Pathwise Stochastic Taylor Expansion and Forward Path-Dependent PDEs

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Abstract

The fully nonlinear stochastic PDE is a subject often seen in applications, especially in stochastic control theory and stochastic finance. The main purpose of this talk is to introduce a new notion of the stochastic viscosity solution to a class of (forward) fully nonlinear stochastic PDEs. I will begin by revisiting the notion of pathwise stochastic Taylor expansion, and will show a new result that extends our previous works to a more general setting, and in terms of the newly developed notion of path-derivative initiated by Dupire. We will then show how this new form of pathwise Taylor expansion could lead to a notion of *stochastic viscosity solution* for a class of fully nonlinear SPDEs, and the corresponding Path-dependent PDEs (PPDEs). We will then discuss the issues of consistency, stability, and comparison principles for the stochastic viscosity solutions. In the semilinear case, we show that the PPDE, whence the SPDE, is well-posed in our new framework.

This is a joint work with Rainer Buckdahn and Jianfeng Zhang.