Organizer: Todd Oliver
University of Texas at Austin, USA

Organizer: Xiu Yang
Pacific Northwest National Laboratory, USA

8:35-9:00 Quantifying and Reducing Model-Form Uncertainties in Reynolds Averaged Navier-Stokes Simulations: An Open-Box, Physics-Based, Bayesian Approach
Heng Xiao, Jinlong Wu, Jianxun Wang, Rui Sun, and Chris J. Roy, Virginia Tech, USA

9:05-9:30 Epistemic Uncertainty Quantification of the Second Moment Closure Turbulence Modeling Framework
Aashwin Mishra and Sharath Girimaji, Texas A&M University, USA

9:35-10:00 Reducing Epistemic Uncertainty of Fluid-Structure Instabilities
Rakesh Sarma and Richard P. Dwight, Delft University of Technology, Netherlands

10:05-10:30 Uncertainty Quantification for Modeling Night-Time Ventilation in Stanford's Y2E2 Building
Catherine Gorlé and *Giacomo Lamberti*, Columbia University, USA

continued in next column

Thursday, April 7

MS85

Uncertainty Quantification and Inversion of Multiphysics and Multiscale Problems - Part I of III

8:35 AM-10:35 AM

Room:Garden 3C

For Part 2 see MS100

UQ methodologies, deterministic/ Bayesian approaches are essential to diagnose the model errors, integrate data and models to infer uncertain parameters. Scientific and engineering codes for multiparameter, multiphyiscs problems commonly achieve correct simulations through the calibration of model parameters. As computational science moves to estimate optimized model parameters from noisy and indirect observational data, the quality of decision making improves. We will present and discuss the methodologies and approaches in the applications across a wide range of scientific and engineering problems.

Organizer: Tulin Kaman
University of Zurich, Switzerland

Organizer: Remi Abgrall
Inria Bordeaux Sud-Ouest, France

Organizer: James G. Glimm
State University of New York, Stony Brook, USA

8:35-9:00 Calibration of Velocity Moments from Experimental and Les Simulation Data
James G. Glimm, State University of New York, Stony Brook, USA

9:05-9:30 Model Validation for Porous Media Flows
Felipe Pereira, University of Texas at Dallas, USA

9:35-10:00 Recent Developments in High-Order Stochastic Finite Volume Method for the Uncertainty Quantification in Cfd Problems
Svetlana Tokareva, University of Zurich, Switzerland; Christoph Schwab and Siddhartha Mishra, ETH Zürich, Switzerland; Remi Abgrall, University of Zurich, Switzerland

10:05-10:30 Uncertainty Quantification for the Simulation of Bubbly Flows
Tulin Kaman and Remi Abgrall, University of Zurich, Switzerland

Thursday, April 7

MS86

Hierarchical and Multi-scale Methods for Uncertainty Quantification in Forward and Inverse Problems - Part I of II

8:35 AM-10:35 AM

Room:Garden 4A

For Part 2 see MS101

The minisymposium focuses on recent advances in hierarchical methods for uncertainty quantification in porous media and other engineering applications. We are interested in methods employing any kind of nested representation of the same problem (i.e. length or time-scales, mesh resolution, model complexity) with two or more levels. Possible topics include: coupling of multi-fidelity formulations of the physical problem, approaches based on multi-level grid refinement, hierarchical response surface methods, multi-resolution and multi-scale methods for Bayesian inversion, efficient implementation techniques for hierarchical or nested simulations, innovative model reduction and scale-bridging methods, understanding of modelling error across the levels.

Organizer: Matteo Icardi
University of Warwick, United Kingdom

Organizer: Ahmed H. ElSheikh
Heriot-Watt University, United Kingdom

Organizer: Ivan Lunati
University of Lausanne, Switzerland

8:35-9:00 Bayesian Hierarchical Model in Spatial Inverse Problems
Anirban Mondal, Case Western Reserve University, USA

continued in next column

9:05-9:30 Accelerating Uncertainty Quantification with Proxy and Error Models
Laureline Josset and Ivan Lunati, University of Lausanne, Switzerland

9:35-10:00 Application of Multilevel Concepts for Uncertainty Quantification in Reservoir Simulation
Doaa Elsakout, Mike Christie, and Gabriel J. Lord, Heriot-Watt University, United Kingdom

10:05-10:30 Machine Learning Assisted Sampling Algorithm for Inverse Uncertainty Quantification
Ahmed H. ElSheikh, Heriot-Watt University, United Kingdom

Thursday, April 7

MS87

Mathematical Advances in High-dimensional Approximation and Integration - Part I of III

8:35 AM-10:35 AM

Room:Garden 4B

For Part 2 see MS102

Predicting the behavior of complex phenomena relies on constructing solutions in terms of high dimensional spaces, particularly in the case when the input data (coefficients, forcing terms, initial and boundary conditions, geometry) are affected by large amounts of uncertainty. The resulting explosion in computational effort is a symptom of the curse of dimensionality and this symposium will focus on the fundamental problem of how to accurately recover the approximate solution of such high-dimensional functions. Mathematical breakthroughs in sparse random and deterministic sampling nonlinear and greedy approximations, compressed sensing, least squares, interpolation, and "best-N-term" approximations will be explored.

Organizer: Clayton G. Webster
Oak Ridge National Laboratory, USA

Organizer: Albert Cohen
Université Pierre et Marie Curie, France

8:35-9:00 Multi-Index Stochastic Collocation

Raul F. Tempone and Abdul Lateef Haji Ali, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Fabio Nobile, École Polytechnique Fédérale de Lausanne, Switzerland; Lorenzo Tamellini, Università di Pavia, Italy

9:05-9:30 Domain Uncertainty for Navier Stokes Equations

Jakob Zech and Christoph Schwab, ETH Zürich, Switzerland; Albert Cohen, Université Pierre et Marie Curie, France

9:35-10:00 Gradient-Enhanced Stochastic Collocation Approximations for Uncertainty Quantification

Tao Zhou, Chinese Academy of Sciences, China

10:05-10:30 Best S-Term Polynomial Approximations Via Compressed Sensing for High-Dimensional Parameterized Pdes

Clayton G. Webster, Hoang A. Tran, and Abdellah Chkifa, Oak Ridge National Laboratory, USA

continued in next column

Thursday, April 7

MS88

Stochastic Optimization for Engineering Applications - Part I of III

8:35 AM-10:35 AM

Room:Garden 4C

For Part 2 see MS103

Engineering applications often require the solution to multiple optimization problems including inversion, control, and design. The solution of these problems must account for and be resilient to varied forms of uncertainty associated with problem inputs. Such requirements motivate research in novel risk models and robust probabilistic formulations. This minisymposium focuses on recent advances in the field of optimization under uncertainty including probabilistic computation, risk aversion, and distributionally robust optimization.

Organizer: Drew P. Kouri
Sandia National Laboratories, USA

Organizer: Bart G. Van Bloemen Waanders
Sandia National Laboratories, USA

8:35-9:00 Risk Averse Optimization for Engineering Applications

Bart van Bloemen Waanders, Sandia National Laboratories, USA; Harriet Li, Massachusetts Institute of Technology, USA; Tim Wildey, Sandia National Laboratories, USA

9:05-9:30 Uncertainty Quantification for Subsurface Flow Problems

Claudia Schillings and Andrew Stuart, University of Warwick, United Kingdom

9:35-10:00 A Full-Space Approach to Stochastic Optimization with Simulation Constraints

Denis Ridzal and Drew P. Kouri, Sandia National Laboratories, USA

10:05-10:30 Sensitivity Analysis Methods for Uncertainty Budgeting in System Design

Max Opgenoord and Karen E. Willcox, Massachusetts Institute of Technology, USA

Thursday, April 7

MS89

Reduced-order Modeling in Uncertainty Quantification - Part I of III

8:35 AM-10:35 AM

Room:Garden 5A

For Part 2 see MS104

Reduced-order models (ROMs) are physics-based surrogate models that can make the sampling requirements of UQ applications tractable, as they reduce the computational complexity arising from repeated evaluation of the underlying (e.g., steady or unsteady PDE- based) model. ROMs are constructed by 1) projecting the governing equations onto a low- dimensional subspace, and 2) introducing other approximations (e.g., empirical interpolation) to tackle complex parametric dependencies or nonlinearities. This minisymposium describes novel approaches for effectively integrating ROMs within a UQ setting, including methods for Bayesian inference, quantifying uncertainties introduced by the reduced-order model, PDE- constrained optimization under uncertainty, and adaptive-sampling techniques.

Organizer: Kevin T. Carlberg
Sandia National Laboratories, USA

Organizer: Andrea Manzoni
École Polytechnique Fédérale de Lausanne, Switzerland

8:35-9:00 Model and Error Reduction for Inverse UQ Problems Governed by Unsteady Nonlinear Pdes

Andrea Manzoni, École Polytechnique Fédérale de Lausanne, Switzerland; Stefano Pagani, Politecnico di Milano, Italy; Alfio Quarteroni, École Polytechnique Fédérale de Lausanne, Switzerland

9:05-9:30 Integrating Reduced-order Models in Bayesian Inference via Error Surrogates

Kevin T. Carlberg, Sandia National Laboratories, USA; Matthias Morzfeld and Fei Lu, Lawrence Berkeley National Laboratory, USA

continued in next column

9:35-10:00 EIM/GEIM and PBDW Approaches with Noisy Informations

Yvon Maday, Université Pierre et Marie Curie, France and Brown University, USA

10:05-10:30 Goal-oriented Error Estimation

Clémentine Prieur, Université Joseph Fourier and Inria, France; Alexandre Janon, Université Paris-Sud, France; Maelle Nodet, Universite Joseph Fourier and Inria, France; Christophe Prieur, CNRS, France

Thursday, April 7

MS90

Rare Event Study for Stochastic Dynamical System and Random Field - Part I of III

8:35 AM-10:35 AM

Room:Garden 5B

For Part 2 see MS105

Rare events are a class of important stochastic effect in contrast to the averaged behaviour of the systems. Dynamical phase transitions, noise-induced instabilities, structural failures, extreme waves, etc., are typical examples of rare events, for which the traditional computational methods for uncertainty quantification may not be applied directly. We shall focus on the theoretic development (large deviation principle, extreme value analysis), numerical methods (rare-event simulation, multi- scale/stochastic modelling, optimization, importance sampling) and the applied problems in physics.

Organizer: Xiang Zhou
City University of Hong Kong, Hong Kong

Organizer: Jingchen Liu
Columbia University, USA

8:35-9:00 Adaptive Simulation for Large Deviations Conditioning

Florian Angeletti, National Institute for Theoretical Physics, South Africa

9:05-9:30 A Surrogate Accelerated Multicanonical Monte Carlo Method for Uncertainty Quantification

Keyi Wu and Jinglai Li, Shanghai Jiao Tong University, China

9:35-10:00 Uniformly Efficient Simulation for the Supremum of Gaussian Random Fields

Gongjun Xu, University of Minnesota, USA

10:05-10:30 Rare Event and Subset Simulation for Discontinuous Random Variables

Clément Walter, Université Paris-Diderot, France

Thursday, April 7

MS91

Software for Uncertainty Quantification

8:35 AM-10:35 AM

Room:Garden 5C

Although the need for softwares able to quantify uncertainties is obvious for a large community of engineers and researchers, there is a great amount of variety among the actual implementations of the general principles. The goal of this symposium is to present several of these tools, with an emphasis on software design, high performance computing and graphical analysis. This will also be the opportunity to distinguish the tools based on their advanced features including the modeling of statistical dependency, global sensitivity analysis, meta-modeling (e.g. polynomial chaos and kriging) and optimization.

Organizer: Anne-Laure Popelin
EDF, France

Organizer: Michael Baudin
EDF, France

Organizer: Anne Dutfoy
EDF, Clamart, France

8:35-9:00 Openturns for Uncertainty Quantification
Michael Baudin, EDF, France; Anne Dutfoy, EDF, Clamart, France; Anne-Laure Popelin, EDF, France

9:05-9:30 Promethee Environment for Computer Code Inversion
Yann Richet, Institut de Radioprotection et de Surete Nucleaire, France; Gregory Caplin, IRSN, France

9:35-10:00 'Mystic': Highly-constrained Non-convex Optimization and Uncertainty Quantification
Michael McKerns, California Institute of Technology, USA

10:05-10:30 Uranie: the Uncertainty and Optimization Platform
Fabrice Gaudier and Jean-Marc Martinez, CEA, France; Gilles Arnaud, CEA-Saclay, France

Thursday, April 7

Coffee Break

10:35 AM-11:05 AM

Room: "Campus" Area, 1st Floor

IP5

Multi-fidelity Approaches to UQ for PDEs

11:05 AM-11:50 AM

Room:Auditorium A

Chair: Albert Cohen, Université Pierre et Marie Curie, France

We discuss the use of a set of multi-fidelity computational physical models for reducing the costs of obtaining statistical information about PDE outputs of interest. Multilevel Monte Carlo and multilevel stochastic collocation methods use a hierarchy of successively coarser discretizations, in physical space, of the parent method. Reduced-order models of different dimension can be also be used as can surrogates built from data. More generally, a management strategy for the use of combinations of these and other computational models is discussed.

Max Gunzburger
Florida State University, USA

Thursday, April 7

IP6

Uncertainty Quantification in Weather Forecasting

11:55 AM-12:40 PM

Room:Auditorium A

Chair: Bani Mallick, Texas A&M University, USA

A major desire of all humankind is to make predictions for an uncertain future. Clearly then, forecasts ought to be probabilistic in nature, taking the form of probability distributions over future quantities or events. Over the past decades, the meteorological community has been taking massive steps in a reorientation towards probabilistic weather forecasts, serving to quantify the uncertainty in the predictions. This is typically done by using a numerical model, perturbing the inputs to the model (initial conditions, physics parameters) in suitable ways, and running the model for each perturbed set of inputs. The result is then viewed as an ensemble of forecasts. However, forecast ensembles typically are biased and uncalibrated. These shortcomings can be addressed by statistical postprocessing, using methods such as distributional regression and Bayesian model averaging.

Tilmann Gneiting
Heidelberg Institute for Theoretical Studies and Karlsruhe Institute of Technology, Germany

Lunch Break

12:40 PM-2:10 PM

Attendees on their own

Thursday, April 7

MT6

High-Dimensional Statistics

2:10 PM-4:10 PM

Room:Auditorium A

Chair: Peter Buehlmann, ETH Zürich, Switzerland

We will discuss some basic methodological and mathematical concepts for high-dimensional statistical inference where the number of parameters in a model is much greater than sample size. Particular emphasis will be given to uncertainty quantification with statistical confidence statements. The methods will be motivated and illustrated on problems in genetics and genomics.

Peter Buehlmann, ETH Zürich, Switzerland

Thursday, April 7

MS92

Characterizing the Effects of Data Variability and Uncertainty on Simulation Based Geophysical Hazards Analyses - Part II of III

2:10 PM-4:10 PM

Room:Garden 1A

For Part 1 see MS77
For Part 3 see MS107

Large scale simulations and ensemble based methodologies for UQ are now widely used in analysis of geophysical flows like storm surges, tsunamis, lahars. Simulation based hazard assessments are critically dependent on proper identification and characterization of parameters ranging from basal resistance, topography/ bathymetry and other initiation conditions. Furthermore, one must carefully handle the rare nature of the most dangerous events to both exploit the limited geophysical data and use simulations efficiently. In this set of talks we will invite 12 speakers dealing with these issues for storm surges, tsunamis, landslides and volcanic plume transport using different methodologies.

Organizer: Elaine Spiller
Marquette University, USA

Organizer: Abani K. Patra
State University of New York at Buffalo, USA

Organizer: Serge Guillas
University College London, United Kingdom

2:10-2:35 Bayesian Inference of Manning's N Coefficient of a Storm Surge Model: An Ensemble Kalman Filter Vs. a Polynomial Chaos-Mcmc

Adil Sripitana, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Talea Mayo, Princeton University, USA; Ihab Sraj, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Clint Dawson, University of Texas at Austin, USA; Omar Knio, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Olivier Le Maitre, LIMSI-CNRS, France; Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

2:40-3:05 Source Parameter Estimation For Volcanic Ash Transport and Dispersion Using Polynomial Chaos Type Surrogate Models

E. Bruce Pitman, Abani K. Patra, Puneet Singla, and Tarunraj Singh, State University of New York at Buffalo, USA; Reza Madankan, University of Texas MD Anderson Cancer Center, USA; Peter Webley, University of Alaska, Fairbanks, USA

3:10-3:35 Robust Gaussian Stochastic Process Emulation

Mengyang Gu and James Berger, Duke University, USA

3:40-4:05 Adjoint Based Methods for Numerical Error Estimation and Surrogate Construction For Uq and Inverse Problems

Abani K. Patra and Hossein Aghakhani, State University of New York at Buffalo, USA; Elaine Spiller, Marquette University, USA

continued in next column

Thursday, April 7

MS93

Model Error Assessment in Computational Physical Models - Part I of II

2:10 PM-4:10 PM

Room:Garden 1B

For Part 2 see MS108

There is growing interest in the quantification of model error, i.e. the discrepancy from the truth that cannot be reduced within the model assumptions, in the context of statistical model calibration. However, model error assessment still faces challenges in physical model calibration. For example, it is unclear how to properly disambiguate data noise from model errors, or how to extrapolate towards the prediction of unobservable model outputs of interest. This minisymposium will highlight those challenges and present novel methods for tackling them, hoping to contribute significantly towards improving predictive fidelity of computational physical models across a range of disciplines.

Organizer: Khachik Sargsyan
Sandia National Laboratories, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

2:10-2:35 Density Estimation Framework for Model Error Quantification

Khachik Sargsyan and Habib N. Najm, Sandia National Laboratories, USA; Jason Bender, University of Minnesota, USA; Chi Feng and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

2:40-3:05 A Bayesian Viewpoint to Understanding Model Error

Mark Berliner and *Radu Herbei*, Ohio State University, USA

continued in next column

3:10-3:35 Learning About Physical Parameters: the Importance of Model Discrepancy

Jenny Brynjarsdottir, Case Western Reserve University, USA; Anthony O'Hagan, University of Sheffield, United Kingdom

3:40-4:05 Bayesian Estimates of Model Inadequacy in Reynolds-Averaged Navier-Stokes

Richard P. Dwight and Wouter Edeling, Delft University of Technology, Netherlands; Paola Cinnella, ENSAM, ParisTech, France; Martin Schmelzer, Delft University of Technology, Netherlands

Thursday, April 7

MS94

Multi Level and Multi Index Sampling Methods and Applications - Part I of III

2:10 PM-4:10 PM

Room:Garden 1C

For Part 2 see MS109

We aim to present the latest algorithmic and theoretical contributions to Multilevel Sampling methods, focusing also on novel applications. Accurately computing expected values of observables of solutions to large stochastic systems arising from the discretization of random differential equations remains a challenging task in complex applications. Fortunately, using multiple discretization levels can effectively reduce the overall computational cost. This idea led to the Multi Level Monte Carlo method and subsequent extensions which include, among others, the i) Multi Index Monte Carlo and ii) the use of deterministic sampling strategies such as sparse grids and low discrepancy sequences.

