

A spatial version of the Itô-Stratonovich correction

Martin Hairer, Jan Maas

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We consider a class of stochastic PDEs of Burgers type in spatial dimension 1, driven by space-time white noise. Even though it is well-known that these equations are well-posed, it turns out that if one performs a spatial discretisation of the nonlinearity in the "wrong" way, then the sequence approximate equations does converge to a limit, but this limit exhibits an additional correction term.

This correction term is proportional to the local quadratic cross-variation (in space!) of the gradient of the conserved quantity with the solution itself. This can be understood as a consequence of the fact that for any fixed time, the law of the solution is locally equivalent to Wiener measure, where space plays the role of time. In this sense, the correction term is similar to the usual Itô-Stratonovich correction term that arises when one considers different temporal discretisations of stochastic ODEs.

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