INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Computer experiments & Stochastic Calculus with applications to PDE modeling

ECTS
3 crédits

Hourly volume

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts) the following.

Computer Experiment
· Metamodelling for optimization / uncertainty quantification of a computer code
· At least the two main families of metamodels : chaos polynomials and Gaussian processes
· Kernel customization to account for external knowledge
· Design of computer experiments
· Global sensivity analysis
Stochastic calculus
· The brownian motion as well as the Wiener integral and Itô¿s formula
· The relationship between a stochastic differential equation and its Fokker-Planck equation.
· The rewriting of a parabolic or elliptical problem using a well-chosen stochastic process.

The student should be able:
Computer Experiments
· At a theoretical level, to do computations for:
· covariance kernels and Gaussian process
· ANOVA decomposition, Sobol indices
· At a practical level, to perform the complete methodology for analyzing a computer code
· design of experiments
· metamodel construction / evaluation
· application to optimization / uncertainty quantification of a computer code
Stochastic calculus
· Derive simple models on noise filtration and stochastic control.
· Numerically implement the resolution of a parabolic or elliptic equation using a particle-based probabilistic method.

Necessary prerequisites

Gaussian vectors. Probability. ODE. Basics of PDE.

Practical info

Location(s)

Toulouse