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Mike Giles
University of Oxford, United Kingdom

2:10-2:35 MLMC for Multi-Dimensional Reflected Diffusions

Mike Giles, University of Oxford, United Kingdom; Kavita Ramanan, Brown University, USA

2:40-3:05 Monte Carlo Methods and Mean Field Approximation for Stochastic Particle Systems

Abdul Lateef Haji Ali and Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

continued on next page

Thursday, April 7

MS94

Multi Level and Multi Index Sampling Methods and Applications - Part I of III

2:10 PM-4:10 PM

Room:Garden 1C

continued

3:10-3:35 Multilevel Monte Carlo Approximation of Quantiles

Sebastian Krumscheid, Fabio Nobile, and Michele Pisaroni, École Polytechnique Fédérale de Lausanne, Switzerland

3:40-4:05 Multilevel Drift-Implicit Tau Leap

Chiheb BenHammouda, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Thursday, April 7

MS95

Design of Computer Experiments and Sequential Strategies with Gaussian Process Models - Part II of III

2:10 PM-3:40 PM

Room:Garden 2A

For Part 1 see MS80
For Part 3 see MS110

Design and analysis of computer experiments constitute an active research field at a crossroads between applied mathematics, statistics, and many application domains. Gaussian process models have become an essential tool for guiding sequential strategies dedicated to a number of goals including single- and multi-objective optimization, estimation of regions of interest, etc. In this session, we will gather junior and senior researchers from various communities, who will present novel contributions pertaining to one or the other aspect of static and sequential design of computer experiments, with a specific focus on the potentialities offered by stochastic models such as Gaussian process ones.

Organizer: Xu He
Chinese Academy of Sciences, China

Organizer: David Ginsbourger
Idiap Research Institute and University of Bern, Switzerland

Organizer: C. F. Jeff Wu
Georgia Institute of Technology, USA

2:10-2:35 High Dimensional Bayesian Optimization Via Random Embeddings Applied to Automotive Design

Mickaël Binois, Ecole des Mines de St Etienne, France; David Ginsbourger, Idiap Research Institute and University of Bern, Switzerland; Roustant Olivier, Ecole des Mines de St Etienne, France

2:40-3:05 Scalable Bayesian Optimization

Javier González and Zhenwen Dai, University of Sheffield, United Kingdom; Philipp Hennig, Max Planck Institute for Intelligent Systems, Germany; Neil Lawrence, University of Sheffield, United Kingdom

3:10-3:35 Multi-Objective Bayesian Optimization: Calibrating a Tight Gas Condensate Well in Western Canada

Ivo Couckuyt, Ghent University, Belgium; Hamidreza Hamdi, University of Calgary, Canada; Tom Dhaene, Ghent University, Belgium

continued in next column

Thursday, April 7

MS96

Perspectives on Model-informed Data Assimilation - Part II of II

2:10 PM-4:10 PM

Room:Garden 2B

For Part 1 see MS81

In many applications noisy and incomplete information about a process of interest arrives online in a sequential manner and one aims to recover the relevant conditional state estimates. Often one is confronted with high dimensional problems based on imperfect forward models. The field of data assimilation has grown out of the necessity to obtain approximate, computationally feasible solutions to this problem. This minisymposium aims to bring together experts interested in nonlinear filtering and data assimilation, and in particular the incorporation of model-specific insight and constraints on model uncertainties, to share their latest ideas on systematic improvements of data assimilation algorithms.

Organizer: Kody Law
Oak Ridge National Laboratory, USA

Organizer: Michal Branicki
University of Edinburgh, United Kingdom

2:10-2:35 Filtering Compressible and Incompressible Turbulent Flows with Noisy Lagrangian Tracers

Nan Chen, New York University, USA; Andrew Majda and Xin T. Tong, Courant Institute of Mathematical Sciences, New York University, USA

2:40-3:05 Forward Backward Doubly Stochastic Differential Equations and the Optimal Filtering of Diffusion Processes

Feng Bao and Clayton G. Webster, Oak Ridge National Laboratory, USA

3:10-3:35 A Variational Bayesian Sequential Monte Carlo Filter for Large-Dimensional Systems

Boujemaa Ait-El-Fquih and Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

3:40-4:05 Efficient Assimilation of Observations Via a Localized Particle Filter in High-Dimensional Geophysical Systems

Jonathan Poterjoy, University Corporation for Atmospheric Research, USA; Jeffrey Anderson, National Center for Atmospheric Research, USA

continued in next column

Thursday, April 7

MS97

Low-rank Tensor Approximations for High-dimensional UQ Problems - Part I of II

2:10 PM-4:10 PM

Room:Garden 2C

For Part 2 see MS112

Uncertainty quantification in computational models is strongly challenged by the high- dimensionality of the input parameter space. Relatedly, classical techniques such as polynomial chaos expansions typically lead to underdetermined problems. This curse of dimensionality has recently been tackled by so-called low-rank tensor approximations. These methods successfully address the high-dimensionality challenge at an affordable cost, i.e. with the fewest simulations of the computational model, if the latter has an underlying sparse structure. This minisymposium will focus on the latest developments of these techniques for the sake of uncertainty propagation and sensitivity analysis.

Organizer: Alireza Doostan
University of Colorado Boulder, USA

Organizer: Bruno Sudret
ETH Zürich, Switzerland

Organizer: Khachik Sargsyan
Sandia National Laboratories, USA

2:10-2:35 Ordering Heuristics for Minimal Rank Approximations in Tensor-Train Format

Daniele Bigoni and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

continued on next page

Thursday, April 7

MS97

Low-rank Tensor Approximations for High-dimensional UQ Problems - Part I of II

2:10 PM-4:10 PM

Room:Garden 2C

continued

2:40-3:05 Adapted Tensor Train Approximations of Multivariate Functions Using Least-Squares Methods

Mathilde Chevreuil, Université de Nantes, France; Loic Giraldi, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Anthony Nouy, Ecole Centrale de Nantes, France; Prashant Rai, Sandia National Laboratories, USA

3:10-3:35 Low-Rank Tensor Approximations for the Computation of Rare Event Probabilities

Katerina Konakli and Bruno Sudret, ETH Zürich, Switzerland

3:40-4:05 Low Rank Approximation-Based Quadrature for Fast Evaluation of Quantum Chemistry Integrals

Prashant Rai, Khachik Sargsyan, and Habib N. Najm, Sandia National Laboratories, USA; Matthew Hermes and So Hirata, University of Illinois at Urbana-Champaign, USA

Thursday, April 7

MS98

Advances in Sampling Methods for Bayesian Inverse Problems - Part II of III

2:10 PM-4:10 PM

Room:Garden 3A

For Part 1 see MS83
For Part 3 see MS113

The numerical solution of inverse problems involving complex forward models has become essential to uncertainty quantification in many science and engineering applications. Here, the Bayesian approach provides rigorous characterizations of uncertainty. Yet computational characterisation of the posterior distribution---typically via sampling---remains a computationally challenging task. Challenges include adapting to correlated, concentrated, and non-Gaussian posterior structure; performing real-time estimation from large data streams; handling forward models in a non-intrusive setting; and developing mathematical analysis to illuminate and guide these approaches. This minisymposium presents recent developments in sampling methods, including MCMC, EnKF, and sparse quadratures in high or infinite-dimensional parameter spaces.

Organizer: Tan Bui-Thanh
University of Texas at Austin, USA

Organizer: Mark Girolami
University of Warwick, United Kingdom

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Christoph Schwab
ETH Zürich, Switzerland

continued in next column

2:10-2:35 Multilevel Markov Chain Monte Carlo Method for Bayesian Inverse Problems

Viet Ha Hoang, Nanyang Technological University, Singapore; Christoph Schwab, ETH Zürich, Switzerland; Andrew Stuart, University of Warwick, United Kingdom

2:40-3:05 Metropolis-Hastings Algorithms in Function Space for Bayesian Inverse Problems

Oliver G. Ernst, Technische Universitat Chemnitz, Germany; Björn Sprungk, Technical University of Chemnitz, Germany; Daniel Rudolf, University of Jena, Germany

3:10-3:35 Accelerating Metropolis Algorithms Using Transport Maps

Matthew Parno and *Youssef M. Marzouk*, Massachusetts Institute of Technology, USA

3:40-4:05 Multilevel Sequential Monte Carlo Samplers

Kody Law, Oak Ridge National Laboratory, USA; *Alexandros Beskos*, University College London, United Kingdom

Thursday, April 7

MS99

Uncertainty Quantification for Complex Physical Models - Part II of III

2:10 PM-4:10 PM

Room:Garden 3B

For Part 1 see MS84
For Part 3 see MS114

Advances in modeling, algorithms, and computational resources are allowing simulations to play an increasingly important role in driving decisions regarding complex physical systems. However, computational models of such systems are commonly afflicted by many types of error and uncertainty. In this context, uncertainty quantification are crucial to making well-informed decisions. The aim of this minisymposium is to bring together researchers developing approaches for quantifying uncertainties, including those due to uncertain parameters, inadequate physical models, and uncertain or sparse experimental data, for models of complex physical systems such as turbulent flows, subsurface flow, oceanic flow, and materials applications.

Organizer: Heng Xiao
Virginia Tech, USA

Organizer: Todd Oliver
University of Texas at Austin, USA

Organizer: Xiu Yang
Pacific Northwest National Laboratory, USA

2:10-2:35 Speeding Up Variational Inference
Adrian Sandu, Virginia Tech, USA; Vishwas Rao, University of Texas at Austin, USA

2:40-3:05 Solver- vs. Grid-Hierarchies for Multi-Level Monte Carlo Sampling of Subsurface Flow and Transport
Florian Müller, ETH Zürich, Switzerland; Daniel W. Meyer, Institute of Fluid Dynamics, Switzerland; *Patrick Jenny*, ETH Zürich, Switzerland

continued in next column

3:10-3:35 Detecting Low Dimensional Structure in Uncertainty Quantification Problems
Xiu Yang, *Huan Lei*, and Nathan Baker, Pacific Northwest National Laboratory, USA; Guang Lin, Purdue University, USA

3:40-4:05 Reduced Hessian Method for Uncertainty Quantification in Ocean State Estimation
Alex Kalmikov, Massachusetts Institute of Technology, USA; Patrick Heimbach, Massachusetts Institute of Technology and University of Texas at Austin, USA; Carl Wunsch, Massachusetts Institute of Technology, USA

Thursday, April 7

MS100

Uncertainty Quantification and Inversion of Multiphysics and Multiscale Problems - Part II of III

2:10 PM-4:10 PM

Room:Garden 3C

For Part 1 see MS85
For Part 3 see MS115

UQ methodologies, deterministic/ Bayesian approaches are essential to diagnose the model errors, integrate data and models to infer uncertain parameters. Scientific and engineering codes for multiparameter, multiphyiscs problems commonly achieve correct simulations through the calibration of model parameters. As computational science moves to estimate optimized model parameters from noisy and indirect observational data, the quality of decision making improves. We will present and discuss the methodologies and approaches in the applications across a wide range of scientific and engineering problems.

Organizer: Tulin Kaman
University of Zurich, Switzerland

Organizer: Remi Abgrall
Inria Bordeaux Sud-Ouest, France

Organizer: James G. Glimm
State University of New York, Stony Brook, USA

2:10-2:35 Bayesian Filtering in Cardiovascular Models
Andrea Arnold, North Carolina State University, USA; Brian Carlson, University of Michigan, Ann Arbor, USA; Mette S. Olufsen, North Carolina State University, USA

2:40-3:05 Sparse Mode Decomposition for High Dimensional Random Fields, and Its Application on Spde
Qin Li, University of Wisconsin, USA; Thomas Hou and Pengchuan Zhang, California Institute of Technology, USA

3:10-3:35 Efficient Evaluation of Hessian Operators Arising in Large-scale Inverse Transport Problems
Andreas Mang and George Biros, University of Texas at Austin, USA

3:40-4:05 A Hierarchical Bayesian Approach to Pharmacokinetics Study
Stephen Wu, Panagiotis Angelikopoulos, and Petros Koumoutsakos, ETH Zürich, Switzerland

Thursday, April 7

MS101

Hierarchical and Multi-scale Methods for Uncertainty Quantification in Forward and Inverse Problems - Part II of II

2:10 PM-4:10 PM

Room:Garden 4A

For Part 1 see MS86

The minisymposium focuses on recent advances in hierarchical methods for uncertainty quantification in porous media and other engineering applications. We are interested in methods employing any kind of nested representation of the same problem (i.e. length or time-scales, mesh resolution, model complexity) with two or more levels. Possible topics include: coupling of multi-fidelity formulations of the physical problem, approaches based on multi-level grid refinement, hierarchical response surface methods, multi-resolution and multi-scale methods for Bayesian inversion, efficient implementation techniques for hierarchical or nested simulations, innovative model reduction and scale-bridging methods, understanding of modelling error across the levels.

Organizer: Matteo Icardi
University of Warwick, United Kingdom

Organizer: Ahmed H. ElSheikh
Heriot-Watt University, United Kingdom

Organizer: Ivan Lunati
University of Lausanne, Switzerland

2:10-2:35 Balancing Sampling and Discretization Error in the Context of Multi-Level Monte Carlo

Florian Müller, ETH Zürich, Switzerland; Daniel W. Meyer, Institute of Fluid Dynamics, Switzerland; Patrick Jenny, ETH Zürich, Switzerland

2:40-3:05 Solving Stochastic Elliptic Boundary Value Problems with a Multis-Scale Domain Decomosition Method

Bradley Mccaskill, University of Wyoming, USA; Prosper Torsu, University of Minnesota, Twin Cities, USA; Victor E. Ginting, University of Wyoming, USA

3:10-3:35 Uncertainty Quantification in Cloud Cavitation Collapse Using Multi-Level Monte Carlo

Jonas Šukys, Panagiotis Hadjidoukas, Diego Rossinelli, Babak Hejazialhosseini, Ursula Rasthofer, Fabian Wermelinger, and Petros Koumoutsakos, ETH Zürich, Switzerland

3:40-4:05 Uncertainty Quantification for Complex Multiscale Systems

Sham Bhat, Los Alamos National Laboratory, USA

continued in next column

Thursday, April 7

MS102

Mathematical Advances in High-dimensional Approximation and Integration - Part II of III

2:10 PM-4:10 PM

Room:Garden 4B

For Part 1 see MS87
For Part 3 see MS117

Predicting the behavior of complex phenomena relies on constructing solutions in terms of high dimensional spaces, particularly in the case when the input data (coefficients, forcing terms, initial and boundary conditions, geometry) are affected by large amounts of uncertainty. The resulting explosion in computational effort is a symptom of the curse of dimensionality and this symposium will focus on the fundamental problem of how to accurately recover the approximate solution of such high-dimensional functions. Mathematical breakthroughs in sparse random and deterministic sampling nonlinear and greedy approximations, compressed sensing, least squares, interpolation, and "best-N-term" approximations will be explored.

Organizer: Clayton G. Webster
Oak Ridge National Laboratory, USA

Organizer: Albert Cohen
Université Pierre et Marie Curie, France

2:10-2:35 High-Dimensional Approximation Using Equilibrium Measures

Akil Narayan, University of Utah, USA; John D. Jakeman, Sandia National Laboratories, USA; Tao Zhou, Chinese Academy of Sciences, China

continued on next page

2:40-3:05 Sparse Approximation of Elliptic PDEs with Lognormal Coefficients
Markus Bachmayr and Albert Cohen, Université Pierre et Marie Curie, France; Ronald DeVore, Texas A&M University, USA; Giovanni Migliorati, Université Pierre et Marie Curie, France

3:10-3:35 Smoothing by Integration and Anova Decomposition of High-Dimensional Functions
Ian H. Sloan and Frances Y. Kuo, University of New South Wales, Australia; Andreas Griewank and Hernan Leovey, Humboldt University Berlin, Germany

3:40-4:05 Title Not Available
Hoang A. Tran and Clayton G. Webster, Oak Ridge National Laboratory, USA

Thursday, April 7

MS103

Stochastic Optimization for Engineering Applications - Part II of III

2:10 PM-4:10 PM

Room:Garden 4C

For Part 1 see MS88
For Part 3 see MS118

Engineering applications often require the solution to multiple optimization problems including inversion, control, and design. The solution of these problems must account for and be resilient to varied forms of uncertainty associated with problem inputs. Such requirements motivate research in novel risk models and robust probabilistic formulations. This minisymposium focuses on recent advances in the field of optimization under uncertainty including probabilistic computation, risk aversion, and distributionally robust optimization.

Organizer: Drew P. Kouri
Sandia National Laboratories, USA

Organizer: Bart G. Van Bloemen Waanders
Sandia National Laboratories, USA

2:10-2:35 Gas Transportation under Stochastic Uncertainty: Nomination Validation and Beyond
Rüdiger Schultz and Claudia Gotzes, University of Duisburg-Essen, Germany; Holger Heitsch, Rene Henrion, and Holger Heitsch, Weierstrass Institute for Applied Analysis and Stochastics, Germany

2:40-3:05 A Data-Driven Approach to PDE-Constrained Optimization Under Uncertainty
Drew P. Kouri, Sandia National Laboratories, USA

3:10-3:35 Buffered Probability of Exceedance, Support Vector Machines, and Robust Optimization
Matthew Norton, Aleksandr Mafusalov, and Stan Uryasev, University of Florida, USA

3:40-4:05 Multidimensional Buffered Probability of Exceedance and Applications to Distribution Approximation
Aleksandr Mafusalov and Stan Uryasev, University of Florida, USA

Thursday, April 7

MS104

Reduced-order Modeling in Uncertainty Quantification - Part II of III

2:10 PM-4:10 PM

Room:Garden 5A

For Part 1 see MS89
For Part 3 see MS119

Reduced-order models (ROMs) are physics-based surrogate models that can make the sampling requirements of UQ applications tractable, as they reduce the computational complexity arising from repeated evaluation of the underlying (e.g., steady or unsteady PDE- based) model. ROMs are constructed by 1) projecting the governing equations onto a low- dimensional subspace, and 2) introducing other approximations (e.g., empirical interpolation) to tackle complex parametric dependencies or nonlinearities. This minisymposium describes novel approaches for effectively integrating ROMs within a UQ setting, including methods for Bayesian inference, quantifying uncertainties introduced by the reduced-order model, PDE- constrained optimization under uncertainty, and adaptive-sampling techniques.

