THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

Superposition and mimicking theorems for conditional McKean-Vlasov equations

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Abstract

We consider conditional McKean-Vlasov stochastic differential equations (SDEs), such as the ones arising in the large-system limit of mean field games and particle systems with mean field interactions when common noise is present. The conditional time-marginals of the solutions to these SDEs satisfy non-linear stochastic partial differential equations (SPDEs) of the second order, whereas the laws of the conditional time-marginals follow Fokker-Planck equations on the space of probability measures. We prove two superposition principles: The first establishes that any solution of the SPDE can be lifted to a solution of the conditional McKean-Vlasov SDE, and the second guarantees that any solution of the Fokker-Planck equation on the space of probability measures can be lifted to a solution of the SPDE. We use these results to obtain a mimicking theorem which shows that the conditional time-marginals of an Ito process can be emulated by those of a solution to a conditional McKean-Vlasov SDE with Markovian coefficients. This yields, in particular, a tool for converting open-loop controls into Markovian ones in the context of controlled McKean-Vlasov dynamics.

Date:	May 21, 2025 (Wednesday)
Time:	3:00 pm – 4:00 pm
Venue:	Room 210, Run Run Shaw Building, HKU

All are welcome