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Hypocoercivity for degenerate Kolmogorov equations and applications to the Langevin dynamics

Abstract

The aim of this talk is to apply an extended version of the modern, powerful and simple abstract Hilbert space strategy for proving hypocoercivity that has been developed originally by Dolbeault, Mouhot and Schmeiser. It is well-known that hypocoercivity methods imply an exponential decay to equilibrium with explicit computable rate of convergence for degenerate evolution equations. In the stated extension we introduced important domain issues that have not been considered before. Necessary conditions for proving hypocoercivity need then only to be verified on a fixed operator core of the evolution operator. Additionally, the setting is suitably reformulated to incorporate also strongly continuous semigroups solving the Kolmogorov equation as an abstract Cauchy problem. In this way it can be applied to the Langevin dynamics arising in Statistical Mechanics and Mathematical Physics. In this application, the strongly continuous contraction semigroup can be constructed via using Kato perturbation tools. Moreover, via using techniques from the theory of generalised Dirichlet forms, it admits a natural representation as the transition kernel of a diffusion process solving the underlying equation in the martingale sense. Summarising, we provide the first complete elaboration of the Hilbert space hypocoecivity theorem for the degenerate Langevin dynamics in this hypocoercivity setting.