I Workshop on Optimal Control and Sweeping Processes

lundi 1 juillet 2024 - lundi 1 juillet 2024

XLIM, University of Limoges, Faculty of Sciences and Techniques

Recueil des résumés

Contents

1

Hamilton-Jacobi-Bellman approach for optimal control problems of sweeping processes

Auteur: Emilio Vilches[1]

[1] *Universidad de O'Higgins*

In this talk, we are concerned with a state-constrained optimal control problem governed by Moreau's sweeping process with a controlled drift. We discuss the Bellman approach for an infinite horizon problem. In particular, we focus on the regularity of the value function and on the Hamilton-Jacobi-Bellman equation it satisfies. We discuss a uniqueness result and we make a comparison with standard state-constrained optimal control problems to highlight a regularizing effect that the sweeping process induces on the value function.

2

Numerical methods to approximate deterministic mean field games

Auteur: Justina Gianatti[1]

[1] *Universidad Nacional de Rosario*

In this work we deal with the numerical approximation of deterministic Mean Field Games with control affine dynamics. We approximate such mean field games by analogous problems in discrete time and finite state space, for which, we show the existence and, under an additional monotonicity assumption, the uniqueness of solutions. We prove the convergence of equilibria of the discrete mean field game problems towards equilibria of the continuous one. Finally, we show some numerical results.

3

A scheme for Hamilton-Jacobi-Bellman equations with oblique boundary conditions

Auteur: Francisco Silva[1]

[1] *Université de Limoges*

In this talk we consider a fully-discrete semi-Lagrangian approximation of second order possibly degenerate Hamilton-Jacobi-Bellman (HJB) equations on a bounded domain with oblique boundary conditions. These equations appear naturally in the study of optimal control of diffusion processes with oblique reflection at the boundary of the domain.
The proposed scheme is shown to satisfy a consistency type property, it is monotone and stable. Our main result is the convergence of the numerical solution towards the unique viscosity solution of the HJB equation.

Based on a joint work with E. Calzola, E. Carlini and X. Dupuis.

4

On the rate of convergence for first-order singular perturbation problems

Auteur: Cristian Mendico[1]

[1] *Università degli studi di Roma Tor Vergata*

In this talk we will present some recent results obtained in collaboration with P. Cannarsa on the rate of convergence for first-order singular perturbation problems. Such a problem concerns the analysis of systems where some state variables evolve at a much faster time scale and the limit leads to the elimination of such fast variables. We will, in particular, focus the attention to the application to differential games and mean field games.
Work in memory of Maurizio Falcone.

5

Resource Allocation Games on a Graph

Auteur: Nabil Kazi-Tani[1]

[1] *Université de Lorraine*

In this talk, we will start by defining and providing examples of Colonel Blotto games, a class of resource allocation games that has a wide range of applications. We will then extend standard Colonel Blotto games to a dynamic framework using the model of continuous-time two-player zero-sum stochastic differential games. The game is played on a graph, where each edge represents a battlefield, and where players control the drift of their state process on each battlefield, subject to a budget constraint. When both players have the same budget, using a dynamic programming approach, we explicitly characterize the Nash equilibria and the value function of the game in terms of a Hamilton-Jacobi-Bellman PDE that admits a regular solution. Our formulation is sufficiently general to include various rewards, whether continuous or not, allowing for different interpretations of the game. When the players' budgets are different, we provide a numerical approximation of the equilibrium strategies, relying on a class of neural networks. This is a joint work with Amine Hazzami (IECL, Univ. Lorraine, Metz) and Vineeth S Varma (CNRS, CRAN, Nancy).

6

About the hybrid maximum principle on stratified domains

Auteur: Terence Bayen[1]

[1] *Avignon Université*

The objective of the presentation is to show how to derive the hybrid maximum principle (HMP) for optimal control problems governed by spatially heterogeneous systems. Under a strong transverse hypothesis on optimal trajectories, we first show that it is possible to use the HMP for temporal hybrid optimal control problems. When optimal trajectories fulfill only a weak transverse hypothesis, we prove thanks to a counter example that this approach is no longer valid. Nevertheless, we show how to bypass this obstruction by introducing a new notion of minimum in optimal control (called L1-square) which allows us to derive the HMP in our setting.

7

A sweeping force against congestion in crowd motion

Auteur: Noureddine Igbida[1]

[1] *Université de Limoges*

This talk explores novel models for crowd motion involving two interacting populations that disperse to avoid overcrowding. We will delve into the existence and potential uniqueness of solutions for these models, along with their connection to the underlying sweeping process.

8

On a mathematical model for crowd motion

Auteur: Hamza Ennaji[1]

[1] *LJK*

In this talk we present a new variant of the mathematical prediction-correction model for crowd motion. As the prediction step is somehow classical and performed via a transport equation, we shall focus on the correction step which relies on a minimum flow problem à la Beckmann and allows handling the congestion phenomenon. We discuss some duality results and how to solve the minimum flow problem via a primal-dual algorithm. We provide some numerical examples to illustrate our approach.