

# Stochastic Control and Calculus of Variations for Mean-Field Type Problems

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We are interested in control problems which arise in the context of mean field games and their numerical solutions. There seems to be four different approaches to the stochastic case:

1. Stochastic Calculus of Variations [1]
2. Deterministic Calculus of Variations with the underlying Fokker-Planck equation.
3. Dynamic Programming and the Hamilton-Jacobi-Equation for stochastic control
4. Deterministic Dynamic Programming and the HJB equations on the underlying Fokker-Planck equation

Approach 3 is generally considered to be impossible in the context of mean field games, but by using Approach 4 we will show that it is not necessarily so. The 4 methods will be presented in the talk and applied to some classical problems like portfolio optimization and systemic risk assessment [2].

## References

- [1] Andersson D. and Djehiche B. A Maximum Principle for SDE of Mean-Field Type. *Appl Math Optim* (2011) 63: 341356
- [2] Garnier, J. and Papanicolaou, G. and Yang, T.-W. Large deviations for a mean field model of systemic risk. *SIAM Math. Finance*, Vol. 4, pp. 151–184 (2013).