

## Seminar

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### Topic

$\alpha$ -potential game: A new paradigm for N-player dynamic game

### Date | Time

11 December 2024 (Wed) | 10:30 am – 11:30 am (HK Time)

### Venue:

Y303, Main Campus

### Abstract:

Static potential games, pioneered by Monderer and Shapley (1996), are non-cooperative games in which there exists an auxiliary function called static potential function, so that any player's change in utility function upon unilaterally deviating from her policy can be evaluated through the change in the value of this potential function. The introduction of the potential function is powerful as it simplifies the otherwise challenging task of finding Nash equilibria for non-cooperative games: maximizers of potential functions lead to the game's Nash equilibria.

In this talk, we propose an analogous and new framework called  $\alpha$ -potential game for dynamic N-player games, with the potential function in the static setting replaced by an  $\alpha$ -potential function. We present an analytical characterization of  $\alpha$ -potential functions for any dynamic game. For stochastic differential games in which the state dynamic is a controlled diffusion,  $\alpha$  is explicitly identified in terms of the number of players, and the intensity of interactions and the level of heterogeneity among players. Two classes of stochastic differential games, namely distributed games and games with mean field interactions, are analyzed to highlight the dependence of  $\alpha$  on general game characteristics that are beyond the mean-field paradigm, which focuses merely on the limit of  $N$  with homogeneous players. We show the  $\alpha$ -Nash equilibrium of the stochastic game can be constructed through an associated conditional McKean-Vlasov control problem.

The talk is based on joint work with Xin Guo and Xinyu Li:  
<https://arxiv.org/abs/2403.16962>

ALL ARE WELCOME