

Probabilistic interpretations of systems of nonlinear parabolic equations with cross-diffusion

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Systems of nonlinear parabolic equations with cross-diffusion serve as mathematical models for various phenomena in many fields. In this talk we construct a stochastic model for a system of this type which describes the dynamics of two populations interacting via a chemical agent. We reduce the Cauchy problem for a system of three nonlinear PDEs with cross-diffusion to a correspondent stochastic problem. This reduction works as soon as we treat the original system as a system of forward Kolmogorov equations and derive SDEs for correspondent Markov processes. Due to nonlinearity of original PDEs coefficients of these SDEs depend on the unknown functions and the most tricky part is to derive the respective closing relations. Finally, we prove the existence and uniqueness of a solution to the derived stochastic problem and verify that this solution gives rise to a weak and a mild solutions of the Cauchy problem for the PDE system.