List of Abstracts BSSM 2025

Mardi-Tuesday

Pierre Vandenhove

Titre: Strategy Complexity: How Much Does It Take to Win?

Abstract:

In mathematics, a *game* is any situation where multiple agents interact, each aiming to achieve a goal. In real life, we often find ourselves in similar situations: we have a goal and we can take controllable actions toward our goal, but unpredictable events — beyond our control — can occur. For instance, if we want to get to work on time, we need to account for uncertain traffic delays. By modeling these uncertainties as the moves of an adversarial agent, we can represent such situations using the mathematical framework of games.

This talk will discuss the following insight: depending on the nature of the objective, the *resources* we need to implement a "good" strategy may vary dramatically. This leads to the question of *strategy complexity*: given an objective, how *complex* must a strategy be to achieve it? What resources (e.g., memory, randomness) should it use? Understanding strategy complexity helps design algorithms that make smart decisions automatically.

The study of strategy complexity began with foundational work by Büchi and Rabin in the 1960s. Since then, *strategy complexity* remained relevant thanks to its connection with multiple fields: game theory, but also logic, model checking, reinforcement learning, and decision theory. In this talk, I will introduce the framework of *games on graphs* and their applications. We will explore why strategy complexity matters and highlight recent developments and open problems related to this topic.

Sasha Viktorova

Titre: Singular points on algebraic hypersurfaces

Abstract: Singularity theory is an area of mathematics that can be studied from different points of view, such as topology, analysis, or algebra. In this talk, we will look at isolated singular points that appear on complex algebraic hypersurfaces. We will explore what these points look like close up by studying the equations that define them in a small neighbourhood, and also consider the

global picture, for example, determining how many singular points a hypersurface can have.

Eileen Robinson

Titre: L'épopée des graphes parfaits

Abstract: TBA

Mercredi-Wednesday

Denis Bonheure

Title: Quelques paradoxes en mécanique des fluides

Abstract: "Fluid mechanics was discredited by engineers from the start, which resulted in an unfortunate split – between the field of hydraulics, observing phenomena

which could not be explained, and theoretical fluid mechanics explaining phenomena which could not be observed" — Sir Cyril Hinshelwood, 1956 Nobel Prize in Chemistry.

Dans cet exposé, nous découvrirons quelques illustrations de cette citation dont le paradoxe de d'Alembert (1752) qui implique que les équations d'Euler prédisent qu'un oiseau ne peut pas voler.

La résolution de ce paradoxe a suscité un débat houleux, Birkhoff déclarant par exemple en 1950 "The root [of this paradox] lies deeper, in lack of precisely that deductive rigor whose importance is so commonly minimized by physicists and engineers". Cette citation, qui a valu à Birkhoff de nombreuses critiques, n'a certainement pas favorisé un débat serein entre physiciens, ingénieurs et mathématiciens s'intéressant à la mécanique des fluides.

Quiz mathématique

Title: Puzzles mathématiques

Abstract: L'équipe de la BSSM vous propose une série de problèmes mathématiques amusants.