Organizer: Kevin T. Carlberg
Sandia National Laboratories, USA

Organizer: Andrea Manzoni
École Polytechnique Fédérale de Lausanne, Switzerland

2:10-2:35 Adaptive Stochastic Collocation for PDE-Constrained Optimization under Uncertainty using Sparse Grids and Model Reduction
Matthew J. Zahr, Stanford University, USA; Kevin T. Carlberg and Drew P. Kouri, Sandia National Laboratories, USA

continued on next page

Thursday, April 7

MS104

Reduced-order Modeling in Uncertainty Quantification - Part II of III

2:10 PM-4:10 PM

Room:Garden 5A

continued

2:40-3:05 Multifidelity Methods for Uncertainty Quantification
Benjamin Peherstorfer and Karen E. Willcox, Massachusetts Institute of Technology, USA; Max Gunzburger, Florida State University, USA

3:10-3:35 Error Estimates for Reduced-Order Models Using Statistical Learning
Sumeet Trehan, Stanford University, USA; Kevin T. Carlberg, Sandia National Laboratories, USA; Louis Durlofsky, Stanford University, USA

3:40-4:05 Combined Reduction for Uncertainty Quantification
Christian Himpe and Mario Ohlberger, University of Muenster, Germany

Thursday, April 7

MS105

Rare Event Study for Stochastic Dynamical System and Random Field - Part II of III

2:10 PM-4:10 PM

Room:Garden 5B

For Part 1 see MS90
For Part 3 see MS120
Rare events are a class of important stochastic effect in contrast to the averaged behaviour of the systems. Dynamical phase transitions, noise-induced instabilities, structural failures, extreme waves, etc., are typical examples of rare events, for which the traditional computational methods for uncertainty quantification may not be applied directly. We shall focus on the theoretic development (large deviation principle, extreme value analysis), numerical methods (rare-event simulation, multi- scale/stochastic modelling, optimization, importance sampling) and the applied problems in physics.

Organizer: Xiang Zhou
City University of Hong Kong, Hong Kong

Organizer: Jingchen Liu
Columbia University, USA

2:10-2:35 Rare Event Computation and Large Deviation for Geophysical Turbulent Flows and Climate Applications
Freddy Bouchet, ENS Lyon, France

2:40-3:05 Singularities, Instantons and Turbulence
Rainer Grauer, Ruhr-Universität Bochum, Germany

3:10-3:35 A Minimum Action Method for Navier-Stokes Equations Based on a Divergence-Free Basis
Xiaoliang Wan, Louisiana State University, USA

3:40-4:05 Gentlest Ascent Dynamics for Locating Transition States
Xiang Zhou, City University of Hong Kong, Hong Kong

Thursday, April 7

MS106

Towards a Unifying Probabilistic Framework for Scientific Computations Under Uncertainty - Part I of II

2:10 PM-3:40 PM

Room:Garden 5C

For Part 2 see MS121
The purpose of this minisymposium is to initiate a dialogue between the statistics and the applied mathematics communities.

Organizer: Ilias Bilionis
Purdue University, USA

Organizer: Phaedon S. Koutsourelakis
Technische Universität München, Germany

2:10-2:35 Probability Models for Discretization Uncertainty and Adaptive Mesh Selection
Oksana A. Chkrebtii, Ohio State University, USA

2:40-3:05 Lightweight Error Estimation, Using the Probabilistic Interpretation of Classic Numerical Methods
Philipp Hennig, *Michael Schober*, and Hans Kersting, Max Planck Institute for Intelligent Systems, Germany

3:10-3:35 Uncertainty Quantification with Gaussian Process Latent Variable Models
Charles Gadd, University of Warwick, United Kingdom

Coffee Break

4:10 PM-4:40 PM

Room: "Campus" Area, 1st Floor

Thursday, April 7

MS107

Characterizing the Effects of Data Variability and Uncertainty on Simulation Based Geophysical Hazards Analyses - Part III of III

4:40 PM-6:40 PM

Room:Garden 1A

For Part 2 see MS92

Large scale simulations and ensemble based methodologies for UQ are now widely used in analysis of geophysical flows like storm surges, tsunamis, lahars. Simulation based hazard assessments are critically dependent on proper identification and characterization of parameters ranging from basal resistance, topography/ bathymetry and other initiation conditions. Furthermore, one must carefully handle the rare nature of the most dangerous events to both exploit the limited geophysical data and use simulations efficiently. In this set of talks we will invite 12 speakers dealing with these issues for storm surges, tsunamis, landslides and volcanic plume transport using different methodologies.

Organizer: Elaine Spiller
Marquette University, USA

Organizer: Abani K. Patra
State University of New York at Buffalo, USA

Organizer: Serge Guillas
University College London, United Kingdom

4:40-5:05 Coupling Computer Models Through Linking Their Statistical Emulators

Ksenia N. Kyzyurova, James Berger, and Robert L. Wolpert, Duke University, USA

5:10-5:35 Multi-Objective Sequential Design for Computer Experiments

Regis Rutarindwa and Elaine Spiller, Marquette University, USA; Marcus Bursik, State University of New York, Buffalo, USA

continued in next column

5:40-6:05 Structural Discrepancy Analysis for Natural Hazards Models

Michael Goldstein and Nathan Huntley, Durham University, United Kingdom

6:10-6:35 Developing a Shallow-Layer Model of Lahars for Hazard Assessment

Mark Woodhouse, University of Bristol, United Kingdom; Eliza Calder, University of Edinburgh, United Kingdom; Andrew Hogg, University of Bristol, United Kingdom; Chris Johnson, University of Manchester, United Kingdom; Jerry Phillips, University of Bristol, United Kingdom; Elaine Spiller, Marquette University, USA

Thursday, April 7

MS108

Model Error Assessment in Computational Physical Models - Part II of II

4:40 PM-6:40 PM

Room:Garden 1B

For Part 1 see MS93

There is growing interest in the quantification of model error, i.e. the discrepancy from the truth that cannot be reduced within the model assumptions, in the context of statistical model calibration. However, model error assessment still faces challenges in physical model calibration. For example, it is unclear how to properly disambiguate data noise from model errors, or how to extrapolate towards the prediction of unobservable model outputs of interest. This minisymposium will highlight those challenges and present novel methods for tackling them, hoping to contribute significantly towards improving predictive fidelity of computational physical models across a range of disciplines.

Organizer: Khachik Sargsyan
Sandia National Laboratories, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

4:40-5:05 Uncertainty in Modeling Turbulence: Data Inference and Physics Constraints

Karthikeyan Duraisamy, University of Michigan, USA; *Gianluca Iaccarino* and Juan J. Alonso, Stanford University, USA

5:10-5:35 Assessing Model Error in Reduced Chemical Mechanisms

Rebecca Morrison and Robert D. Moser, University of Texas at Austin, USA

5:40-6:05 Multi-Response Approach to Improving Identifiability in Model Calibration

Zhen Jiang, Dan Apley, and Wei Chen, Northwestern University, USA

6:10-6:35 Uncertainty Due to Inadequate Models of Scalar Dispersion in Porous Media

Joyce Rigelo, *Teresa Portone*, Damon McDougall, and Robert D. Moser, University of Texas at Austin, USA

Thursday, April 7

MS109

Multi Level and Multi Index Sampling Methods and Applications - Part II of III

4:40 PM-6:10 PM

Room:Garden 1C

For Part 1 see MS94
For Part 3 see MS124

We aim to present the latest algorithmic and theoretical contributions to Multilevel Sampling methods, focusing also on novel applications. Accurately computing expected values of observables of solutions to large stochastic systems arising from the discretization of random differential equations remains a challenging task in complex applications. Fortunately, using multiple discretization levels can effectively reduce the overall computational cost. This idea led to the Multi Level Monte Carlo method and subsequent extensions which include, among others, the i) Multi Index Monte Carlo and ii) the use of deterministic sampling strategies such as sparse grids and low discrepancy sequences.

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Mike Giles
University of Oxford, United Kingdom

4:40-5:05 Multilevel Subset Simulation for Rare Events

Daniel Elfverson, Uppsala University, Sweden; Robert Scheichl, University of Bath, United Kingdom

5:10-5:35 An Optimized Multilevel Monte Carlo Method

Andrea Barth, Universität Stuttgart, Germany; Raphael Kruse, Technische Universität Berlin, Germany

5:40-6:05 Mean Square Adaptive Mlmc for Sdes

Juho Happola and Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Håkon Hoel, University of Oslo, Norway

Thursday, April 7

MS110

Design of Computer Experiments and Sequential Strategies with Gaussian Process Models - Part III of III

4:40 PM-6:40 PM

Room:Garden 2A

For Part 2 see MS95

Design and analysis of computer experiments constitute an active research field at a crossroads between applied mathematics, statistics, and many application domains. Gaussian process models have become an essential tool for guiding sequential strategies dedicated to a number of goals including single- and multi-objective optimization, estimation of regions of interest, etc. In this session, we will gather junior and senior researchers from various communities, who will present novel contributions pertaining to one or the other aspect of static and sequential design of computer experiments, with a specific focus on the potentialities offered by stochastic models such as Gaussian process ones.

Organizer: Xu He
Chinese Academy of Sciences, China

Organizer: David Ginsbourger
Idiap Research Institute and University of Bern, Switzerland

Organizer: C. F. Jeff Wu
Georgia Institute of Technology, USA

4:40-5:05 Sequential Design for the Estimation of High-Variation Regions Using Differentiable Non-Stationary Gaussian Process Models

Sébastien Marmin, University of Bern, Switzerland; David Ginsbourger, Idiap Research Institute and University of Bern, Switzerland; Jean Baccou, IRSN, France; Frédéric Perales, Institut de Radioprotection et de Surete Nucleaire, France; Jacques Liandrat, Institut de Mathématiques de Marseille, France

continued in next column

5:10-5:35 Adaptive Design of Experiments for Conservative Estimation of Excursion Sets

Dario Azzimonti, University of Bern, Switzerland; David Ginsbourger, Idiap Research Institute and University of Bern, Switzerland; Clément Chevalier, Universite de Neuchatel, Switzerland; Julien Bect, SUPELEC, France; Yann Richet, Institut de Radioprotection et de Surete Nucleaire, France

5:40-6:05 Stepwise Uncertainty Reduction Strategies for Inversion of Expensive Functions with Nuisance Parameters

Clément Chevalie, Universite de Neuchatel, Switzerland; David Ginsbourger, Idiap Research Institute and University of Bern, Switzerland; Yann Richet and Grégory Caplin, Institut de Radioprotection et de Surete Nucleaire, France

6:10-6:35 Bias and Variance in the Bayesian Subset Simulation Algorithm

Julien Bect, CentraleSupéle, France; Roman Sueur, EDF, France; Emmanuel Vazquez, CentraleSupélec, France

Thursday, April 7

MS111

Data-driven Methods for Uncertainty Quantification - Part I of II

4:40 PM-6:40 PM

Room:Garden 2B

For Part 2 see MS126

Data-driven methods for uncertainty quantification are essential for credible estimates of uncertainty in predictions from numerical simulations. Development of such methods requires combining knowledge from a wide spectrum of disciplines to ensure reliable and robust quantification of uncertainties, starting from data or exploiting it. This minisymposium will feature approaches for quantifying uncertainties due to parametric and model-form uncertainties in both data-rich and data-limited settings. Presentations will focus on both the development and application of advanced data-driven methods for forward and inverse propagation of uncertainty.

Organizer: Fabian Franzelin
University of Stuttgart, Germany

Organizer: John D. Jakeman
Sandia National Laboratories, USA

Organizer: Dirk Pflüger
University of Stuttgart, Germany

Organizer: Tim Wildey
Sandia National Laboratories, USA

4:40-5:05 On Probabilistic Transformations and Optimal Sampling Rules for Emulator Based Inverse UQ Problems

Fabian Franzelin and Dirk Pflüger, University of Stuttgart, Germany; John D. Jakeman, Sandia National Laboratories, USA

continued in next column

5:10-5:35 Incomplete Statistical Information Limits the Utility of Higher-Order Polynomial Chaos Expansions

Sergey Oladyshkin and Wolfgang Nowak, University of Stuttgart, Germany

5:40-6:05 Adaptive Response Surface Approximations for Bayesian Inference

Tim Wildey and John D. Jakeman, Sandia National Laboratories, USA; Troy Butler, University of Colorado, Denver, USA

6:10-6:35 Probabilistic Inference of Model Parameters and Missing High-Dimensional Data Based on Summary Statistics

Mohammad Khalil, Habib N. Najm, Kenny Chowdhary, Cosmin Safta, and Khachik Sargsyan, Sandia National Laboratories, USA

Thursday, April 7

MS112

Low-rank Tensor Approximations for High-dimensional UQ Problems - Part II of II

4:40 PM-6:10 PM

Room:Garden 2C

For Part 1 see MS97

Uncertainty quantification in computational models is strongly challenged by the high- dimensionality of the input parameter space. Relatedly, classical techniques such as polynomial chaos expansions typically lead to underdetermined problems. This curse of dimensionality has recently been tackled by so-called low-rank tensor approximations. These methods successfully address the high-dimensionality challenge at an affordable cost, i.e. with the fewest simulations of the computational model, if the latter has an underlying sparse structure. This minisymposium will focus on the latest developments of these techniques for the sake of uncertainty propagation and sensitivity analysis.

Organizer: Alireza Doostan
University of Colorado Boulder, USA

Organizer: Bruno Sudret
ETH Zürich, Switzerland

Organizer: Khachik Sargsyan
Sandia National Laboratories, USA

4:40-5:05 Anova Based Reduced Basis Methods for Partial Differential Equations with High Dimensional Random Inputs

Qifeng Liao, ShanghaiTech University, China; Lin Guang, Pacific Northwest National Laboratory, USA

5:10-5:35 Parallel Implementation of Non-Intrusive Stochastic Galerkin Method for Solving Stochastic Pdes

Alexander Litvinenko, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Hermann Matthies and Elmar Zander, Technische Universität Braunschweig, Germany; Raul F. Tempone and David E. Keyes, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

5:40-6:05 Deep Learning for Multiscale Inverse Problems

Louis Ellam and Nicholas Zabaras, University of Warwick, United Kingdom

Thursday, April 7

MS113

Advances in Sampling Methods for Bayesian Inverse Problems - Part III of III

4:40 PM-6:40 PM

Room:Garden 3A

For Part 2 see MS98

The numerical solution of inverse problems involving complex forward models has become essential to uncertainty quantification in many science and engineering applications. Here, the Bayesian approach provides rigorous characterizations of uncertainty. Yet computational characterisation of the posterior distribution---typically via sampling---remains a computationally challenging task. Challenges include adapting to correlated, concentrated, and non-Gaussian posterior structure; performing real-time estimation from large data streams; handling forward models in a non-intrusive setting; and developing mathematical analysis to illuminate and guide these approaches. This minisymposium presents recent developments in sampling methods, including MCMC, EnKF, and sparse quadratures in high or infinite-dimensional parameter spaces.

Organizer: Tan Bui-Thanh
University of Texas at Austin, USA

Organizer: Mark Girolami
University of Warwick, United Kingdom

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Christoph Schwab
ETH Zürich, Switzerland

4:40-5:05 An Analytical Technique for Forward and Inverse Propagation of Uncertainty

Umberto Villa and Omar Ghattas, University of Texas at Austin, USA

continued in next column

5:10-5:35 Analysis and Optimization of Stratified Sampling

Brian Van Koten, Aaron Dinner, Jeremy Tempkin, Erik Thiede, and Jonathan Weare, University of Chicago, USA

5:40-6:05 Asymptotic Analysis of Random-Walk Metropolis on Ridged Densities

Alexandre Thiery, National University of Singapore, Singapore

6:10-6:35 Affine Invariant Samplers for Bayesian Inverse Problems

Charlie Mathews and Jonathan Weare, University of Chicago, USA; Ben Leimkuhler, University of Edinburgh, United Kingdom

Thursday, April 7

MS114

Uncertainty Quantification for Complex Physical Models - Part III of III

4:40 PM-7:10 PM

Room:Garden 3B

For Part 2 see MS99

Advances in modeling, algorithms, and computational resources are allowing simulations to play an increasingly important role in driving decisions regarding complex physical systems. However, computational models of such systems are commonly afflicted by many types of error and uncertainty. In this context, uncertainty quantification are crucial to making well-informed decisions. The aim of this minisymposium is to bring together researchers developing approaches for quantifying uncertainties, including those due to uncertain parameters, inadequate physical models, and uncertain or sparse experimental data, for models of complex physical systems such as turbulent flows, subsurface flow, oceanic flow, and materials applications.

Organizer: Heng Xiao
Virginia Tech, USA

Organizer: Todd Oliver
University of Texas at Austin, USA

Organizer: Xiu Yang
Pacific Northwest National Laboratory, USA

4:40-5:05 Recursive k-d Darts Sampling for Exploring High-Dimensional Spaces

Ahmad A. Rushdi, University of Texas at Austin, USA; Mohamed S. Ebeida, Laura Swiler, and Scott A. Mitchell, Sandia National Laboratories, USA; Anjul Patney and John Owens, University of California, Davis, USA

continued on next page

5:10-5:35 Reduction of Chemical Models under Uncertainty
Habib N. Najm, Sandia National Laboratories, USA; Mauro Valorani, Università di Roma "La Sapienza", Italy; Riccardo Malpica Galassi, University of Rome La Sapienza, Italy; Cosmin Safta and Mohammad Khalil, Sandia National Laboratories, USA; Pietro Paolo Ciottoli, Università di Roma "La Sapienza", Italy

5:40-6:05 Stochastic Representation of Model Inadequacy for Supercapacitors
Leen Alawieh, University of Texas at Austin, USA; Damien Lebrun-Grandie, Oak Ridge National Laboratory, USA; Damon McDougall, Todd Oliver, and Robert D. Moser, University of Texas at Austin, USA

6:10-6:35 Uncertainty Quantification in Diffuse Optical Tomography
Eric De Sturler, Virginia Tech, USA; Misha E. Kilmer, Arvind Saibaba, and Eric Miller, Tufts University, USA

6:40-7:05 Hierarchical Optimization for Neutron Scattering Problems
Feng Bao and *Richard Archibald*, Oak Ridge National Laboratory, USA

Thursday, April 7

MS115

Uncertainty Quantification and Inversion of Multiphysics and Multiscale Problems - Part III of III

4:40 PM-5:40 PM

Room:Garden 3C

For Part 2 see MS100

UQ methodologies, deterministic/ Bayesian approaches are essential to diagnose the model errors, integrate data and models to infer uncertain parameters. Scientific and engineering codes for multiparameter, multiphyiscs problems commonly achieve correct simulations through the calibration of model parameters. As computational science moves to estimate optimized model parameters from noisy and indirect observational data, the quality of decision making improves. We will present and discuss the methodologies and approaches in the applications across a wide range of scientific and engineering problems.

