MARTINGALE SOLUTION TO STOCHASTIC REACTION DIFFUSION EQUATION DRIVEN BY JUMP PROCESSES

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We study a reaction diffusion equation driven by Poissonian, respectively, Lévy noise. We first show existence of a martingale solution for a parabolic SPDE driven by a Poisson random measure. This result is then transferred to a parabolic SPDE driven by Lévy noise and allows us to establish the existence of a martingale solution of reaction-diffusion-type equation driven by Poissonian noise, respectively, Lévy noise. The result answers positively a long standing open question about existence of martingale solutions driven by genuine Lévy processes. Let $L = \{L(t) : t \geq 0\}$ be a one dimensional Lévy process whose characteristic measure ν has finite p-moment for some $p \in (1, 2]$, $\mathcal{O} \subset \mathbb{R}^d$ be a bounded domain with smooth boundary and Δ be the Laplace operator with Dirichlet boundary conditions.

A typical example of interest is the following stochastic partial differential equation

$$\begin{cases} du(t,\xi) &= \Delta u(t,\xi)\,dt + \left[u(t,\xi) - u(t,\xi)^3\right] dt \\ &+ \sin(u(t,\xi))\sin(\frac{1}{u(t,\xi)})1_{\mathbb{R}\setminus\{0\}}(u(t,\xi))\,dL(t), \quad t > 0, \\ u(t,\xi) &= 0, \quad \xi \in \partial\mathcal{O}, \\ u(0,\xi) &= u_0(\xi), \quad \xi \in \mathcal{O}\ . \end{cases}$$

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