DEPARTMENT OF MATHEMATICS (DMATH)

Whatever the field, modern scientific progress comes from mathematics, or requires mathematical input. The research at the DMATH in geometry, algebra, and probability paves the way for the next 200 years of innovation.
We contribute to meeting the needs of Luxembourg and beyond by training students to develop mathematical skills and thinking, and by eliciting new vocations through outreach.

MEMBERS

- 16 professors
- 29 post-docs and research scientists
- 24 doctoral candidates
- 2 technical and administrative staff

FUNDING AND COLLABORATIONS

- €2.9 million acquired in new research projects (2022)
- FNR-funded interdisciplinary doctoral programme in Mathematical Tools for Complex Data Structures DTU MATHCODA (€1..2 million)

PUBLICATIONS

- 107 peer-reviewed articles in scientific journals

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Research areas

ALGEBRA AND NUMBER THEORY (ANT)

Pieter Belmans, Sergei Merkulov, Antonella Perucca, Sarah Scherotzke, Bruno Teheux, Gabor Wiese

At its foundation algebra concerns polynomial equations and their solutions. These can be used to model and study very rich objects, like varieties and algebraic groups in algebraic and arithmetic geometry, modular forms in number theory, or operads. We then study invariants, symmetries and deformations of these algebraic structures, in order to understand how they behave under various transformations and how they are related to one another. We regularly combine these abstract questions with computational tools and real-life applications in cryptography, and our research often involves aspects of representation theory and topology.

GEOMETRY & TOPOLOGY (GT)

Pieter Belmans, Karin Melnick, Sergei Merkulov, Hugo Parlier, Sarah Scherotzke, Jean-Marc Schlenker

Modern geometry and topology can take many forms, from understanding simple shapes to more abstract manifolds and higher structures. Beyond their intrinsic beauty, these geometric and topological worlds often become model spaces for other sciences. At DMATH, we study a plethora of geometric objects and how they deform, including moduli spaces, hyperbolic and Riemannian manifolds, and algebraic curves and varieties.

PROBABILITY AND STOCHASTIC ANALYSIS (PSA)

Yannick Baraud, Ivan Nourdin, Giovanni Peccati, Mark Podolskij

Probability theory is concerned with the analysis of random events and the mathematical rules that govern their outcome. Stochastic analysis is the branch of probability theory that focuses on the study of random phenomena driven by a random process (e.g. a Brownian motion) by means of a stochastic calculus (e.g. Itô's or Malliavin calculus). At DMATH, we use the full strength of probability theory and stochastic analysis for understanding and predicting the behavior of complex systems, ranging from financial markets to physical systems.

STATISTICS AND DATA SCIENCE (SDS)

Yannick Baraud, Mark Podolskij, Christophe Ley

Statistics is the branch of mathematics that is devoted to the study of data. It is closely related to the branch of probability since statisticians interpret data as outcomes of random variables. Statisticians develop models and strategies from observed data in order to make predictions, estimations and decisions based on rational grounds. They study the mathematical properties of statistical procedures, assess their risks and improve the state of the art by creating new ones. Statistics provides tools and techniques that feed into the broader field Data Science, which encompasses all academic disciplines involved in data processing.

DISCRETE AND GEOMETRIC ANALYSIS (DGA)

Jean-Luc Marichal, Martin Olbrich, Jean-Marc Schlenker, Bruno Teheux

Discrete analysis and geometry is concerned about the applications of analysis in the investigation of discrete structures and geometries. It covers (and is not limited to) some areas of combinatorial geometry, harmonic analysis, functional equations and convexity. DMATH also contributes to current developments in geometric analysis, where questions of differential geometry such as the properties of minimal surfaces are studied using analytic techniques.