Organizer: Tulin Kaman
University of Zurich, Switzerland

Organizer: Remi Abgrall
Inria Bordeaux Sud-Ouest, France

Organizer: James G. Glimm
State University of New York, Stony Brook, USA

4:40-5:05 Bayesian Reconstruction of Catalytic Properties of Thermal Protection Materials for Atmospheric Reentry
Francois Sanson, Purdue University, USA; Pietro Marco Congedo, Inria, France; Thierry Magin, von Karman Institute for Fluid Dynamics, Belgium; Francesco Panerai, NASA Ames Research Center, USA; Alessandro Turchi, von Karman Institute for Fluid Dynamics, Belgium

5:10-5:35 Scalable Subsurface Characterization with Multiphysics Models and Massive Data Using Principal Component Geostatistical Approach
Jonghyun Harry Lee and Peter K Kitanidis, Stanford University, USA

Thursday, April 7

MS116

Uncertainty Quantification in an Industrial Context - Part I of II

4:40 PM-6:10 PM

Room:Garden 4A

For Part 2 see MS131

Industrial processes and applications are subject to uncertainties in e.g. modeling, construction, external physical influences and measurements. The increase of computational capabilities has moved away the focus from ensemble simulations with a simple error forward propagation to developments for optimization, control, robustness and parameter identification under uncertain conditions. However, model complexities, time limitations, fixed investment budgets or missing expertise put rather extreme constraints on such developments. This minisymposium aims at bringing together experts for uncertainty quantification in industry, to be able to showcase real-world industrial applications and to propose ways out of some of the given problems.

Organizer: Peter Zaspel
Universität Heidelberg, Germany

Organizer: Vincent Heuveline
Universität Heidelberg, Germany

4:40-5:05 Uncertainty Quantification for An Industrial Application
Philipp Glaser and Kosmas Petridis, Robert Bosch GmbH, Germany; Vincent Heuveline, Universität Heidelberg, Germany

5:10-5:35 Numerical Methods for Uncertainty Propagation in Hybrid-dynamical Systems
Michael Schick, Antoine Vandamme, and Kosmas Petridis, Robert Bosch GmbH, Germany; Vincent Heuveline, Universität Heidelberg, Germany

5:40-6:05 Uncertainty Quantification for a Biomedical Blood Pump Application
Chen Song, Heidelberg Institute for Theoretical Studies, Germany; Peter Zaspel and Vincent Heuveline, Universität Heidelberg, Germany

Thursday, April 7

MS117

Mathematical Advances in High-dimensional Approximation and Integration - Part III of III

4:40 PM-6:40 PM

Room:Garden 4B

For Part 2 see MS102

Predicting the behavior of complex phenomena relies on constructing solutions in terms of high dimensional spaces, particularly in the case when the input data (coefficients, forcing terms, initial and boundary conditions, geometry) are affected by large amounts of uncertainty. The resulting explosion in computational effort is a symptom of the curse of dimensionality and this symposium will focus on the fundamental problem of how to accurately recover the approximate solution of such high-dimensional functions. Mathematical breakthroughs in sparse random and deterministic sampling nonlinear and greedy approximations, compressed sensing, least squares, interpolation, and "best-N-term" approximations will be explored.

Organizer: Clayton G. Webster
Oak Ridge National Laboratory, USA

Organizer: Albert Cohen
Université Pierre et Marie Curie, France

4:40-5:05 Cross Validation for Function Approximation: Quantitative Guarantees and Error Estimates
Rachel Ward, University of Texas at Austin, USA

5:10-5:35 Title Not Available
Abdellah Chkifa and Clayton G. Webster, Oak Ridge National Laboratory, USA

continued in next column

5:40-6:05 Quasi-Monte Carlo and FFT Sampling for Elliptic PDEs with Lognormal Random Coefficients
Dirk Nuyens, KU Leuven, Belgium; Ivan G. Graham, University of Bath, United Kingdom; Frances Y. Kuo, University of New South Wales, Australia; Robert Scheichl, University of Bath, United Kingdom; Ian H. Sloan, University of New South Wales, Australia

6:10-6:35 Gradient-Free Active Subspace Construction Via Adaptive Morris Indices
Allison Lewis and *Ralph C. Smith*, North Carolina State University, USA; Brian Williams, Los Alamos National Laboratory, USA; Bassam A. Khuwaileh, North Carolina State University, USA; Max D. Morris, Iowa State University, USA

Thursday, April 7

MS118

Stochastic Optimization for Engineering Applications - Part III of III

4:40 PM-6:40 PM

Room:Garden 4C

For Part 2 see MS103

Engineering applications often require the solution to multiple optimization problems including inversion, control, and design. The solution of these problems must account for and be resilient to varied forms of uncertainty associated with problem inputs. Such requirements motivate research in novel risk models and robust probabilistic formulations. This minisymposium focuses on recent advances in the field of optimization under uncertainty including probabilistic computation, risk aversion, and distributionally robust optimization.

Organizer: Drew P. Kouri
Sandia National Laboratories, USA

Organizer: Bart G. Van Bloemen Waanders
Sandia National Laboratories, USA

4:40-5:05 Constrained Optimization with Low-Rank Tensors and Applications to Problems with Pdes under Uncertainty
Michael Ulbrich and Sebastian Garreis, Technische Universität München, Germany

5:10-5:35 Managing Uncertainty in PDE-Constrained Optimization Using Risk Measures
Thomas M. Surowiec, Humboldt University at Berlin, Germany; Drew P. Kouri, Sandia National Laboratories, USA

5:40-6:05 Length Scale and Manufacturability of Topology Optimized Designs
Boyan S. Lazarov, Technical University of Denmark, Denmark

6:10-6:35 A Space-time Fractional Optimal Control Problem: Analysis and Discretization
Harbir Antil, George Mason University, USA

Thursday, April 7

MS119

Reduced-order Modeling in Uncertainty Quantification - Part III of III

4:40 PM-6:40 PM

Room:Garden 5A

For Part 2 see MS104

Reduced-order models (ROMs) are physics-based surrogate models that can make the sampling requirements of UQ applications tractable, as they reduce the computational complexity arising from repeated evaluation of the underlying (e.g., steady or unsteady PDE- based) model. ROMs are constructed by 1) projecting the governing equations onto a low- dimensional subspace, and 2) introducing other approximations (e.g., empirical interpolation) to tackle complex parametric dependencies or nonlinearities. This minisymposium describes novel approaches for effectively integrating ROMs within a UQ setting, including methods for Bayesian inference, quantifying uncertainties introduced by the reduced-order model, PDE- constrained optimization under uncertainty, and adaptive-sampling techniques.

Organizer: Kevin T. Carlberg
Sandia National Laboratories, USA

Organizer: Andrea Manzoni
École Polytechnique Fédérale de Lausanne, Switzerland

4:40-5:05 The Discrete Empirical Interpolation Method for the Steady-State Navier-Stokes Equations
Howard C. Elman and Virginia Forstall, University of Maryland, College Park, USA

5:10-5:35 A Triple Model Reduction for Data-Driven Large-Scale Inverse Problems in High Dimensional Parameter Spaces
Ellen Le, Aaron Myers, and Tan Bui-Thanh, University of Texas at Austin, USA

5:40-6:05 POD-Galerkin Modeling with Adaptive Finite Elements for Stochastic Sampling
Sebastian Ullmann and Jens Lang, Technische Universität Darmstadt, Germany

6:10-6:35 Reduced-Order Modeling Of Hidden Dynamics
Patrick Héas and Cédric Herzet, Inria, France

continued in next column

Thursday, April 7

MS120

Rare Event Study for Stochastic Dynamical System and Random Field - Part III of III

4:40 PM-6:40 PM

Room:Garden 5B

For Part 2 see MS105

Rare events are a class of important stochastic effect in contrast to the averaged behaviour of the systems. Dynamical phase transitions, noise-induced instabilities, structural failures, extreme waves, etc., are typical examples of rare events, for which the traditional computational methods for uncertainty quantification may not be applied directly. We shall focus on the theoretic development (large deviation principle, extreme value analysis), numerical methods (rare-event simulation, multi- scale/stochastic modelling, optimization, importance sampling) and the applied problems in physics.

Organizer: Xiang Zhou
City University of Hong Kong, Hong Kong

Organizer: Jingchen Liu
Columbia University, USA

4:40-5:05 The String Method for the Study of Rare Events
Weiqing Ren, National University of Singapore and IHPC, Singapore

5:10-5:35 Local Optimal Rotation for Min-mode Calculation in Computing Transition State
Weiguo Gao, Fudan University, China

5:40-6:05 Quantifying Transition Dynamics of Nanoscale Complex Fluid via Mesoscopic Modeling
Lei Wu, Peking University, China

6:10-6:30 A Convex Splitting Scheme for the Saddle Point Search in Phase Filed Model
Shuting Gu, City University of Hong Kong, Hong Kong

Thursday, April 7

MS121

Towards a Unifying Probabilistic Framework for Scientific Computations Under Uncertainty - Part II of II

4:40 PM-6:40 PM

Room:Garden 5C

For Part 1 see MS106

The purpose of this minisymposium is to initiate a dialogue between the statistics and the applied mathematics communities.

Organizer: Ilias Bilionis
Purdue University, USA

Organizer: Phaedon S. Koutsourelakis
Technische Universität München, Germany

4:40-5:05 Stratified Bayesian Optimization
S. T. Palmerin, Unaffiliated

5:10-5:35 Learning to Optimize with Confidence
Andreas Krause, ETH Zürich, Switzerland

5:40-6:05 Variational Bayesian Inference Using Basis Adaptation in Homogeneous Chaos Surrogates
Panagiotis Tsilifis and Roger Ghanem, University of Southern California, USA

6:10-6:35 Empirical Orthogonal Function Calibration with Simulator Uncertainty
Matthew T. Pratola, Ohio State University, USA

Friday, April 8

Registration

7:30 AM-6:40 PM

Room: "Campus" Area, 1st Floor

MT7

Sobol' Indices: An Introduction and Some Recent Results

8:35 AM-10:35 AM

Room:Auditorium A

Chair: Art Owen, Stanford University, USA

Let f be a function of d independent variables. Sobol' indices provide importance measures for those variables. Like some kind of tomography, they can be directly estimated without first estimating the ANOVA components through which they are defined. This talk will cover their history, derivation, and recent results on their estimation, on generalized Sobol' indices, connections to Shapley value, and non L2 approaches. Some of this work is joint with Josef Dick and Su Chen.

Art Owen, Stanford University, USA

Friday, April 8

MS122

Numerical Bayesian Analysis - Part I of III

8:35 AM-10:35 AM

Room:Garden 1A

For Part 2 see MS137

Computational Bayesian inference has provided a route to uncertainty quantification for two decades. The algorithmic mainstay has been the Markov chain Monte carlo (MCMC) algorithms, though these are proving inefficient when scaling up to large and complex problems. How can classical numerical analysis and computational science be used to improve this situation? This minisymposium focuses on utilizing methods from numerical analysis and computational science to inform the computation over stochastic models required in a Bayesian formulation of UQ.

Organizer: Tiangang Cui
Massachusetts Institute of Technology, USA

Organizer: Colin Fox
University of Otago, New Zealand

Organizer: Richard A. Norton
University of Otago, New Zealand

8:35-9:00 Marginal Then Conditional Sampling for Hierarchical Models
Colin Fox and Richard A. Norton, University of Otago, New Zealand; J. Andrés Christen, Centro de Investigacion en Matematicas, Mexico

9:05-9:30 Fitting Lateral Transfer: MCMC for a Phylogenetic Likelihood Obtained from a Massive Linear ODE System
Geoff Nicholls and Luke Kelly, University of Oxford, United Kingdom

9:35-10:00 Sampling Gaussian Distributions in High Dimensional Statistical Inference
Saïd Moussaoui and Jérôme Idier, Ecole Centrale de Nantes, France

10:05-10:30 Fast Sampling for Inverse Equilibrium Problems
Markus Neumayer, Technische Universität, Graz, Austria; Colin Fox, University of Otago, New Zealand

Friday, April 8

MS123

Uncertainty Quantification with Vague, Imprecise and Scarce Information

8:35 AM-10:35 AM

Room:Garden 1B

Engineering problems typically involve information in various forms and of various nature. Uncertainty and imprecision of this information may considerably influence the results of an analysis and associated decisions. In this context, probabilistic, non-probabilistic as well as mixed concepts of imprecise probabilities have been developed and applied successfully. In addition, considerable advancements in numerical efficiency have significantly increased their practical applicability in the recent past. This minisymposium aims at bundling the most recent developments of theories, concepts, methods and techniques for a proper numerical treatment of vague and imprecise information in the context of uncertainty quantification for decision making.

Organizer: Edoardo Patelli
University of Liverpool, United Kingdom

8:35-9:00 Nonlinear Statistical Analysis Based on Imprecise Data
Thomas Augustin, Ludwig-Maximilians-Universität München, Germany

9:05-9:30 Dealing with Limited and Scarse Information in Complex Systems and Critical Infrastructures
Roberto Rocchetta and Edoardo Patelli, University of Liverpool, United Kingdom

9:35-10:00 Nonparametric Bayesian Estimation of System Reliability with Imprecise Prior Information on Component Lifetimes
Gero Walter, Eindhoven University of Technology, Netherlands; Louis Aslett, University of Oxford, United Kingdom; Frank Coolen, Durham University, United Kingdom

10:05-10:30 Modelling with Random Sets in Engineering
Michael Oberguggenberger, University of Innsbruck, Austria

Friday, April 8

MS124

Multi Level and Multi Index Sampling Methods and Applications - Part III of III

8:35 AM-10:35 AM

Room:Garden 1C

For Part 2 see MS109

We aim to present the latest algorithmic and theoretical contributions to Multilevel Sampling methods, focusing also on novel applications. Accurately computing expected values of observables of solutions to large stochastic systems arising from the discretization of random differential equations remains a challenging task in complex applications. Fortunately, using multiple discretization levels can effectively reduce the overall computational cost. This idea led to the Multi Level Monte Carlo method and subsequent extensions which include, among others, the i) Multi Index Monte Carlo and ii) the use of deterministic sampling strategies such as sparse grids and low discrepancy sequences.

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Mike Giles
University of Oxford, United Kingdom

8:35-9:00 MLMC with Control Variate for Lognormal Diffusion
Fabio Nobile and Francesco Tesei, École Polytechnique Fédérale de Lausanne, Switzerland

9:05-9:30 A Multiscale Model and Variance Reduction Method for Wave Propagation in Heterogeneous Materials
Ferran Vidal-Codina, Cuong Nguyen, and Jaime Peraire, Massachusetts Institute of Technology, USA

continued in next column

9:35-10:00 Approximation of Probability Density Functions by the Multilevel Monte Carlo Maximum Entropy Method
Alexey Chernov and Claudio Bierig, Carl von Ossietzky Universitaet Oldenburg, Germany

10:05-10:30 Efficient Coupling of Multi-Level Monte Carlo Method with Multigrid
Richard P. Dwight, Delft University of Technology, Netherlands; *Prashant Kumar* and Kees Oosterlee, Centrum voor Wiskunde en Informatica (CWI), Netherlands

Friday, April 8

MS125

Advances in Optimal Experimental Design for Physical Models - Part I of III

8:35 AM-10:35 AM

Room:Garden 2A

For Part 2 see MS140

The challenge of optimal information gathering---for the purpose of inference, prediction, design, or control---pervades fields ranging from geophysics to chemical engineering and beyond. It can be formalized through the framework of optimal experimental design. Yet new algorithms and formulations are needed to tackle problems of greater scale and dynamic complexity, and to find optimal sequential designs. This minisymposium gathers approaches focusing on design for large-scale inverse problems and nonlinear models motivated by physical applications. Relevant techniques include surrogate modeling, model reduction, model error, sparse quadrature, asymptotic approximations, PDE-constrained optimization, information metrics approximation, stochastic optimization, and approximate dynamic programming.

Organizer: Xun Huan
Massachusetts Institute of Technology, USA

Organizer: Quan Long
United Technologies Research Center, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

8:35-9:00 Efficient Computation of Bayesian Optimal Designs
Quan Long, United Technologies Research Center, USA; *Marco Scavino*, Universidad de la República, Uruguay; Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

9:05-9:30 Optimal Experimental Design for ODE Models
Matthias Chung and Justin Krueger, Virginia Tech, USA; Mihai Pop, University of Maryland, USA

9:35-10:00 Variance Reduction Methods for Efficient Bayesian Experimental Design
Roger Ghanem and Panagiotis Tsilifis, University of Southern California, USA

10:05-10:30 A Layered Multiple Importance Sampling Scheme for Focused Optimal Bayesian Experimental Design
Chi Feng and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

continued in next column

Friday, April 8

MS126

Data-driven Methods for Uncertainty Quantification - Part II of II

8:35 AM-10:35 AM

Room:Garden 2B

For Part 1 see MS111

Data-driven methods for uncertainty quantification are essential for credible estimates of uncertainty in predictions from numerical simulations. Development of such methods requires combining knowledge from a wide spectrum of disciplines to ensure reliable and robust quantification of uncertainties, starting from data or exploiting it. This minisymposium will feature approaches for quantifying uncertainties due to parametric and model-form uncertainties in both data-rich and data-limited settings. Presentations will focus on both the development and application of advanced data-driven methods for forward and inverse propagation of uncertainty.

Organizer: Fabian Franzelin
University of Stuttgart, Germany

Organizer: John D. Jakeman
Sandia National Laboratories, USA

Organizer: Dirk Pflüger
University of Stuttgart, Germany

Organizer: Tim Wildey
Sandia National Laboratories, USA

8:35-9:00 Sequential Design of Computer Experiments for the Solution of Bayesian Inverse Problems
Michael Sinsbeck and Wolfgang Nowak, University of Stuttgart, Germany

continued on next page

9:05-9:30 On a Data Assimilation Method Coupling Kalman Filtering, MCRE Concept, and PGD Model Reduction for Real-Time Updating of Structural Mechanics Models
Basile Marchand, CNRS, France; Ludovic Chamoin, ENS Cachan, France; Christian Rey, Safran, Research & Technology Center, France

9:35-10:00 Parametric Uncertainty in Macroscopic Traffic Flow Models Calibration from Gps Data
Enrico Bertino, Politecnico di Milano, Italy; Regis Duvigneau, Inria Sophia Antipolis, France; *Paola Goatin*, Inria, France

10:05-10:30 Stochastic Collocation for Differential Algebraic Equations Arising from Gas Network Simulation
Barbara Fuchs and Jochen Garcke, University of Bonn, Germany

Friday, April 8

MS127

Error Estimation and Adaptive Methods for Uncertainty Quantification in Computational Sciences - Part I of III

8:35 AM-10:35 AM

Room:Garden 2C

For Part 2 see MS142

Advances in computational science have led the community to consider applications involving the solution of increasingly complex multiphysics and multiscale problems. Such problems involve many sources of uncertainties that need to be taken into account for reliable predictions of physical phenomena. It has thus become crucial to rely on error estimation tools to assess the accuracy of the uncertainty propagation process and develop efficient adaptive strategies to reduce the cost of output predictions. The objective of the minisymposium will therefore be to present fundamental contributions and exchange ideas on error estimation and adaptive methods for uncertainty quantification.

