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Kolloquium über Mathematische Statistik und Stochastische Prozesse

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Pathwise Uniform Convergence Rates in Time for Hyperbolic SPDEs

Abstract: When approximating the mild solution of a semilinear stochastic evolution equation, several challenges arise due to the lack of temporal regularity caused by Gaussian noise. In this talk, optimal convergence rates in time are presented for such problems, where the leading operator A is the generator of a contraction semigroup on a Hilbert space, focusing on hyperbolic problems. The main result are optimal bounds for the pathwise uniform strong error arising from their temporal discretisation. Up to a logarithmic factor, we recover the convergence rates up to 1/2 for the whole path from the semigroup corresponding to the semilinear SPDE with globally Lipschitz nonlinearity and noise. Improved rates up to 1 are achieved for wave equations and additive noise.

For equations such as Maxwell's or Schrödinger, our results improve several existing results with a unified method using semigroup theory rather than groups and provide the first results known for rational approximations of the semigroup such as implicit Euler. We give an outlook on extensions of the framework to superlinearly growing nonlinearities and noise, concerning both local and global well-posedness as well as convergence rates.

This is based partly on joint work with Mark Veraar (TU Delft).

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