

ETICS 2020

École Thématique sur les Incertitudes en Calcul Scientifique

Research School on Uncertainty in Scientific Computing

October, 4-9, Ile d'Oléron, France - <https://www.caes.cnrs.fr/sejours/la-vieille-perrotine/>



Source : Figaronautisme

Objectives

The goal of this school is to develop the skills of researchers and engineers in the domain of uncertainty management of computer codes. Some of the lectures will be followed by practical computer works. Collaborative works, round tables and poster sessions will promote exchanges between participants. The prerequisites to possess are the mathematical bases of the uncertainty quantification science.

Lecturers

- Prof. [Anne-Laure Fougères](#) (Université Claude Bernard Lyon 1, France) - Extreme value theory and applications
- Prof. [Josselin Garnier](#) (Ecole Polytechnique, France) - Rare event simulation
- Prof. [Robert B. Gramacy](#) (Virginia Tech, USA) - Surrogates: Gaussian process modeling, design and optimization for the applied sciences
- CEA and EDF R&D: Lectures on robustness analysis in UQ and metamodeling techniques on CEA and EDF applications

Organization

CEA DAM



EDF R&D



Centre Borelli
ENS Paris
Saclay



Under the scientific labeling of the [GdR MASCOT-NUM](#)



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Registration: <https://www.azur-colloque.fr/DR04/inscription/inscription/175>

Registration fees 900€ including accommodation and meals

Schedule

Sunday, October, 4th: Travel (at the charge of each participant) to l'Ile d'Oléron – Bus from la Rochelle at 18h15

Monday, October, 5th:

9:00 - 9:30	Opening and Welcome speech	Bertrand Iooss Guillaume Perrin
9:30 – 12:30	Extreme value theory and applications	A-L. Fougères
14:00 – 17:30	Surrogates: Gaussian process modeling, design and optimization for the applied sciences	R. Gramacy
19 :00 – 20 :00	Apéritif “Découvertes”	All

Tuesday, October, 6th:

9:00 – 12:30	Extreme value theory and applications – Practical session	A-L. Fougères
14:00 – 17 :30	Surrogates: Gaussian process modeling, design and optimization for the applied sciences	R. Gramacy
17 :30-19 :00	Poster session	All

Wednesday, October, 7th:

9:00 – 12:30	Rare event simulation	J. Garnier
14:00 – 20 :00	Social event or free afternoon	All
20 :00	Gala dinner	All

Thursday, October, 8th:

9:00 – 12:30	Rare event simulation	J. Garnier
14:00 – 17:30	Robustness analysis in uncertainty quantification	EDF and CEA

Friday, October, 9th:

9:00 – 12:30	Applicative talks	CEA, EDF, CNRS, SafranTech
13 :30	Bus to La Rochelle	

ABSTRACTS

- Prof. [Anne-Laure Fougères](#) (Université Claude Bernard Lyon 1, France) - Extreme value theory and applications

The aim of this course is to introduce the main questions where extreme value theory can be a fruitful modeling tool: in a univariate context. First, we will consider the evaluation of risks of failure of type $P(X > x)$ for a stationary variable X and a high value x , or the estimation of extreme quantiles and so-called return levels. We will focus on the methodology and practical tools used to produce estimators of such quantities. The multivariate context will also be presented, and several examples will be detailed. We will emphasize the role of the dependence between variables to evaluate joint failure risks, and briefly sketch the geostatistical context. The lab practice will be the opportunity of implementing some of the techniques introduced previously and also of getting some useful plots.

- Prof. [Josselin Garnier](#) (Ecole Polytechnique, France) - Rare event simulation

We propose an overview of some elements of the theory and practice of rare event simulation, estimation of small probabilities, and quantile estimation.

- Elementary Monte Carlo methods
 - Control variates (Multilevel Monte Carlo)
 - Importance sampling
 - Adaptive methods (sequential importance sampling, cross entropy)
- Sequential Monte Carlo methods
 - Subset Simulation (Splitting)
 - Adaptive methods (Adaptive Multilevel Splitting)
 - Convergence, asymptotic normality, variance estimation
- Rare event simulation and surrogate models
 - Reliability methods
 - Stepwise Uncertainty Reduction
 - Metamodels and estimators

- Prof. [Robert B. Gramacy](#) (Virginia Tech, USA) - Surrogates: Gaussian process modeling, design and optimization for the applied sciences

This course details statistical techniques at the interface between geostatistics, machine learning, mathematical modeling via computer simulation, calibration of computer models to data from field experiments, and model-based sequential design and optimization under uncertainty (a.k.a. Bayesian Optimization). The treatment will include some of the historical methodology in the literature, and canonical examples, but will primarily concentrate on modern statistical methods, computation and implementation, as well as modern application/data type and size. The course will return at several junctures to real-world experiments coming from the physical, biological and engineering sciences, such as studying the aeronautical dynamics of a rocket booster re-entering the atmosphere; modeling the drag on satellites in orbit; designing a hydrological remediation scheme for water sources threatened by underground contaminants; studying the formation of supernova via radiative shock hydrodynamics; modeling the evolution a spreading epidemic. The course material will emphasize deriving and implementing methods over proving theoretical properties.

- Robustness analysis in uncertainty quantification:
 - Vincent Chabridon (EDF R&D) : Epistemic uncertainty management in uncertainty quantification
 - Bertrand Iooss (EDF R&D) : Perturbed-law based sensitivity indices : motivations, methodology and industrial application
 - Guillaume Perrin (CEA) : Isoprobabilist transform for robust uncertainty analyses
 - Clément Gauchy (CEA) and J. Stenger : Optimal Fisher-based perturbed-law indices

- Applicative talks
 - Jérôme Breil, Lucas Tallois (CEA) : Optimisation d'un diaphragme hydraulique
 - Sanaa Zannane (EDF R&D) : Optimisation coûteuse boîte noire à variables mixtes. Revue bibliographique
 - Rodolphe Le Riche (CNRS) : Dimension reduction ofr Bayesian optimization
 - Sébastien Da Veiga (SafranTech) and Amandine Marrel (CEA) : Gaussian process regression with linear inequality constraints – An adaptive strategy
 - Gaël Poette (CEA) : A new MC scheme for the resolution of intrusive-gPC based reduced models for the uncertain linear Boltzmann equation