

ON STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS WITH RANDOM INITIAL CONDITIONS

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This talk addresses two problems about solutions of stochastic partial differential equations with random initial conditions.

The first part focuses on the Cauchy problem for random fields generated by partial differential equations on the unit sphere. The exact solution as a series expansion in terms of spherical harmonics is given. An approximation to the solution is provided and analysed by finitely truncating the series expansion. We establish upper bounds for the convergence rates of approximation errors and investigate the smoothness of both the exact and truncated solutions. In particular, we show how the sample Hölder continuity of the resulting spherical fields is determined by the decay of the angular power spectrum.

The second part examines multiscaling limit theorems for renormalised solutions of higher-order heat equations with initial conditions given by random processes exhibiting cyclic long-range dependence. We derive the spectral and covariance representations of the corresponding limit fields and explain why analogous limit results are not valid in subordinated settings with Hermite rank greater than one. Numeric examples will be presented to illustrate the theoretical findings.

The talk is based on joint results in [1, 2, 3].

REFERENCES

- [1] Leonenko N., Olenko A., Vaz J. (2024) *On fractional spherically restricted hyperbolic diffusion random field*. Commun. Nonlinear Sci. Numer. Simul., 131, 107866.
- [2] Broadbridge P., Donhauzer I. Olenko A. (2024) *Stochastic diffusion within expanding space-time*. Z. Angew. Math. Phys. 75, 42.
- [3] Alghamdi M.M., Leonenko N., Olenko A. (2025) *Multiscaling limit theorems for stochastic FPDE with cyclic long-range dependence*. Braz. J. Probab. Stat. 39(2): 226-247

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