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数学与统计学院学术报告

Nonlinear Fokker–Planck–Kolmogorov equations and their probabilistic counterparts: The strong Markov property

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摘要: Already in 1966 in his visionary paper in PNAS, H.P. McKean, jr., formulated a programme to construct a probabilistic counterpart to nonlinear parabolic partial differential equations (PDEs) in the form of nonlinear Markov processes, similarly as in the linear case. Subsequently, in contrast to the latter McKean's nonlinear case was, however, much less developed and many standard nonlinear parabolic PDEs could not be covered because of too strong assumptions on the coefficients. Starting from around 2018 the situation substantially changed and by employing a new technique, that is, the (nonlinear) superposition principle, the said restrictions on the coefficients could be considerably weakened. As a consequence a substantial number of nonlinear parabolic PDEs, among them the viscous Burgers equation, the generalized (possibly in space nonlocal) porous media equations, the 2D vorticity Navier–Stokes equation, the parabolic p -Laplace equation and the (doubly nonlinear) Leibenson equation, could be shown to have a nonlinear Markov process as their respective probabilistic counterpart. The question, whether these nonlinear Markov processes even have the strong Markov property, remained, however, open. As is well-known from the linear case, this property is of crucial importance for analyzing further and deeper relations to the respectively associated nonlinear parabolic PDE, also called nonlinear Fokker–Planck–Kolmogorov equation. In this talk we present a new general method how to prove the strong Markov property in the nonlinear case, which is, however, completely different from the linear case and applies for example to generalized porous media equations, but as well to new linear cases.

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