Organizer: Serge Prudhomme
École Polytechnique de Montréal, Canada

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Marco Picasso
École Polytechnique Fédérale de Lausanne, Switzerland

8:35-9:00 Adaptive Stochastic Galerkin Fem with Hierarchical Tensor Representation
Martin Eigel, WIAS, Berlin, Germany

9:05-9:30 Error Estimation and Adaptivity for PGD Reduced Models
Ludovic Chamoin, Pierre Ladeveze, and Pierre-Eric Allier, ENS Cachan, France

9:35-10:00 Separating Discretization Error and Parametric Uncertainty in Goal-Oriented Error Estimation for Pdes with Uncertainty
Corey M. Bryant, University of Texas at Austin, USA; Serge Prudhomme, École Polytechnique de Montréal, Canada

10:05-10:30 A Posteriori Error Estimates for Navier-Stokes Equations with Small Uncertainties
Diane Guignard, Fabio Nobile, and Marco Picasso, École Polytechnique Fédérale de Lausanne, Switzerland

continued in next column

Friday, April 8

MS128

Learning Parameters from Data: Calibration, Inverse Problems, and Model Updating

8:35 AM-10:35 AM

Room:Garden 3A

Complex numerical models have become so ubiquitous in science, that nowadays the conclusions drawn from their use influence critical and expensive decisions in science, engineering and public policy. The predictive power of such models relies on how well they are calibrated to experimental data. The main aim of this minisymposium is to bring together experts in calibration and inverse problem modelling. Relevant topics for include: robust calibration techniques, inverse problem methodologies, Bayesian model updating, history matching, data assimilation, model discrepancy, amongst others. Theoretical and computational developments are of interest, with particular focus on numerical efficiency.

Organizer: Alejandro Diaz
University of Liverpool, United Kingdom

Organizer: Marco Iglesias
University of Nottingham, United Kingdom

Organizer: Richard D. Wilkinson
University of Sheffield, United Kingdom

Organizer: Siu Kui Au
University of Liverpool, United Kingdom

8:35-9:00 History Matching with Structural Reliability Methods
Alejandro Diaz, University of Liverpool, United Kingdom

continued in next column

9:05-9:30 Iterative History Matching for Computationally Intensive Inverse Problems
Ian Vernon, University of Durham, United Kingdom

9:35-10:00 Efficient Inverse Problems with Gaussian Process Surrogates Via Entropy Search
James Hensman, University of Lancaster, United Kingdom

10:05-10:30 Bayesian Inference for Linear Parabolic PDEs with Noisy Boundary Conditions
Zaid Sawlan, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Friday, April 8

MS129

Surrogate Models for Efficient Robust Optimization and Data Assimilation in Computational Mechanics - Part I of III

8:35 AM-10:35 AM

Room:Garden 3B

For Part 2 see MS144

Computational mechanics is subject to numerous uncertainties arising from random variations. Their effects must be reduced to make systems more robust. Incorporation of stochastic components in predictive simulations makes difficult the resolution of multidisciplinary/multifidelity design optimization and inverse problems. Alternative surrogate models, based on global or local approximations, may offer faster model predictions and sensitivity analysis facilitating uncertainty quantification for such large-scale systems. The MS will highlight modeling and computational challenges faced in these areas. The goal is to bridge the gap between the stochastic methods developed for robust optimization and for data assimilation and calibration.

Organizer: Pietro Marco Congedo
Inria, France

Organizer: Didier Lucor
Brown University, USA

Organizer: Regis Duvigneau
Inria Sophia Antipolis, France

continued on next page

8:35-9:00 Regression-Based Adaptive Sparse Polynomial Dimensional Decomposition for Sensitivity Analysis in Fluids Simulation
Pietro Marco Congedo, Inria, France; Kunkun Tang, University of Illinois at Urbana-Champaign, USA; Remi Abgrall, University of Zurich, Switzerland; Pietro M. Congedo, Inria Bordeaux Sud-Ouest, France

9:05-9:30 Effective Improvement of Aerodynamic Performance over a Parameter Interval
Regis Duvigneau and Jean-Antoine Desideri, Inria Sophia Antipolis, France

9:35-10:00 Adaptive Surrogate Modeling Strategies for Efficient Bayesian Inference
Olivier P. Le Maître and Didier Lucor, LIMSI-CNRS, France; Lionel Mathelin, CNRS, France

10:05-10:30 Time-Optimal Path Planning in Uncertain Flow Field Using Ensemble Method
Tong Wang, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Olivier P. Le Maître, LIMSI-CNRS, France; Ibrahim Hoteit and Omar M. Knio, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Friday, April 8

MS130

Towards Data-driven, Predictive Multiscale Simulations - Part I of III

8:35 AM-10:35 AM

Room:Garden 3C

For Part 2 see MS145

Despite the continuous increase in our computational capabilities, the ultimate goal of predictive simulations remains elusive. The key challenges are: High-dimensionality of uncertainties; Information fusion, e.g., multi-fidelity, multi-scale/physics models, and experiments; Model-form uncertainties induced by limited data and incomplete physics; Cost of information acquisition, i.e., the cost of doing simulations/experiments. The purpose of this minisymposium is to address these roadblocks and achieve groundbreaking advances by promoting synergies between applied mathematics, computational physics, and data sciences. Specific topics include but are not limited to: Data-driven model identification; Learning from high-dimensional data; Task-specific information acquisition policies; Non-linear dimension- reduction for coarse graining.

Organizer: Ilias Bilionis
Purdue University, USA

Organizer: Phaedon S. Koutsourelakis
Technische Universität München, Germany

8:35-9:00 No Equations, No Variables: Data, and the Computational Modeling of Complex Systems
I. G. Kevrekidis, Princeton University, USA

9:05-9:30 Coarse-Graining of Stochastic Dynamics
Tony Lelievre, CERMICS ENPC, France; *Frederic Legoll*, Ecole Nationale des Ponts et Chaussées, France

9:35-10:00 Path-Space Information Criteria and Uq Bounds for the Long-Time Behavior of Extended Stochastic Systems
Markos A. Katsoulakis, University of Massachusetts, Amherst, USA

10:05-10:30 Bayesian Inference and Model Selection in Molecular Dynamics Simulations
Panagiotis Angelikopoulos, ETH Zürich, Switzerland

continued in next column

Friday, April 8

MS131

Uncertainty Quantification in an Industrial Context - Part II of II

8:35 AM-10:05 AM

Room:Garden 4A

For Part 1 see MS116

Industrial processes and applications are subject to uncertainties in e.g. modeling, construction, external physical influences and measurements. The increase of computational capabilities has moved away the focus from ensemble simulations with a simple error forward propagation to developments for optimization, control, robustness and parameter identification under uncertain conditions. However, model complexities, time limitations, fixed investment budgets or missing expertise put rather extreme constraints on such developments. This minisymposium aims at bringing together experts for uncertainty quantification in industry, to be able to showcase real-world industrial applications and to propose ways out of some of the given problems.

Organizer: Peter Zaspel
Universität Heidelberg, Germany

Organizer: Vincent Heuveline
Universität Heidelberg, Germany

8:35-9:00 Uncertainty Quantification for Reliable Simulation of Fuel Cell
Thomas Carraro, Universität Heidelberg, Germany

9:05-9:30 Uncertainty Quantification for Engineering in An Industrial Application
Carsten Proppe, Karlsruhe Institute of Technology, Germany

9:35-10:00 Towards Meshless Uncertainty Quantification in Medical Imaging on GPUs
Peter Zaspel, Universität Heidelberg, Germany

Friday, April 8

MS132

Control Design Under Uncertainties

8:35 AM-10:35 AM

Room:Garden 4B

Analysis and design of control systems in the presence of uncertainty are of major relevance. Various objectives are of interest, such as providing assessments on the system characteristics, or retrieving more influential uncertain parameters on a given output of interest. Different points of view are considered in the literature. We mainly distinguish probabilistic approaches from worst-case management of the uncertainties. This minisymposium aims at confronting various methodologies, as far as efficient algorithms, and at connecting the automatic control community with the one from uncertainty quantification. The speakers we propose are experts from different communities: automatic, statistics, control theory.

Organizer: Clémentine Prieur
Université Joseph Fourier and Inria, France

8:35-9:00 Global Sensitivity Analysis for the Boundary Control of An Open Channel
Alexandre Janon, Université Paris-Sud, France

9:05-9:30 Uncertainty Propagation Estimates with Semidefinite Optimization
Didier Henrion, LAAS-CNRS, Toulouse, France

9:35-10:00 Uncertainty Randomization in Control Systems
Roberto Tempo, CNR, Italy

10:05-10:30 Worst-Case Robustness Analysis and Synthesis in Control
Carsten W. Scherer, University of Stuttgart, Germany

Friday, April 8

MS133

Stochastic Modeling and Optimization in Power Grid Operations and Planning - Part I of III

8:35 AM-10:35 AM

Room:Garden 4C

For Part 2 see MS148

Increasing renewable energy penetration levels in modern power grids increase variability and uncertainty in system behavior, with corresponding impacts on operations and planning. Existing deterministic approaches to solving these problems have sufficed in the past, due to the relative predictability of system inputs. In this minisymposium we emphasize techniques for modeling and addressing uncertainty from wind and solar renewables for the purpose of improving power systems predictability and reliability. Invited talks include contributions on stochastic optimization models, multi-stage mixed integer stochastic programs, and efficient scenario management.

Organizer: Cosmin Safta
Sandia National Laboratories, USA

Organizer: Jean-Paul Watson
Sandia National Laboratories, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

8:35-9:00 Adaptive Sparse Quadrature for Stochastic Optimization
Cosmin Safta, Richard L. Chen, Jianqiang Cheng, Habib N. Najm, Ali Pinar, and Jean-Paul Watson, Sandia National Laboratories, USA

9:05-9:30 Renewable Energy Integration in the Central Western European System
Ignacio Aravena and Anthony Papavasiliou, Université Catholique de Louvain, Belgium

continued on next page

9:35-10:00 Multi-Timescale Stochastic Power Systems Operation with High Wind Energy Penetration
Hongyu Wu and Ibrahim Krad, National Renewable Energy Laboratory, USA; Erik Ela, Electric Power Research Institute, USA; Anthony Florita, Jie Zhang, Eduardo Ibanez, and *Bri-Mathias Hodge*, National Renewable Energy Laboratory, USA

10:05-10:30 Introducing Uncertainty to Transmission Expansion Planning Models – A North Sea Case Study
Martin Kristiansen and Magnus Korpås, Norwegian University of Science and Technology, Norway

Friday, April 8

MS134

Monte Carlo Methods for High Dimensional Data Assimilation

8:35 AM-10:35 AM

Room:Garden 5A

Data assimilation (DA) is the problem of prediction or estimation of the state using noisy, partial observations of chaotic dynamical systems, and is closely related to nonlinear filtering. Common approaches such as particle filters do not work well for high dimensional problems while others such as ensemble Kalman filters work well mainly for linear systems. Active research is being conducted to bridge this gap. The main idea behind the proposed MS is to bring together researchers working on particle and ensemble Kalman filtering, and more generally Monte Carlo methods, in the context of DA.

Organizer: Amit Apte
TIFR Centre, Bangalore, India

Organizer: David Kelly
University of Warwick, United Kingdom

8:35-9:00 Hybrid Particle - Ensemble Kalman Filter for Lagrangian Data Assimilation
Amit Apte, TIFR Centre, Bangalore, India; Elaine Spiller, Marquette University, USA; Laura Slivinski, Woods Hole Oceanographic Institute, USA

9:05-9:30 Accuracy and Stability of Nonlinear Filters
David Kelly, University of Warwick, United Kingdom

9:35-10:00 Non-Degenerate Particle Filters in High-Dimensional Systems
Javier Amezcua, Peter Jan van Leeuwen, and Mengbin Zhu, University of Reading, United Kingdom

10:05-10:30 Sequential Implicit Sampling Methods for Bayesian Inverse Problems
Xuemin Tu, University of Kansas, USA

Friday, April 8

MS135

Rare Events: Theory, Algorithms, and Applications - Part I of II

8:35 AM-10:35 AM

Room:Garden 5B

For Part 2 see MS150

Conformal changes in molecules, rearrangements of atomic clusters, and magnetization switches exemplify rare but important events in physical systems induced by small thermal fluctuations. Direct simulation of such events is exceedingly difficult because they occur on much longer time scales than the inner time scale of the underlying system. The purpose of this minisymposium is bringing together scientists tackling the difficulties in the study of rare events from different directions and sharing recent innovations. These will include theoretical developments providing mathematical foundations for deterministic and Monte-Carlo algorithms as well as studies of rare events in some particular complex physical systems.

Organizer: Maria K. Cameron
University of Maryland, USA

8:35-9:00 Spectral Analysis of Stochastic Networks
Maria K. Cameron, University of Maryland, USA

9:05-9:30 Competition Between Energy and Entropy in the Stochastic Allen-Cahn Equation
Felix Otto, Max Planck Institute for Mathematics in the Sciences, Germany; Hendrik Weber, University of Warwick, United Kingdom; *Maria G. Westdickenberg*, RWTH Aachen University, Germany

9:35-10:00 Vortices in the Stochastic Parabolic Ginzburg-Landau Equation
Olga Chugreeva, RWTH Aachen University, Germany

10:05-10:30 Packing and Unpacking
Matthieu Wyart, École Polytechnique Fédérale de Lausanne, Switzerland

Friday, April 8

MS136

Intrusive and Hybrid Intrusive UQ Approaches for Extreme Scale Computing

8:35 AM-10:05 AM

Room:Garden 5C

The evolution towards novel extreme scale computing architectures is bringing both challenges and opportunities to the field of uncertainty quantification. On the one hand, the increase in computing power helps to offset the cost of UQ, even for complex applications. On the other hand, communication bottlenecks, increased frequencies of soft and hard faults, and limits on memory create computational challenges for UQ algorithms. There is a need for UQ algorithms to scale effectively on heterogeneous computer architectures and to be resilient to system faults. This minisymposium focuses on intrusive and hybrid intrusive approaches to address these UQ challenges.

Organizer: Bert J. Debusschere
Sandia National Laboratories, USA

Organizer: Eric Phipps
Sandia National Laboratories, USA

Organizer: Karla Morris
Sandia National Laboratories, USA

8:35-9:00 A Hybrid Approach to Tackle Resiliency in Extreme Scale Computations Using a Domain Decomposition Solver for Uncertain Elliptic Pdes

Paul Mycek and Andres Contreras, Duke University, USA; Olivier P. Le Maître, LIMSI-CNRS, France; Khachik Sargsyan, Francesco Rizzi, Karla Morris, Cosmin Safta, and Bert J. Debusschere, Sandia National Laboratories, USA; Omar M. Knio, Duke University, USA

continued in next column

9:05-9:30 A Soft and Hard Faults Resilient Solver for 2D Uncertain Elliptic PDEs via Fault-tolerant MPI Server-client-based Implementation

Francesco Rizzi and Karla Morris, Sandia National Laboratories, USA; Paul Mycek, Duke University, USA; Khachik Sargsyan, Sandia National Laboratories, USA; Olivier P. Le Maître, LIMSI-CNRS, France; Omar M. Knio and Andres Contreras, Duke University, USA; Cosmin Safta and Bert J. Debusschere, Sandia National Laboratories, USA

9:35-10:00 VPS: Voronoi Piecewise Surrogates for High-Dimensional Data

Mohamed S. Ebeida, Sandia National Laboratories, USA; Ahmad A. Rushdi, University of Texas at Austin, USA; Laura Swiler, Scott A. Mitchell, and Eric Phipps, Sandia National Laboratories, USA

Coffee Break

10:35 AM-11:05 AM

Room: "Campus" Area, 1st Floor

Friday, April 8

IP7

Uncertainty Quantification and Numerical Analysis: Interactions and Synergies

11:05 AM-11:50 AM

Room:Auditorium A

Chair: Clémentine Prieur, Université Joseph Fourier and Inria, France

The computational costs of uncertainty quantification can be challenging, in particular when the problems are large or real time solutions are needed. Numerical methods appropriately modified can turn into powerful and efficient tools for uncertainty quantification. Conversely, state-of-the-art numerical algorithms reinterpreted from the perspective of uncertainty quantification can becomes much more powerful. This presentation will highlight the natural connections between numerical analysis and uncertainty quantification and illustrate the advantages of re-framing classical numerical analysis in a probabilistic setting. In particular, we will show that using preconditioning as a vehicle for coupling hierarchical models with iterative linear solvers becomes a means not only to assess the reliability of the solutions, but also to achieve super-resolution, as illustrated with an application to magneto-encephalography.

Daniela Calvetti
Case Western Reserve University, USA

Friday, April 8

IP8

Multilevel Monte Carlo Methods

11:55 AM-12:40 PM

Room:Auditorium A

Chair: Frances Y. Kuo, University of New South Wales, Australia

Monte Carlo methods are a standard approach for the estimation of the expected value of functions of random input parameters. However, to achieve improved accuracy often requires more expensive sampling (such as a finer timestep discretisation of a stochastic differential equation) in addition to more samples. Multilevel Monte Carlo methods aim to avoid this by combining simulations with different levels of accuracy. In the best cases, the average cost of each sample is independent of the overall target accuracy, leading to very large computational savings. This lecture will introduce the key ideas, and survey the progress in the area.

