Institute for Applied Mathematics, Bonn University

Oberseminar Stochastik

Thursday, 28 October 2021, 16:30
online

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Feynman-Kac formula under a finite entropy condition

Motivated by entropic optimal transport, we investigate the linear parabolic equation $(\partial_t + \mathrm{b}\cdot\nabla + \Delta_{\mathrm{a}}/2 + V)g = 0$ with a nonnegative final boundary condition. It is well-known that the viscosity solution g of this PDE is represented by the Feynman-Kac formula when the drift b, the diffusion matrix a and the scalar potential V are regular enough and not growing too fast. Extending this result to a setting where b and V are not assumed to be regular and locally bounded requires to introduce a new trajectorial notion of solution to this PDE based on semimartingale extension of Markov generators.

As a by-product, we characterize the drift of Schrödinger bridges when V belongs to some Kato class.

Our probabilistic approach relies on stochastic derivatives, semimartingales, Girsanov's theorem and the Hamilton-Jacobi-Bellman equation satisfied by $\log g$. Preprint: arXiv:2104.09171.