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Abstract

Quantization of Stochastic Navier-Stokes Equation

We consider a stochastic Navier-Stokes equation driven by a space-time Wiener process. This equation is quantized by transformation of the nonlinear term to the Wick product form. An interesting feature of this type of perturbation is that it preserves the mean dynamics: the expectation of the solution of the quantized Navier-Stokes equation solves the underlying deterministic Navier-Stokes equation. From the stand point of a statistician it means that the perturbed model is an unbiased random perturbation of the deterministic Navier-Stokes equation.

The quantized equation is solved in the space of generalized stochastic processes using the Cameron-Martin version of the Wiener chaos expansion. A solution of the quantized version is unique if and only if the uniqueness property holds for the underlying deterministic Navier-Stokes equation. The generalized solution is obtained as an inverse of solutions to corresponding quantized equations. We will also demonstrate that it could be approximated by real (non-generalized processes). A solution of the quantized Navier-Stokes equation turns out to be non- anticipating and Markov.

The talk is based on a joint work with R. Mikulevicius.