Mike Giles
University of Oxford, United Kingdom

Friday, April 8

Closing Remarks

12:40 PM-12:50 PM

Room:Auditorium A

Lunch Break

12:50 PM-2:10 PM

Attendees on their own

MT8

Guidelines for Compressive Sensing in UQ

2:10 PM-4:10 PM

Room:Auditorium A

Chair: Rachel Ward, University of Texas at Austin, USA

Compressive sensing is a signal processing methodology whereby, using nonlinear reconstruction methods such as l1 minimization, the sparsity of a signal can be exploited to recover it from far fewer samples than required by Shannon-Nyquist theory. As sparsity and limited measurements are also salient in UQ, it is a natural fit for applying compressive sensing techniques. However, one needs to take care: compressive sensing in its standard form is finite-dimensional, and relies on strong incoherence assumptions between sparsity and measurement domains. In this tutorial, we present some guidelines for overcoming these issues when applying compressive sensing to UQ. Specific topics to be covered are weighted sparsity, mixed sparsity-smoothness priors, and weighted stochastic strategies for sampling parameter space. We finish by discussing recent progress in speeding up the convex optimization routines underlying compressive sensing in UQ.

Rachel Ward, University of Texas at Austin, USA

Friday, April 8

MS137

Numerical Bayesian Analysis - Part II of III

2:10 PM-4:10 PM

Room:Garden 1A

For Part 1 see MS122
For Part 3 see MS152

Computational Bayesian inference has provided a route to uncertainty quantification for two decades. The algorithmic mainstay has been the Markov chain Monte carlo (MCMC) algorithms, though these are proving inefficient when scaling up to large and complex problems. How can classical numerical analysis and computational science be used to improve this situation? This minisymposium focuses on utilizing methods from numerical analysis and computational science to inform the computation over stochastic models required in a Bayesian formulation of UQ.

Organizer: Tiangang Cui
Massachusetts Institute of Technology, USA

Organizer: Colin Fox
University of Otago, New Zealand

Organizer: Richard A. Norton
University of Otago, New Zealand

2:10-2:35 Dimension Reduction for UQ in Satellite Retrieval Methods
Marko Laine, Finnish Meteorological Institute, Helsinki, Finland

2:40-3:05 Quantifying Model Error in Bayesian Parameter Estimation
Staci White, Wake Forest University, USA; Radu Herbei, Ohio State University, USA

3:10-3:35 Optimization-Based Samplers using the Framework of Transport Maps
Zheng Wang and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

3:40-4:05 Efficient Scalable Variational Bayesian Approximation Methods for Inverse Problems
Ali Mohammad-Djafari, CNRS, France

Friday, April 8

MS138

Over-Confidence in Numerical Predictions: Challenges and Solutions - Part I of II

2:10 PM-4:10 PM

Room:Garden 1B

For Part 2 see MS153

With increasing computational power, many application areas are faced with the realistic prospect that they may be calculating an apparently well-resolved but incorrect numerical prediction for a deterministic or stochastic quantity of interest, and thereby placing excessive confidence in that prediction. Manifestations of this problem include systematic bias, Bayesian inconsistency, or yet-unresolved scales. Such errors may not be obvious or easy to diagnose or resolve. This minisymposium will include multiple perspectives on this area, including recent developments in probabilistic numerics, the consistency properties of Bayesian procedures, classical statistical treatments, and open problems and challenges.

Organizer: Tim Sullivan
Free University of Berlin, Germany

Organizer: Mark Girolami
University of Warwick, United Kingdom

2:10-2:35 Brittleness and Robustness of Bayesian Inference

Tim Sullivan, Free University of Berlin, Germany; Houman Owhadi, California Institute of Technology, USA; Clint Scovel, Los Alamos National Laboratory, USA

2:40-3:05 Probabilistic Formulations of Elementary Algorithms in Linear Algebra and Optimization

Philipp Hennig, Maren Mahsereci, and Simon Bartels, Max Planck Institute for Intelligent Systems, Germany

3:10-3:35 Bayesian Inference for Lambda-coalescents: Failures and Fixes

Jere Koskela, University of Warwick, United Kingdom

3:40-4:05 Opportunity for Uncertainty in Cardiac Modelling

Steven Niederer, King's College London, United Kingdom

continued in next column

Friday, April 8

MS139

Goal Oriented Decision Making Under Uncertainty - Part I of II

2:10 PM-4:10 PM

Room:Garden 1C

For Part 2 see MS154

Decision making under uncertainty is often described as one of the 'end goals' of uncertainty quantification, downstream of inference, uncertainty propagation, and other analyses. In principle, accounting for this end goal should streamline the upstream tasks; yet understanding exactly how to do so remains elusive. Decision-making under uncertainty itself involves optimization with a variety of risk or robustness measures, which necessitate the development of new algorithms---particularly when faced with complex models and non-standard distributions in the objectives and constraints. This session will present strategies for addressing all of these problems, along with several applications.

Organizer: Lior Horesh
IBM Research, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

2:10-2:35 Distribution Shaping and Scenario Bundling for Stochastic Programs with Endogenous Uncertainty

Marco Laumanns, IBM Research-Zurich, Switzerland; Steven Prestwich, University College Cork, Ireland; Ban Kawas and Bruno Flach, IBM Research, USA

continued on next page

2:40-3:05 Should You Derive Or Let the Data Drive? A Framework for Hybrid Data Driven First Principle Model Correction
Lior Horesh, IBM Research, USA; Remi Lam, Massachusetts Institute of Technology, USA; Haim Avron, IBM T.J. Watson Research Center, USA; Karen E. Willcox, Massachusetts Institute of Technology, USA

3:10-3:35 Taming Unidentifiability of Ill-Posed Inverse Problems Through Randomized-Regularized Decision Analyses
Velimir V. Vesselinov, Los Alamos National Laboratory, USA

3:40-4:05 A Gaussian Process Trust Region Method for Stochastic Constrained Derivative-Free Optimization
Florian Augustin, Massachusetts Institute of Technology, USA

Friday, April 8

MS140

Advances in Optimal Experimental Design for Physical Models - Part II of III

2:10 PM-4:10 PM

Room:Garden 2A

For Part 1 see MS125
For Part 3 see MS155

The challenge of optimal information gathering---for the purpose of inference, prediction, design, or control---pervades fields ranging from geophysics to chemical engineering and beyond. It can be formalized through the framework of optimal experimental design. Yet new algorithms and formulations are needed to tackle problems of greater scale and dynamic complexity, and to find optimal sequential designs. This minisymposium gathers approaches focusing on design for large-scale inverse problems and nonlinear models motivated by physical applications. Relevant techniques include surrogate modeling, model reduction, model error, sparse quadrature, asymptotic approximations, PDE-constrained optimization, information metrics approximation, stochastic optimization, and approximate dynamic programming.

Organizer: Xun Huan
Massachusetts Institute of Technology, USA

Organizer: Quan Long
United Technologies Research Center, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

2:10-2:35 Numerical Approaches for Sequential Bayesian Optimal Experimental Design
Xun Huan and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

2:40-3:05 Online Optimum Experimental Design for Control Systems under Uncertainties
Gregor Kriwet, Philipps-Universität Marburg, Germany; Ekaterina Kostina and Hans Georg Bock, Universität Heidelberg, Germany

3:10-3:35 Gaussian Process based Closed-loop Bayesian Experimental Design of Computer Experiments
Udo von Toussaint and Roland Preuss, Max Planck Institute for Plasma Physics, Germany

3:40-4:05 Bayesian Optimal Design for Ordinary Differential Equation Models
Antony Overstall, University of Glasgow, Scotland, United Kingdom; David Woods and Benjamin Parker, University of Southampton, United Kingdom

continued in next column

Friday, April 8

MS141

Data Assimilation Techniques for High Dimensional and Nonlinear Problems - Part I of II

2:10 PM-4:10 PM

Room:Garden 2B

For Part 2 see MS156

High dimensional nonlinear systems pose significant challenges for real-time data assimilation. These challenges include: (1) design of data assimilation techniques for high dimensional and nonlinear systems, (2) selective assimilation of observations when either the data is too frequent or too sparse and the observation process can be controlled, and (3) various impact of observations to model forecasts. This minisymposium aims to bring together experts interested in data assimilation and uncertainty quantification to share their latest research progress and ideas in advanced data assimilation techniques.

Organizer: Gabriel Terejanu
University of South Carolina, USA

Organizer: Haiyan Cheng
Willamette University, USA

2:10-2:35 Fast Data Assimilation for High Dimensional Nonlinear Dynamical Systems
Gabriel Terejanu, University of South Carolina, USA

2:40-3:05 Efficient Particle Filtering for Stochastic Korteweg-De Vries Equations
Feng Bao, Oak Ridge National Laboratory, USA; *Yanzhao Cao* and Xiaoying Han, Auburn University, USA; Jinglai Li, Shanghai Jiao Tong University, China

continued in next column

3:10-3:35 Data-Driven Spectral Decomposition and Forecasting of Ergodic Dynamical Systems
Dimitrios Giannakis, Courant Institute of Mathematical Sciences, New York University, USA

3:40-4:05 Scalable Methods for Optimal Experimental Design for Systems Governed by Pdes with Uncertain Parameter Fields
Alen Alexanderian, North Carolina State University, USA; Noemi Petra, University of California, Merced, USA; Georg Stadler, Courant Institute of Mathematical Sciences, New York University, USA; Omar Ghattas, University of Texas at Austin, USA

Friday, April 8

MS142

Error Estimation and Adaptive Methods for Uncertainty Quantification in Computational Sciences - Part II of III

2:10 PM-4:10 PM

Room:Garden 2C

For Part 1 see MS127
For Part 3 see MS157

Advances in computational science have led the community to consider applications involving the solution of increasingly complex multiphysics and multiscale problems. Such problems involve many sources of uncertainties that need to be taken into account for reliable predictions of physical phenomena. It has thus become crucial to rely on error estimation tools to assess the accuracy of the uncertainty propagation process and develop efficient adaptive strategies to reduce the cost of output predictions. The objective of the minisymposium will therefore be to present fundamental contributions and exchange ideas on error estimation and adaptive methods for uncertainty quantification.

Organizer: Serge Prudhomme
École Polytechnique de Montréal, Canada

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Marco Picasso
École Polytechnique Fédérale de Lausanne, Switzerland

2:10-2:35 Computational Error Estimates for Monte Carlo Finite Element Approximation with Rough Log Normal Diffusion Coefficients
Mattias Sandberg, Royal Institute of Technology, Sweden

continued on next page

2:40-3:05 Adaptive Mesh Re-location for Randomly Fluctuating Material Fields
Pedro Diez, Polytechnical University of Catalonia (UPC), Spain; Regis Cottereau, CNRS, CentraleSupelec, Université Paris-Saclay, France

3:10-3:35 Adaptive Sde Based Sampling for Random Pde
Johannes Neumann, WIAS-Berlin, Germany

3:40-4:05 A Multilevel Control Variate Method Based on Low-Rank Approximation
Hillary Fairbanks, Alireza Doostan, and Christian Ketelsen, University of Colorado Boulder, USA

Friday, April 8

MS143

Gaussian Processes: Feature Extraction vs Sensitivity Analysis - Part I of II

2:10 PM-4:10 PM

Room:Garden 3A

For Part 2 see MS158

Gaussian process models have been used as a basic brick in uncertainty quantification when conducting sensitivity analyses and related studies in the case of expensive response evaluations. On the other hand, feature extraction is a vivid topic in machine learning, where numerous approaches have been proposed and Gaussian process models also increasingly come into play. In this session, we will gather experts from both communities in order to have an overview of the latest developments and foster interdisciplinary discussions, with a special focus on the interplay between the definition of ad hoc covariance kernels and the pursued methodological goals.

Organizer: David Ginsbourger
Idiap Research Institute and University of Bern, Switzerland

Organizer: Bruno Sudret
ETH Zürich, Switzerland

2:10-2:35 Incorporating and Learning Functional Properties Through Covariance Kernels
David Ginsbourger, Idiap Research Institute and University of Bern, Switzerland; Olivier Roustant, Ecole des Mines de St Etienne, France

2:40-3:05 Detecting Periodicities with Gaussian Processes
Nicolas Durrande, Ecole des Mines de St Etienne, France

3:10-3:35 Gaussian Process Models for Predicting on Circular Domains
Olivier Roustant, Ecole des Mines de St Etienne, France; Esperan Padonou, STMicroelectronics, Switzerland

3:40-4:05 Jointly Informative Feature Selection
Leonidas Lefakis, Zalando SE, Germany and Francois Fleuret, Idiap Research Institute, Switzerland

Friday, April 8

MS144

Surrogate Models for Efficient Robust Optimization and Data Assimilation in Computational Mechanics - Part II of III

2:10 PM-4:10 PM

Room:Garden 3B

For Part 1 see MS129
For Part 3 see MS159

Computational mechanics is subject to numerous uncertainties arising from random variations. Their effects must be reduced to make systems more robust. Incorporation of stochastic components in predictive simulations makes difficult the resolution of multidisciplinary/ multifidelity design optimization and inverse problems. Alternative surrogate models, based on global or local approximations, may offer faster model predictions and sensitivity analysis facilitating uncertainty quantification for such large-scale systems. The MS will highlight modeling and computational challenges faced in these areas. The goal is to bridge the gap between the stochastic methods developed for robust optimization and for data assimilation and calibration.

Organizer: Pietro Marco Congedo
Inria, France

Organizer: Didier Lucor
Brown University, USA

Organizer: Regis Duvigneau
Inria Sophia Antipolis, France

2:10-2:35 Sensitivity and Uncertainty Analysis in Cfd
Dominique Pelletier, École Polytechnique de Montréal, Canada

continued on next page

Friday, April 8

MS144

Surrogate Models for Efficient Robust Optimization and Data Assimilation in Computational Mechanics - Part II of III

2:10 PM-4:10 PM

Room:Garden 3B

continued

2:40-3:05 Roughness and Discharge Uncertainty Propagation in Water Level Calculations in the Framework of Data Assimilation

Nicole Goutal, EDF R&D & Saint-Venant Hydraulic Lab, France; Cedric Goeury, EDF, France; Nabil El Mocayd and Sophie Ricci, CERFACS, France

3:10-3:35 Uncertainty Propagation in Dynamical Systems with a Novel Intrusive Method Based on Polynomial Algebra

Annalisa Riccardi, *Carlos Ortega Absil*, Chiara Tardioli, and Massimiliano Vasile, University of Strathclyde, United Kingdom

3:40-4:05 Multi-Fidelity Models for Flow Past An Airfoil with Operative and Geometric Uncertainties

Valentino Pediroda, Lucia Parussini, and Carlo Poloni, Universita di Trieste, Italy; Alberto Clarich and Rosario Russo, ESTECO, USA

Friday, April 8

MS145

Towards Data-driven, Predictive Multiscale Simulations- Part II of III

2:10 PM-4:10 PM

Room:Garden 3C

For Part 1 see MS130
For Part 3 see MS160

Despite the continuous increase in our computational capabilities, the ultimate goal of predictive simulations remains elusive. The key challenges are: High-dimensionality of uncertainties; Information fusion, e.g., multi-fidelity, multi-scale/physics models, and experiments; Model-form uncertainties induced by limited data and incomplete physics; Cost of information acquisition, i.e., the cost of doing simulations/experiments. The purpose of this minisymposium is to address these roadblocks and achieve groundbreaking advances by promoting synergies between applied mathematics, computational physics, and data sciences. Specific topics include but are not limited to: Data-driven model identification; Learning from high-dimensional data; Task-specific information acquisition policies; Non-linear dimension-reduction for coarse graining.

Organizer: Ilias Bilionis
Purdue University, USA

Organizer: Phaedon S. Koutsourelakis
Technische Universität München, Germany

2:10-2:35 Title Not Available

Christof Schuette, University of Berlin, Germany

2:40-3:05 Data-Driven Bayesian Uncertainty Quantification for Large-Scale Problems

Lina Kulakova, ETH Zürich, Switzerland

3:10-3:35 Predictive Coarse-Graining

Markus Schöberl, Technische Universität München, Germany; Nicholas Zabaras, University of Warwick, United Kingdom; Phaedon S. Koutsourelakis, Technische Universität München, Germany

3:40-4:05 Image-Based Modeling of Tumor Growth in Patients with Glioma

Bjoern H. Menze, Technische Universität München, Germany

continued in next column

Friday, April 8

MS146

Numerical Methods for BSDES and Stochastic Optimization - Part I of II

2:10 PM-4:10 PM

Room:Garden 4A

For Part 2 see MS161

Stochastic optimization refers to the optimization of a target function in the presence of uncertainty of the state equation and its observations. Backward stochastic differential equations, especially backward doubly stochastic differential equations can be considered as tools of solving stochastic optimization problems, Methods for stochastic optimization provide a means of coping with inherent system uncertainty and coping with models or systems that are highly nonlinear and high dimensional.In this minisymposium, we will explore various methodologies on stochastic optimization, including nonlinear filtering and BSDE approaches, and its applications to machine learning, uncertainty quantification of complex systems, and other engineering and science areas.

Organizer: Yanzhao Cao
Auburn University, USA

Organizer: Weidong Zhao
Shandong University, China

Organizer: Jialin Hong
Chinese Academy of Sciences, China

2:10-2:35 Small Data Driven Algorithms for Solving Large-Dimensional Bsdes
Emmanuel Gobet and Gang Liu, École Polytechnique, France; Jorge P. Zubelli, IMPA, Brazil

continued in next column

2:40-3:05 High Accurate Methods for Coupled FBSDEs with Applications
Weidong Zhao, Shandong University, China; Tao Zhou, Chinese Academy of Sciences, China

3:10-3:35 Nonlinear Filtering with Mcmc Optimization Method
Evangelos Evangelou, University of Bath, United Kingdom

3:40-4:05 Split-step Milstein Methods for Stiff Stochastic Differential Systems with Multiple Jumps
Abdul Khaliq and Viktor Reshniak, Middle Tennessee State University, USA; Guannan Zhang, Oak Ridge National Laboratory, USA; David A. Voss, Western Illinois University, USA

Friday, April 8

MS147

Advanced Methods for Enabling Quantification of Uncertainty in Complex Physical Systems - Part I of II

2:10 PM-4:10 PM

Room:Garden 4B

For Part 2 see MS162

The last few decades have seen broad advancements in computational science, yet the application of modern techniques for predicting the behavior of large-scale physical and engineering problems remains challenged due to the uncertainty in input parameters, as well as the models and operating environments of these systems. This minisymposium aims at exploring efforts related to efficient and mathematically rigorous techniques for both “forward” and “inverse” UQ, used to improve the prediction and design of complex systems. Topics include: high-dimensional approximation from noisy observations, propagation of uncertainty through multiphysics systems, model form uncertainty, and optimization under uncertainty.

