MATH-425 **Spatial statistics**

Cursus	Sem.	Type
Ing.-math	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	During the semester
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Remark

pas donné en 2021-22

Summary

In this course we will focus on stochastic approaches for modelling phenomena taking place in multivariate spaces. Our main focus will be on random field models and on statistical methods for model-based spatial statistics.

Content

In this course we will focus on stochastic approaches for modelling phenomena taking place in multivariate spaces. Our main focus will be on random field models and on statistical methods for model-based spatial statistics. Starting from generalities on random fields, we will subsequently cover topics in spatial interpolation, analysis and simulation of random field paths, model selection and parameter inference, as well as experimental design. Potential additional topics include point pattern analysis and multiple-point statistics simulation. A tentative schedule follows:

- Introduction to random fields
  - Definition, construction and examples
  - Notions of stationarity, continuity/differentiability, etc.
  - Variography and related topics
- Spatial prediction
  - Best Linear Unbiased Prediction / Simple Kriging
  - The Gaussian case: interpretation and (conditional) simulation
  - Parameter estimation and extensions of Kriging
- On path properties and decompositions of random fields
  - General results on path continuity/differentiability
  - Reproducing Kernel Hilbert Spaces ane the Loève isometry
  - Advanced results on Gaussian random fields
- Topics in experimental design
  - Static and sequential model-based design with fixed or plugged-in covariance parameters
  - Experimental design accounting for parameter estimation
  - Towards optimization and set estimation strategies

Keywords

Random fields
Kriging
Positive definite kernels
Conditional simulation
Experimental Design

Learning Prerequisites

Important concepts to start the course

Linear Algebra
Basics in probability and statistics
Hilbert spaces
Notions of programming (Illustrations and computer labs in R along the semester; possible use of other languages to be discussed with the lecturer)

Assessment methods

Combined continuous and final assessment
The nature of the final exam (oral or written) will be decided based on the number of students.
"Dans le cas de l’art. 3 al. 5 du Règlement de section, l’enseignant décide de la forme de l’examen qu’il communique aux étudiants concernés."