Mean Field Games and related fields

Schedule

Monday

09: 00- 09: 10 Welcome address Barry Green (Director of AIMS South Africa)

09: 10- 10: 10 Diogo Gomes

10: 10 -10: 25 Breakout room

10: 25- 11: 20 Mou Chenchen

11: 20- 11: 30 Break

11: 30- 12: 25 Mou ChenChen

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Tuesday

09: 00- 09: 55 Levon Nurbekyan

09: 55- 10: 05 Break

10: 05 -11: 00 Levon Nurbekyan

11: 00- 11: 15 Breakout room

11: 15- 12: 10 Daniel Nickelsen

12: 10- 12: 25 Break

`12: 10- 12: 25 Daniel Nickelsen

Wednesday

09: 00- 09: 55 Olivier Pamen

09: 55- 10: 05 Break

10: 05 -11: 00 Olivier Pamen

11: 00- 11: 15 Breakout room

11: 15- 12: 10 Alpar Meszaros

12: 10- 12 : 20 Break

`12: 20- 13 : 15 Alpar Meszaros

Thursday

09: 00- 09: 55 Diogo Gomes

09: 55- 10: 05 Break

10: 05 -11: 00 Diogo Gomes

11: 00- 11: 15 Breakout room

11: 15- 12: 15 Dirk Bercherer

12: 15- 12: 25 Break

`12: 10- 12: 25 Martha Nansubuga

Titles and Abstracts

Diogo Gomes (KAUST)

Title: Mean-field games: a quick introduction

Abstract: Mean-field games model systems with a large number of rational agents in competition and whose decisions are based on statistical information about the remaining agents (mean-field). These games arise in crowd and population dynamics, socio-economic problems, and energy management, for example. This course is a quick introduction to mean-field games. We begin with a brief discussion of Hamilton-Jacobi equations and optimal control, a quick review of transport equations, and how systems of coupling these two equations arise in mean-field game theory. Then, we present in detail a price formation model. The course ends with recent developments in the theory that extend ideas from optimal transport to systems arising in mean-field games.

MOU Chenchen (City University of Hong Kong, China)

Title: Mean field games master equations with non-separable Hamiltonian.

Abstract: In this talk, we give a structural condition on non-separable Hamiltonians, which we term displacement monotonicity condition, to study second order mean field games master equations. A rate of dissipation of a bilinear form is brought to bear a global (in time) well-posedness theory, based on a--priori uniform Lipschitz estimates in the measure variable. Displacement monotonicity being sometimes in dichotomy with the widely used Lasry-Lions monotonicity condition, the novelties of this work persist even when restricted to separable Hamiltonians.

Levon Nurbekyan (University of California Los Angeles)

Title: On variational methods for mean-field games

Abstract: We will discuss variational techniques for the analysis and numerical solution of mean-field game (MFG) systems. In particular, we will discuss the celebrated Brenier-Benamou formulation for potential MFG systems and its extension to a class of non-potential systems.

Daniel Nickelsen (AIMS South Africa)

Title: Path perspective of Fokker-Planck equation.

Abstract: The Fokker-Planck equation describes the statistics of stochastic agents and as such plays an important role in mean-field game theory. In this talk, I give an introduction to the equivalent path integral formulation of the underlying stochastic process. Central in this formulation are probability measures of individual stochastic realizations. Using these path probabilities, I introduce fluctuation theorems which provide stochastic identities and enable a link to recent advances of thermodynamics -- the field in physics that popularised mean field theory."

Olivier Menoukeu Pamen (University of Liverpool, AIMS Ghana)

Title: A stochastic maximum principle for controlled processes with irregular drifts**.**

Abstract: this talk, we discuss stochastic optimal control of systems driven by stochastic differential equations with irregular drift coefficients. In particular, we derive a necessary and sufficient stochastic maximum principle. We achieve this by first obtaining an explicit representation of the first variation (in the Sobolev sense) process of the controlled diffusion process.
Since the drift coefficient is singular, the representation is given in terms of the local time space integral of the diffusion process. Then by an approximation argument, we construct a sequence of optimal control problems with smooth coefficients. Finally, we use Ekeland's variational principle to obtain an approximating adjoint process from which we establish the maximum principle by passing to the limit.

Alpár Richárd Mészáros (Durham University)

Title: Global well-posedness of master equations for deterministic displacement convex potential mean field games

Abstract: In this talk we show how to construct global in time solutions to master equations arising in deterministic potential Mean Field Games. Our study will concern a class of Lagrangians and initial data functions, which are displacement convex and so, this may be in contrast with the class of so-called monotone functions in the sense of Lasry-Lions, widely considered in the literature. We construct solutions to both the scalar and vectorial master equations in potential Mean Field Games. In the first part of the talk, we present the setting and the derivation of these infinite dimensional PDEs, while in the second half we will give some details on the main ideas behind the proofs. The results have been obtained in collaboration with Wilfrid Gangbo (UCLA).

Diogo Gomes (KAUST)

Title: Mean-field game price models

Abstract: Mean-field games model systems with a large number of rational agents in competition and whose decisions are based on statistical information about the remaining agents (mean-field). These games arise in crowd and population dynamics, socio-economic problems, and energy management, for example. This course is a quick introduction to mean-field games. We begin with a brief discussion of Hamilton-Jacobi equations and optimal control, a quick review of transport equations, and how systems of coupling these two equations arise in mean-field game theory. Then, we present in detail a price formation model. The course ends with recent developments in the theory that extend ideas from optimal transport to systems arising in mean-field games.

Diogo Gomes (KAUST)

Title: Displacement convexity in mean-field games

Abstract: Mean-field games model systems with a large number of rational agents in competition and whose decisions are based on statistical information about the remaining agents (mean-field). These games arise in crowd and population dynamics, socio-economic problems, and energy management, for example. This course is a quick introduction to mean-field games. We begin with a brief discussion of Hamilton-Jacobi equations and optimal control, a quick review of transport equations, and how systems of coupling these two equations arise in mean-field game theory. Then, we present in detail a price formation model. The course ends with recent developments in the theory that extend ideas from optimal transport to systems arising in mean-field games.

Dirk Becherer (Humboldt University)

Title: introduction to the probabilistic approach to mean field games,

Martha Nansubuga (Humboldt University)

Title: Singular stochastic control and Marcus integrals in mean field games