Organizer: Clayton G. Webster
Oak Ridge National Laboratory, USA

Organizer: Fariba Fahroo
Defense Advanced Research Projects Agency, USA

2:10-2:35 Uncertainty Inclusion and Characterization in Nonlocal Theories for Materials Modeling
Pablo Seleson, Miroslav Stoyanov, Clayton G. Webster, and Guannan Zhang, Oak Ridge National Laboratory, USA

2:40-3:05 Title Not Available
Dongbin Xiu, University of Utah, USA

3:10-3:35 Parameter Estimation and Uncertainty Quantification in Turbulent Combustion Computations
Layal Hakim, Guilhem Lacaze, Mohammad Khalil, Habib N. Najm, and Joseph C. Oefelein, Sandia National Laboratories, USA

3:40-4:05 Uncertainty Propagation Across Domains with Vastly Different Correlation Lengths
Dongkun Zhang, Brown University, USA; Heyrim Cho, University of Maryland, USA; George E. Karniadakis, Brown University, USA

Friday, April 8

MS148

Stochastic Modeling and Optimization in Power Grid Operations and Planning - Part II of III

2:10 PM-4:10 PM

Room:Garden 4C

For Part 1 see MS133
For Part 3 see MS163

Increasing renewable energy penetration levels in modern power grids increase variability and uncertainty in system behavior, with corresponding impacts on operations and planning. Existing deterministic approaches to solving these problems have sufficed in the past, due to the relative predictability of system inputs. In this minisymposium we emphasize techniques for modeling and addressing uncertainty from wind and solar renewables for the purpose of improving power systems predictability and reliability. Invited talks include contributions on stochastic optimization models, multi-stage mixed integer stochastic programs, and efficient scenario management.

Organizer: Cosmin Safta
Sandia National Laboratories, USA

Organizer: Jean-Paul Watson
Sandia National Laboratories, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

2:10-2:35 Quasi-Monte Carlo Methods Applied to Stochastic Energy Optimization Models
Werner Roemisch and Hernan Leovey, Humboldt University Berlin, Germany

2:40-3:05 An Uncertainty Reduction Technique for Short-term Transmission Expansion Planning Based on Line Benefits
Quentin Ploussard, Andres Ramos, and Luis Olmos, Universidad Pontificia Comillas de Madrid, Spain

continued in next column

3:10-3:35 Probabilistic Forecasting of Wind and Solar Power Using Epi-Splines
Jean-Paul Watson, Sandia National Laboratories, USA; David Woodruff, University of California, Davis, USA

3:40-4:05 Scalable Algorithms for Large-Scale Mixed-Integer Optimization Problems in Ac Power Systems
Marc Vuffray, Los Alamos National Laboratory, USA; Daniel Bienstock, Columbia University, USA; Misha Chertkov, Los Alamos National Laboratory, USA; Krishnamurthy Dvijotham, University of Washington, USA; Miles Lubin, Massachusetts Institute of Technology, USA; Sidhant Misra, Los Alamos National Laboratory, USA

Friday, April 8

MS149

Model Reduction in Stochastic Dynamical Systems - Part I of II

2:10 PM-3:40 PM

Room:Garden 5A

For Part 2 see MS164

Stochastic dynamical systems have been extensively used to describe the evolution of chemical, biological and physical processes due to the presence of stochasticity. These stochastic dynamical systems usually involve complex mechanisms. For example, chemical and biological reaction networks often involve large number of species, multiple chains of reactions and multiple time scales. Such complexity stimulates the research on reduction methods that seek reduced dynamic models with fewer number of variables and processes, yet can approximate the original massive systems. This minisymposium will be focusing on recent developments in methodologies for model reduction in stochastic dynamical systems.

Organizer: Xiaoying Han
Auburn University, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

2:10-2:35 Model Order Reduction of Linear Systems Driven by Levy Noise
Peter Benner, Max-Planck-Institute for Dynamics of Complex Technical Systems, Germany; Martin Redmann, Max Planck Institute, Magdeburg, Germany

2:40-3:05 Balanced Truncation of Stochastic Linear Control Systems
Tobias Damm, Technical University Kaiserslautern, Germany

3:10-3:35 ADM-CLE Approach for Detecting Slow Variables in Continuous Time Markov Chains and Dynamic Data
Mihai Cucuringu, University of California, Los Angeles, USA; Radek Erban, University of Oxford, United Kingdom

Friday, April 8

MS150

Rare Events: Theory, Algorithms, and Applications - Part II of II

2:10 PM-4:10 PM

Room:Garden 5B

For Part 1 see MS135

Conformal changes in molecules, rearrangements of atomic clusters, and magnetization switches exemplify rare but important events in physical systems induced by small thermal fluctuations. Direct simulation of such events is exceedingly difficult because they occur on much longer time scales than the inner time scale of the underlying system. The purpose of this minisymposium is bringing together scientists tackling the difficulties in the study of rare events from different directions and sharing recent innovations. These will include theoretical developments providing mathematical foundations for deterministic and Monte-Carlo algorithms as well as studies of rare events in some particular complex physical systems.

Organizer: Maria K. Cameron
University of Maryland, USA

2:10-2:35 The Parallel Replica Algorithm: Mathematical Foundations and Recent Developments
Tony Lelievre, CERMICS ENPC, France

2:40-3:05 On a Connection Between Adaptive Multilevel Splitting and Stochastic Waves
Arnaud Guyader, Sorbonne Universités, France

3:10-3:35 Pseudogenerators for Under-Resolved Molecular Dynamics
Péter Koltai, Freie Universitaet Berlin, Germany; Andreas Bittracher, Technical University of Munich, Germany; Carsten Hartmann, Freie Universität Berlin, Germany; Oliver Junge, Technische Universität München, Germany

3:40-4:05 Generalizing Adaptive Multilevel Splitting
Mathias Rousset, Inria Rocquencourt, France

Friday, April 8

MS151

Analysis and Algorithms for High and Infinite Dimensional Problems - Part III of III

2:10 PM-4:10 PM

Room:Garden 5C

For Part 2 see MS76

Many physical, biological or geological models involve spatially varying input data which may be subject to uncertainty. A common way to deal with these uncertainties is by considering the input data to be a random field. The computational goal is usually to find the expected value, higher order moments or other statistics of the derived quantities of interest. This minisymposium will showcase novel approaches for tackling such model PDE problems with random coefficients. The key theoretical tools will be quasi-Monte Carlo methods and high-order polynomial-type approximations in conjunction with established Sparse Grid techniques.

Organizer: Michael Griebel
Institut für Numerische Simulation, Universität Bonn and Fraunhofer-Institut für Algorithmen und Wissenschaftlich, Germany

Organizer: Frances Y. Kuo
University of New South Wales, Australia

Organizer: Dirk Nuyens
KU Leuven, Belgium

Organizer: Stefan Vandewalle
KU Leuven, Belgium

continued in next column

2:10-2:35 Applying Quasi-Monte Carlo to an Eigenproblem with a Random Coefficient
Alexander Gilbert, University of New South Wales, Australia; Ivan G. Graham, University of Bath, United Kingdom; Frances Y. Kuo, University of New South Wales, Australia; Robert Scheichl, University of Bath, United Kingdom; Ian H. Sloan, University of New South Wales, Australia

2:40-3:05 Novel Monte Carlo Approaches for Uncertainty Quantification of the Neutron Transport Equation
Ivan G. Graham, *Matthew Parkinson*, and Robert Scheichl, University of Bath, United Kingdom

3:10-3:35 Sparse-Grid Quadrature for Elliptic Pdes with Log-Normal Diffusion
Markus Siebenmogen, University of Bonn, Germany

3:40-4:05 Linear Collective Approximations for Parametric and Stochastic Elliptic Pdes
Dinh Dung, Vietnam National University at Ho Chi Minh City, Vietnam

Coffee Break

4:10 PM-4:40 PM

Room: "Campus" Area, 1st Floor

Friday, April 8

MS152

Numerical Bayesian Analysis - Part III of III

4:40 PM-6:10 PM

Room:Garden 1A

For Part 2 see MS137

Computational Bayesian inference has provided a route to uncertainty quantification for two decades. The algorithmic mainstay has been the Markov chain Monte carlo (MCMC) algorithms, though these are proving inefficient when scaling up to large and complex problems. How can classical numerical analysis and computational science be used to improve this situation? This minisymposium focuses on utilizing methods from numerical analysis and computational science to inform the computation over stochastic models required in a Bayesian formulation of UQ.

Organizer: Tiangang Cui
Massachusetts Institute of Technology, USA

Organizer: Colin Fox
University of Otago, New Zealand

Organizer: Richard A. Norton
University of Otago, New Zealand

4:40-5:05 Optimal Bayesian Design of the Oral Glucose Tolerance Test Using An Ode Model
J. Andrés Christen, Nicolás Kuschinski, and Marcos A. Capistran, Centro de Investigacion en Matematicas, Mexico

5:10-5:35 Efficiency and Computability of MCMC with Autoregressive Proposals
Richard A. Norton, University of Otago, New Zealand

5:40-6:05 Fast Solutions to Large Linear Bayesian Inverse Problems
Albert E. Parker, Montana State University, USA

Friday, April 8

MS153

Over-Confidence in Numerical Predictions: Challenges and Solutions - Part II of II

4:40 PM-6:40 PM

Room:Garden 1B

For Part 1 see MS138

With increasing computational power, many application areas are faced with the realistic prospect that they may be calculating an apparently well-resolved but incorrect numerical prediction for a deterministic or stochastic quantity of interest, and thereby placing excessive confidence in that prediction. Manifestations of this problem include systematic bias, Bayesian inconsistency, or yet-unresolved scales. Such errors may not be obvious or easy to diagnose or resolve. This minisymposium will include multiple perspectives on this area, including recent developments in probabilistic numerics, the consistency properties of Bayesian procedures, classical statistical treatments, and open problems and challenges.

Organizer: Tim Sullivan
Free University of Berlin, Germany

Organizer: Mark Girolami
University of Warwick, United Kingdom

4:40-5:05 Confidence in Bayesian Nonparametrics? Some Mathematical (frequentist) Facts
Richard Nickl, University of Cambridge, United Kingdom

5:10-5:35 Probability Measures for Numerical Solutions of Deterministic Differential Equations
Mark Girolami, University of Warwick, United Kingdom

5:40-6:05 The von Neumann-Morgenstern Approach to Choice Under Ambiguity: Updating
Maxwell Stinchcombe, University of Texas at Austin, USA

6:10-6:35 Correction of Model Reduction Errors in Simulations
Ville P. Kolehmainen, University of Eastern Finland, Finland; *Jari Kaipio*, University of Auckland, New Zealand

Friday, April 8

MS154

Goal Oriented Decision Making Under Uncertainty - Part II of II

4:40 PM-6:40 PM

Room:Garden 1C

For Part 1 see MS139

Decision making under uncertainty is often described as one of the 'end goals' of uncertainty quantification, downstream of inference, uncertainty propagation, and other analyses. In principle, accounting for this end goal should streamline the upstream tasks; yet understanding exactly how to do so remains elusive. Decision-making under uncertainty itself involves optimization with a variety of risk or robustness measures, which necessitate the development of new algorithms---particularly when faced with complex models and non-standard distributions in the objectives and constraints. This session will present strategies for addressing all of these problems, along with several applications.

Organizer: Lior Horesh
IBM Research, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

4:40-5:05 Data-Driven Distributionally Robust Optimization Using the Wasserstein Metric
Peyman Mohajerin Esfahani, ETH Zürich, Switzerland; *Daniel Kuhn*, École Polytechnique Fédérale de Lausanne, Switzerland

5:10-5:35 Model Selection Under Uncertainty: Coarse-Graining Atomistic Models
Kathryn Farrell, J. Tinsley Oden, and Danial Faghihi, University of Texas at Austin, USA

5:40-6:05 Compositional Uncertainty Quantification for Coupled Multiphysics Systems
Douglas Allaire, Massachusetts Institute of Technology, USA

6:10-6:35 Multifidelity Uncertainty Propagation in Multidisciplinary Systems
Anirban Chaudhuri and Karen E. Willcox, Massachusetts Institute of Technology, USA

Friday, April 8

MS155

Advances in Optimal Experimental Design for Physical Models - Part III of III

4:40 PM-6:40 PM

Room:Garden 2A

For Part 2 see MS140

The challenge of optimal information gathering---for the purpose of inference, prediction, design, or control---pervades fields ranging from geophysics to chemical engineering and beyond. It can be formalized through the framework of optimal experimental design. Yet new algorithms and formulations are needed to tackle problems of greater scale and dynamic complexity, and to find optimal sequential designs. This minisymposium gathers approaches focusing on design for large-scale inverse problems and nonlinear models motivated by physical applications. Relevant techniques include surrogate modeling, model reduction, model error, sparse quadrature, asymptotic approximations, PDE-constrained optimization, information metrics approximation, stochastic optimization, and approximate dynamic programming.

Organizer: Xun Huan
Massachusetts Institute of Technology, USA

Organizer: Quan Long
United Technologies Research Center, USA

Organizer: Youssef M. Marzouk
Massachusetts Institute of Technology, USA

Organizer: Raul F. Tempone
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

continued in next column

4:40-5:05 Optimal Experimental Design for Geophysical Imaging of Flow in Porous Media

Jennifer Fohring and Eldad Haber, University of British Columbia, Canada

5:10-5:35 Optimal Electrode Positions in Electrical Impedance Tomography

Nuutti Hyvonen, Aalto University, Finland; Aku Seppanen, University of Eastern Finland, Finland; Stratos Staboulis, Technical University of Denmark, Denmark

5:40-6:05 Using Topological Sensitivity and Reachability Analysis Large Model Spaces

Eszter Lakatos and Ann C. Babtie, Imperial College London, United Kingdom; Paul Kirk, Cambridge University, United Kingdom; Michael Stumpf, Imperial College London, United Kingdom

6:10-6:35 Optimal Experimental Design using Multi Level Monte Carlo with application in Composite Material Damage Detection

Ben Mansour Dia and Luis Espath, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Quan Long, United Technologies Research Center, USA; Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Friday, April 8

MS156

Data Assimilation Techniques for High Dimensional and Nonlinear Problems - Part II of II

4:40 PM-6:10 PM

Room:Garden 2B

For Part 1 see MS141

High dimensional nonlinear systems pose significant challenges for real-time data assimilation. These challenges include: (1) design of data assimilation techniques for high dimensional and nonlinear systems, (2) selective assimilation of observations when either the data is too frequent or too sparse and the observation process can be controlled, and (3) various impact of observations to model forecasts. This minisymposium aims to bring together experts interested in data assimilation and uncertainty quantification to share their latest research progress and ideas in advanced data assimilation techniques.

Organizer: Gabriel Terejanu
University of South Carolina, USA

Organizer: Haiyan Cheng
Willamette University, USA

4:40-5:05 Adaptive Data Assimilation Scheme for Shallow Water Simulation

Haiyan Cheng, Tyler Welch, and Carl Rodriguez, Willamette University, USA

5:10-5:35 A Statistical Analysis of the Kalman Filter

Vivak R. Patel, University of Chicago, USA

5:40-6:05 Dynamic Parameter and State Estimation for Power Grid Systems

Cosmin G. Petra, Argonne National Laboratory, USA; Noemi Petra, University of California, Merced, USA; Zheng Zhang, Massachusetts Institute of Technology, USA; Emil M. Constantinescu, Argonne National Laboratory, USA

Friday, April 8

MS157

Error Estimation and Adaptive Methods for Uncertainty Quantification in Computational Sciences - Part III of III

4:40 PM-6:40 PM

Room:Garden 2C

For Part 2 see MS142

Advances in computational science have led the community to consider applications involving the solution of increasingly complex multiphysics and multiscale problems. Such problems involve many sources of uncertainties that need to be taken into account for reliable predictions of physical phenomena. It has thus become crucial to rely on error estimation tools to assess the accuracy of the uncertainty propagation process and develop efficient adaptive strategies to reduce the cost of output predictions. The objective of the minisymposium will therefore be to present fundamental contributions and exchange ideas on error estimation and adaptive methods for uncertainty quantification.

Organizer: Serge Prudhomme
École Polytechnique de Montréal, Canada

Organizer: Fabio Nobile
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Marco Picasso
École Polytechnique Fédérale de Lausanne, Switzerland

4:40-5:05 Goal-Oriented Error Control in Low-Rank Approximations

Serge Prudhomme, École Polytechnique de Montréal, Canada

continued in next column

5:10-5:35 Adaptive Algorithms Driven by A Posteriori Estimates of Error Reduction for PDEs with Random Data

Alex Bespalov, University of Birmingham, United Kingdom; David Silvester, University of Manchester, United Kingdom

5:40-6:05 Goal-Based Anisotropic Adaptive Control of Stochastic and Deterministic Errors

Jan W. Van Langenhove, Anca Belme, and Didier Lucor, Université Paris VI, France

6:10-6:35 Optimal Approach for the Calculation of Stochastically Homogenized Coefficients of Elliptic Pdes

Caroline Geiersbach, Gerhard Tulzer, and *Clemens Heitzinger*, Vienna University of Technology, Austria

Friday, April 8

MS158

Gaussian Processes: Feature Extraction vs Sensitivity Analysis - Part II of II

4:40 PM-6:40 PM

Room:Garden 3A

For Part 1 see MS143

Gaussian process models have been used as a basic brick in uncertainty quantification when conducting sensitivity analyses and related studies in the case of expensive response evaluations. On the other hand, feature extraction is a vivid topic in machine learning, where numerous approaches have been proposed and Gaussian process models also increasingly come into play. In this session, we will gather experts from both communities in order to have an overview of the latest developments and foster interdisciplinary discussions, with a special focus on the interplay between the definition of ad hoc covariance kernels and the pursued methodological goals.

Organizer: David Ginsbourger
Idiap Research Institute and University of Bern, Switzerland

Organizer: Bruno Sudret
ETH Zürich, Switzerland

4:40-5:05 Combining Feature Mapping and Gaussian Process Modelling in the Context of Uncertainty Quantification

Christos Lataniotis, Stefano Marelli, and Bruno Sudret, ETH Zürich, Switzerland

5:10-5:35 Bayesian Screening Through Gaussian Processes Hyper-Parameter Sampling

Alfredo Garbuno-Inigo and Francisco Díaz De la O, University of Liverpool, United Kingdom; Konstantin Zuev, California Institute of Technology, USA

5:40-6:05 Single Nugget Kriging: Better Predictions at the Extreme Values

Minyong Lee and Art Owen, Stanford University, USA

6:10-6:35 Modelling Faces in the Wild with Gaussian Processes

Chaochao Lu, University of Cambridge, United Kingdom and Max Planck Institute for Intelligent Systems, Germany

Friday, April 8

MS159

Surrogate Models for Efficient Robust Optimization and Data Assimilation in Computational Mechanics - Part III of III

4:40 PM-6:40 PM

Room:Garden 3B

For Part 2 see MS144

Computational mechanics is subject to numerous uncertainties arising from random variations. Their effects must be reduced to make systems more robust. Incorporation of stochastic components in predictive simulations makes difficult the resolution of multidisciplinary/multifidelity design optimization and inverse problems. Alternative surrogate models, based on global or local approximations, may offer faster model predictions and sensitivity analysis facilitating uncertainty quantification for such large-scale systems. The MS will highlight modeling and computational challenges faced in these areas. The goal is to bridge the gap between the stochastic methods developed for robust optimization and for data assimilation and calibration.

