"Particle representations for SPDEs with boundary conditions"

Dan Crisan (Imperial College)

Abstract: I will present a weighted particle representation for a class of stochastic partial differential equations with Dirichlet boundary conditions. The locations and weights of the particles satisfy an infinite system of stochastic differential equations (SDEs). The evolution of the particles is modeled by an infinite system of stochastic differential equations with reflecting boundary condition and driven by independent finite dimensional Brownian motions. The weights of the particles evolve according to an infinite system of stochastic differential equations driven by a common cylindrical noise W and interact through V , the associated weighted empirical measure. When the particles hit the boundary their corresponding weights are assigned a pre-specified value. We show the existence and uniqueness of a solution of the infinite dimensional system of stochastic differential equations modeling the location and the weights of the particles. We also prove that the associated weighted empirical measure V is the unique solution of a nonlinear stochastic partial differential equation driven by W with Dirichlet boundary condition. The work is motivated by and applied to the stochastic Allen-Cahn equation and extends the earlier of work of Kurtz and Xiong.
This is joint work with C. Janjigian (IHP) and T. G. Kurtz (Wisconsin-Madison) and is based on the paper: Dan Crisan, Christopher Janjigian, Thomas G. Kurtz, Particle representations for stochastic partial differential equations with boundary conditions https://arxiv.org/abs/1607.08909