Organizer: Pietro Marco Congedo
Inria, France

Organizer: Didier Lucor
Brown University, USA

Organizer: Regis Duvigneau
Inria Sophia Antipolis, France

4:40-5:05 Representation of Model Uncertainty in Space Debris Orbit Determination with Sparse Measurements

Chiara Tardioli, Massimilian Vasile, and Annalisa Riccardi, University of Strathclyde, United Kingdom

5:10-5:35 An Adaptive Strategy on the Error of the Objective Functions for Uncertainty-Based Derivative-Free Optimization

Francesca Fusi, Politecnico di Milano, Italy; *Pietro Marco Congedo*, Inria, France

5:40-6:05 Parameter Calibration and Optimal Experimental Design for Shock Tube Experiments

Daesang Kim and Iman Gharamti, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Quan Long, United Technologies Research Center, USA; Fabrizio Bisetti, Ahmed Elwardani, Aamir Farooq, Raul Tempone, and Omar Knio, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

6:10-6:35 Coordinate Transformation and Polynomial Chaos for the Bayesian Inference of a Gaussian Process with Parametrized Prior Covariance Function

Ihab Sraj, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Olivier P. Le Maître, LIMSI-CNRS, France; Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Omar M. Knio, Duke University, USA

continued in next column

Friday, April 8

MS160

Towards Data-driven, Predictive Multiscale Simulations- Part III of III

4:40 PM-6:40 PM

Room:Garden 3C

For Part 2 see MS145

Despite the continuous increase in our computational capabilities, the ultimate goal of predictive simulations remains elusive. The key challenges are: High-dimensionality of uncertainties; Information fusion, e.g., multi-fidelity, multi-scale/physics models, and experiments; Model-form uncertainties induced by limited data and incomplete physics; Cost of information acquisition, i.e., the cost of doing simulations/experiments. The purpose of this minisymposium is to address these roadblocks and achieve groundbreaking advances by promoting synergies between applied mathematics, computational physics, and data sciences. Specific topics include but are not limited to: Data-driven model identification; Learning from high-dimensional data; Task-specific information acquisition policies; Non-linear dimension- reduction for coarse graining.

Organizer: Ilias Bilionis
Purdue University, USA

Organizer: Phaedon S. Koutsourelakis
Technische Universität München, Germany

4:40-5:05 Multiscale Modeling of with Quantified Uncertainties and Cloud Computing: Towards Computational Materials Design

Alejandro Strachan, Purdue University, USA

continued on next page

Friday, April 8

MS160

Towards Data-driven, Predictive Multiscale Simulations- Part III of III

4:40 PM-6:40 PM

Room:Garden 3C

continued

5:10-5:35 Mapping the Structural and Alchemical Landscape of Materials, from Molecules to the Condensed Phase

Michele Ceriotti, École Polytechnique Fédérale de Lausanne, Switzerland

5:40-6:05 Statistical Approaches to Forcefield Calibration and Prediction Uncertainty in Molecular Simulation

Fabien Cailliez, Université Paris-Sud, France; Pascal Pernot, Université Paris-Sud and CNRS, France

6:10-6:35 Modeling Material Stress Using Integrals of Gaussian Markov Random Fields

Peter W. Marcy and Scott Vander Wiel, Los Alamos National Laboratory, USA; Curtis Storlie, Mayo Clinic, USA; Curt Bronkhorst, Los Alamos National Laboratory, USA

Friday, April 8

MS161

Numerical Methods for BSDES and Stochastic Optimization - Part II of II

4:40 PM-6:40 PM

Room:Garden 4A

For Part 1 see MS146

Stochastic optimization refers to the optimization of a target function in the presence of uncertainty of the state equation and its observations. Backward stochastic differential equations, especially backward doubly stochastic differential equations can be considered as tools of solving stochastic optimization problems, Methods for stochastic optimization provide a means of coping with inherent system uncertainty and coping with models or systems that are highly nonlinear and high dimensional.In this minisymposium, we will explore various methodologies on stochastic optimization, including nonlinear filtering and BSDE approaches, and its applications to machine learning, uncertainty quantification of complex systems, and other engineering and science areas.

Organizer: Yanzhao Cao
Auburn University, USA

Organizer: Weidong Zhao
Shandong University, China

Organizer: Jialin Hong
Chinese Academy of Sciences, China

4:40-5:05 Multi-symplectic Methods for Stochastic Maxwell Equations

Jialin Hong, Chinese Academy of Sciences, China

5:10-5:35 Stochastic Optimization with Bsdes

Mohamed Mnif, Universite de Tunis-El Manar Institut Pasteur de Tunis, Tunisia

5:40-6:05 Error Estimates of the Crank-Nicolson Scheme for Solving Decoupled Forward Backward Stochastic Differential Equations

Yang Li, University of Shanghai for Science and Technology, China

6:10-6:35 Gradient Projection Method for Stochastic Optimal Control in Finance

Bo Gong, Hong Kong Baptist University, Hong Kong

Friday, April 8

MS162

Advanced Methods for Enabling Quantification of Uncertainty in Complex Physical Systems - Part II of II

4:40 PM-6:40 PM

Room:Garden 4B

For Part 1 see MS147

The last few decades have seen broad advancements in computational science, yet the application of modern techniques for predicting the behavior of large-scale physical and engineering problems remains challenged due to the uncertainty in input parameters, as well as the models and operating environments of these systems. This minisymposium aims at exploring efforts related to efficient and mathematically rigorous techniques for both “forward” and “inverse” UQ, used to improve the prediction and design of complex systems. Topics include: high-dimensional approximation from noisy observations, propagation of uncertainty through multiphysics systems, model form uncertainty, and optimization under uncertainty.

Organizer: Clayton G. Webster
Oak Ridge National Laboratory, USA

Organizer: Fariba Fahroo
Defense Advanced Research Projects Agency, USA

4:40-5:05 Overview of New Probabilistic Characteristics: Cvar Norm and Buffered Probability of Exceedance (bpoe)

Stan Uryasev, Matthew Norton, Alexander Mafusalov, and Konstantin Pavlikov, University of Florida, USA

5:10-5:35 Title Not Available

Paul Dupuis, Brown University, USA

5:40-6:05 Active Subspaces and Reduced-Order Models for High-Dimensional Uncertainty Propagation

Juan J. Alonso, Stanford University, USA

6:10-6:35 Global Sensitivity Analysis with Correlated Variables

Ankur Srivastava, GE Global Research, USA; Isaac Asher, University of Michigan, USA; Arun K. Subramanian and Liping Wang, GE Global Research, USA

Friday, April 8

MS163

Stochastic Modeling and Optimization in Power Grid Operations and Planning - Part III of III

4:40 PM-6:40 PM

Room:Garden 4C

For Part 2 see MS148

Increasing renewable energy penetration levels in modern power grids increase variability and uncertainty in system behavior, with corresponding impacts on operations and planning. Existing deterministic approaches to solving these problems have sufficed in the past, due to the relative predictability of system inputs. In this minisymposium we emphasize techniques for modeling and addressing uncertainty from wind and solar renewables for the purpose of improving power systems predictability and reliability. Invited talks include contributions on stochastic optimization models, multi-stage mixed integer stochastic programs, and efficient scenario management.

Organizer: Cosmin Safta
Sandia National Laboratories, USA

Organizer: Jean-Paul Watson
Sandia National Laboratories, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

4:40-5:05 Spatio-Temporal Hydro Forecasting of Multireservoir Inflows for Hydro-Thermal Scheduling

Timo Lohmann, Amanda Hering, and *Steffen Rebennack*, Colorado School of Mines, USA

5:10-5:35 Security and Chance Constrained Unit Commitment with Wind Uncertainty

Kaarthik Sundar, Texas A&M University, USA; *Harsha Nagarajan*, Los Alamos National Laboratory, USA; Miles Lubin, Massachusetts Institute of Technology, USA; Line Roald, ETH Zürich, Switzerland; Russell Bent and Sidhant Misra, Los Alamos National Laboratory, USA; Daniel Bienstock, Columbia University, USA

5:40-6:05 Comparison of Stochastic Programming and Robust Optimization Approaches for Risk Management in Energy Production

Ricardo Lima, Sabique Langodan, and Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Omar M. Knio, Duke University, USA; Antonio Conejo, Ohio State University, USA

6:10-6:35 Surrogate-based Approach for Optimization Problems under Uncertainty

Jianqiang Cheng, Richard L. Chen, Habib N. Najm, Ali Pinar, Cosmin Safta, and Jean-Paul Watson, Sandia National Laboratories, USA

continued in next column

Friday, April 8

MS164

Model Reduction in Stochastic Dynamical Systems - Part II of II

4:40 PM-6:10 PM

Room:Garden 5A

For Part 1 see MS149

Stochastic dynamical systems have been extensively used to describe the evolution of chemical, biological and physical processes due to the presence of stochasticity. These stochastic dynamical systems usually involve complex mechanisms. For example, chemical and biological reaction networks often involve large number of species, multiple chains of reactions and multiple time scales. Such complexity stimulates the research on reduction methods that seek reduced dynamic models with fewer number of variables and processes, yet can approximate the original massive systems. This minisymposium will be focusing on recent developments in methodologies for model reduction in stochastic dynamical systems.

Organizer: Xiaoying Han
Auburn University, USA

Organizer: Habib N. Najm
Sandia National Laboratories, USA

4:40-5:05 Dynamic Model Reduction for Stochastic Chemical Reaction Systems with Stiffness

Xiaoying Han, Auburn University, USA; Habib N. Najm, Sandia National Laboratories, USA

5:10-5:35 Stochastic Effects and Numerical Artefacts in Pure and Mixed Models in Biology

Tomislav Plesa, University of Oxford, United Kingdom

5:40-6:05 Theory and Applications of Random Poincare Maps

Nils Berglund, Universite d'Orleans, France

Friday, April 8

MS165

Stochastic Transport Problems in Subsurface Flow

4:40 PM-6:40 PM

Room:Garden 5B

Large-scale problems in subsurface flow are subject to uncertainty due to heterogeneity, imposing limitations on the amount of information that can be represented with a fixed computational budget. For the utility of applications, quantifying these uncertainties is crucial, whether it is about leakage risk in CCS projects to reduce greenhouse gas emission, optimizing the production of an oil field, or efficient energy production in geothermal flow. This minisymposium addresses challenges of accurate simulation of uncertain forward transport problems in reservoir simulation. Stochastic geological descriptions may be propagated through a range of methods, e.g. accelerated Monte Carlo or polynomial chaos methods.

Organizer: Mass Per Pettersson
Uni Research CIPR, Norway

4:40-5:05 Uncertain CO_2 Transport in Large-Scale Carbon Capture and Storage
Per Pettersson, University of Bergen, Norway

5:10-5:35 Tracer Dispersion in a Realistic Field Case with the Polar Markovian Velocity Process (PMVP) Model
Daniel W. Meyer, Institute of Fluid Dynamics, Switzerland; Simon Dünser, ETH Zürich, Switzerland

5:40-6:05 Efficient Estimation of Saturation Distribution in Stochastic Two-Phase Flow Problems
Fayadhoi Ibrahima and Hamdi Tchelepi, Stanford University, USA; Daniel W. Meyer, Institute of Fluid Dynamics, Switzerland

6:10-6:35 Probabilistic Analysis of a Rock Salt Cavern with Application to Energy Storage System
Raoul Hölter, Elham Mahmoudi, and Tom Schanz, Ruhr-Universität Bochum, Germany

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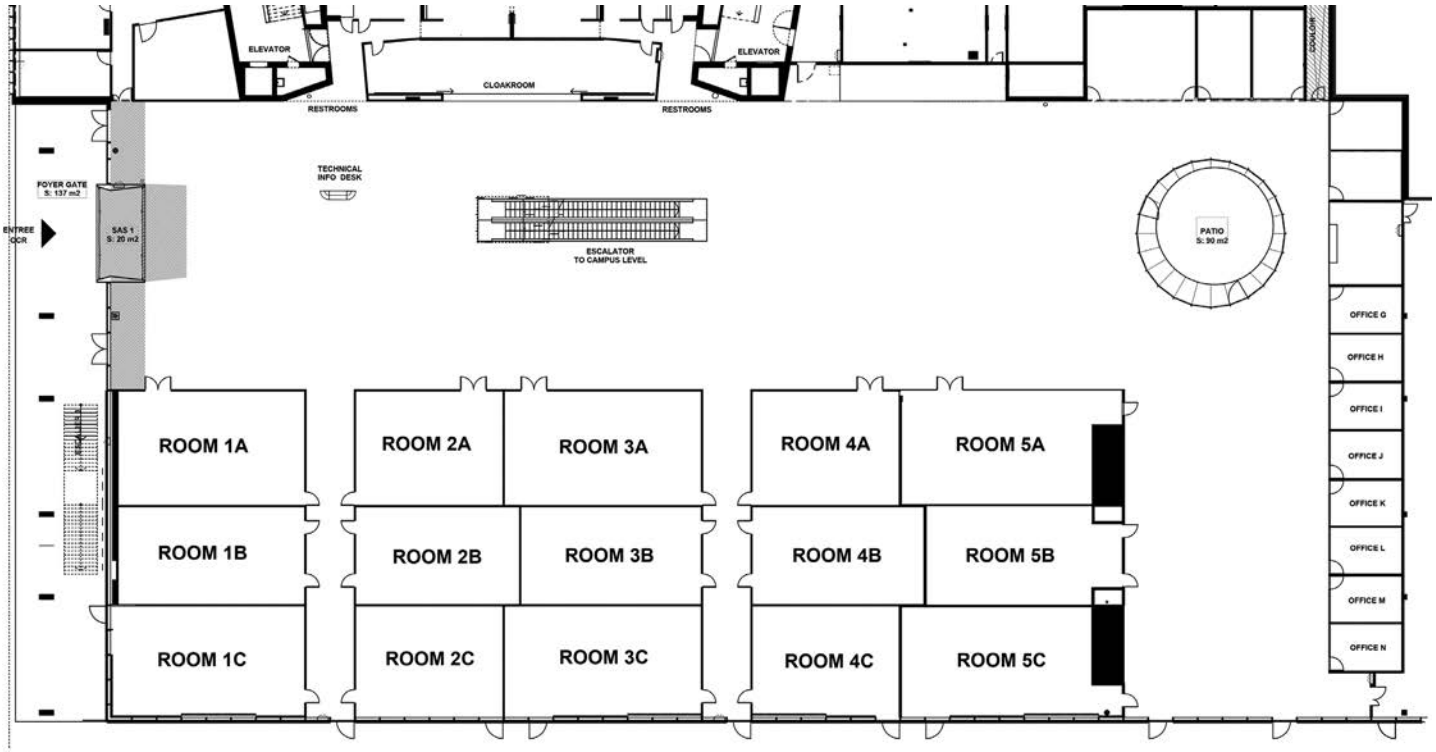
Swiss Tech Convention Center Floor Plan



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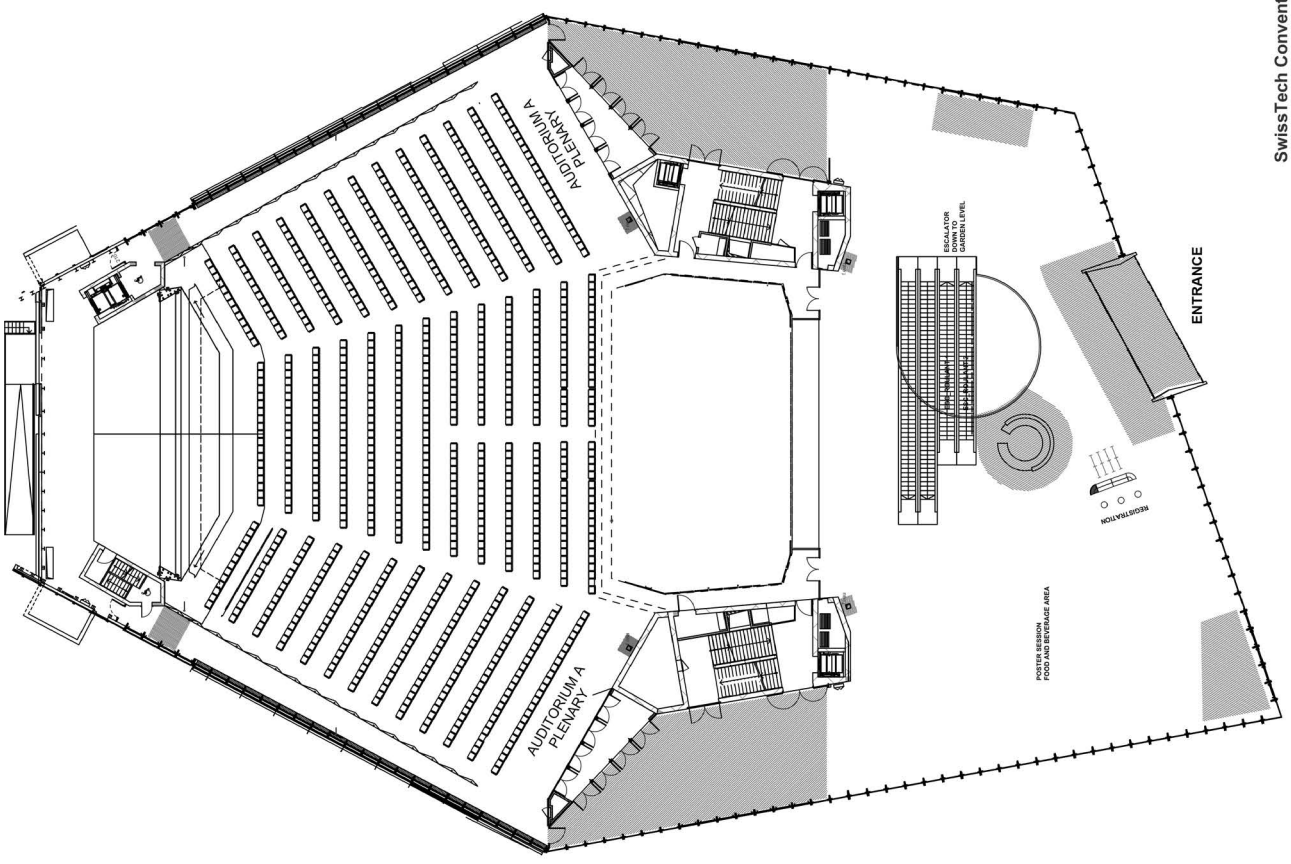

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